PHILIPPINE AGRICULTURAL BIBLIOGRAPHY

July to December 2020

Vol. 1 No. 2

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MONOGRAPH

1 **C10**

2 Enhancement of the forest genetics laboratory of the College of Forestry and 3 Natural Resources (CFNR) University of the Philippines Los Baños (UPLB) [Laguna, Philippines]. **Tolentino, E.L., Jr.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. TR-1826.* 2016. 4 6 5

9 Laboratory mass rearing of the five lepidopteran pests of corn namely the…

10 FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES

SERIAL ARTICLE

1 **E16 Production economics**

2 Enhancing soybean productivity and local availability in Region 2 [Cagayan Valley, Philippines]. **Calderon, V.J.F., Aquino, R.M.G., Olinares, R.B., dela Cruz, C.G., Batang, E.F. Jr., Atalin, V.U., de Guzman, S**. 48. 3

7 Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) . v.43 (Supplement no. 1) p. 43-44 (Jul-2018).* 8

9 The program created awareness on the importance of soybean for human, livestock and soil health in Cagayan Valley [Philippines] through promotion of soybean production, food utilization …

10 GLYCINE MAX; SOYBEANS; PLANT PRODUCTION; PRODUCTIVITY; FOOD TECHNOLOGY; HEALTH FOODS; HOUSEHOLDS; DOMESTIC CONSUMPTION; PHILIPPINES

BOOK CHAPTER

E14

Bioethanol production from macroalgae and socio-ecological implications: Project 1: socio-ecological assessment and analysis for algal biomass production, development and promotion.

Fernandez, P.R.,Jr, Geganzo, L.G.L., Subade, R.F., Napilan-Espectato. L. Bioethanol production from macroalgae and socio-ecological implications. Fernandez, P.R.Demafelis, R.B.Geganzo, L.G.L.Subade, R.F.Napilan-Espectato, L.Santiago, D.E.O.Movillon, J.L.Hourani, K.Gatdula, K.M.Magadia, R.V.Jr.- College, Laguna (Philippines), *2016.* *TR-1732.* *p. 1-71 .*

IPB Var 6 is a white-flint open pollinated variety. It is a quality protein maize (QPM) that is high yielding and

ZEA MAYS; MAIZE; VARIETIES; SEED; PROTEINS; PROCESSED PRODUCTS; FOODS; TECHNOLOGY; TECHNOLOGY

1. Subject category
2. Title
3. Author (s)
4. Corporate author
5. Date
6. TR No.
7. Conference title, place, and date
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A- AGRICULTURE IN GENERAL

A50 Agricultural research

Molecular profiling of polyketide gene clusters of Philippine actinobacteria using PCR-based techniques. **Custodio, A.B.** *2016 TR-1739*.

BACTERIA; SPECIES; ACTINOMYCETALES; PCR; ANTIBIOTICS; PHILIPPINES

C- EDUCATION, EXTENSION AND INFORMATION

C10 Education

Persistence, retention and completion of BS Agriculture students in the University of the Philippines Los Baños. **Ortega-Dela Cruz, R. A., Quimbo, M.A.T.** *2016* TR-1707.

The study used descriptive-correlational research design to identify factors that explain persistence and retention of BS Agriculture students in UP [University of the Philippines] Los Baños [College, Laguna] during their first year of college as they moved on to the next year level towards degree completion. In addition to self-administered questionnaire, Key informant interviews on selected program graduates, faculty and administrators were conducted to determine factors that support/enhance and hinder student persistence and retention towards degree completion. Findings reveal that institution-related factor particularly the institution's commitment to academic excellence constitutes most to the experiences of agriculture students. Result of chi-square test reveals significant relationship between persistence and retention o f BS Agriculture students. Whereas, the ordinal logistic regression proves that student satisfaction, particularly with the campus climate can increase student retention. The Nagelkerke's pseudo R2 value indicates that classroom-related factors explain a relatively large proportion of the variation in the student persistence towards degree completion. Analysis of Variance reveals a significant difference in the persistence of BS Agriculture students across year levels. The results of the study point out that, as per responses of the students as well as the faculty and administrators interviewed, the University has not gone far enough to ensure that BS Agriculture students are supported in an efficient manner. The University of the Philippines, being the National University has much opportunity to make positive changes in persistence and retention of these special populations of agriculture students.

EDUCATION; AGRICULTURE; AGRICULTURAL SECTOR; TRAINING COURSES; UNIVERSITIES; STUDENTS; CURRICULUM; PHILIPPINES

Study tour on sloping agricultural land farming. **Cabahug, R.D., Landicho, L.D., Quimado, M.O., Cereno, R.P., Miranda, M.DC., Domingo, G.C.** *2017 TR-1815*.

AGROFORESTRY; TRAINING COURSES; SLOPING LAND; FARMLAND; TRAINING

C20 Extension

Capacitating the farmers of the rice terraces of Ifugao on organic heirloom rice production through Farmers's Field School. **Credo, R.M.S., Batcagan, J.D., Sabigan, N.A., Miranda, R.B.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside

development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 127 (Jul-2018)*.

The Heirloom Rice Project is an initiative under the Food Staples Sufficiency Program of the Department of Agriculture (DA). With support from the various agencies of the DA and the International Rice Research Institute, this collaborative project aims to enhance the productivity and enrich the legacy of heirloom rice through empowered communities in unfavorable rice-based ecosystems. To realize these goals, Season Long Training on Heirloom Rice Production focusing on Enterprise development and PalayCheck System Technology were conducted. From 2015 to 2016, two training batches were conducted involving 56 farmers from Banaue and Hungduan municipalities of Ifugao. These capacity enhancement trainings were conducted in collaboration with partner stakeholders from PLGU-PAENRO of Ifugao and MGLU-OMAG of the two municipalities. A written community consent through the intervention of the National Commission on Indigenous People was secured prior to project implementation since the participants are indigenous people with their own culture and traditions. Final analysis results showed that 55% of the participants are indigenous of the participants achieved 8 keyChecks with 2.84 tons/ha; 30% achieved 7 KeyChecks with 1.92 tons/ha; 11% achieved 6 KeyChecks with 1.44 tons/ha, and 4% achieved 5 KeyChecks with 1.20 tons/ha. Through participatory discussion during the final analysis session, the learning groups proved the implied technology theory that the more KeyChecks achieved, the higher the yield is. Results also indicated the willingness of the heirloom farmers to gradually adopt new technologies which could improve the yield both in quantity and quality. In addition, the project documented researchable areas which need to be addressed to improve productivity and profitability in the highlands. Identified challenges included ways to organically restore nutrient depleted terraces, natural controls of fungal and bacterial disease, the emerging threats of increasing aquatic worm populations, and reduce the labor cost through introduction of customized mechanical interventions.

ORYZA SATIVA; RICE; VARIETIES; INDIGENOUS ORGANISMS; ORGANIC FOODS; FARMERS; DIFFUSION OF INFORMATION; TECHNOLOGY TRANSFERTERRACES; EXTENSION ACTIVITIES

Communication process of upland farmers in Tayak Hill, Rizal, Laguna [Philippines]. **Garcia, P., Samson, Z.M., Ignacio, M., Evangelio, C.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines). College, Laguna (Philippines): FORESPI, 2018. p. 17.*

Communication process focuses on the sharing of meaningful information between two or more people with the goal of the receiver understanding the sender's intended message. This study focused on the communication process of upland farmers in maintaining their farming systems in Tayak hills [Rizal, Laguna, Philippines]. The objectives of the study include to identify the farming systems of the upland farmers, describe the upland farmers communication process in the context of maintaining their farming systems, determine hindering and facilitating factors in farming systems, and to analyze communication in maintaining the farming systems. Research methods used include focus group discussion, key-informant interview, and review of documents. Data were analyzed through thematic analysis. Results revealed that the components of the communication process in maintaining the farming systems are decoder, interpreter, encoder, channel, message, feedback, and semantic noises after the encoders. Emerging themes are seminars for additional knowledge, upland farmers as experts, farming from generation to generation, solution to the problems on

pests and diseases, individual family consultation on crops, actions taken on problems regarding profit, and the association providing farm inputs. The facilitating factors include passion in upland farming, source of income for their children's education and household needs, and recognition from other farming communities. However, their hindrance in communicating their farming systems include limited educational attainment, unpleasant experiences, distance of their houses in the upland community, hardships entwined in farming, and sustaining daily household needs. It is significant to note that through communication, the upland farmers became aware of profit, problems addressed during meetings, and the effectiveness in farming systems.

HIGHLANDS; FARMERS; DIFFUSION OF INFORMATION; FARMING SYSTEMS; PHILIPPINES

Development and evaluation of an Android application for the MOET-based Mathematical Model or MOET App. **Capistrano, A.O.V., Aungon, J.J.E., Hernandez, J.E.G.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 33-41 (Apr 2016)*.

This paper discusses the development and evaluation of the MOET 3-in-1 Android App (MOET App) after having proven the functionality of the MOET-based Mathematical Model (MMM) in 2011 at PhilRice Negros. The model, developed because of the identified limitations of the MOET kit fertilizer guideline, proved to be very capable of computing the precise amount of nutrients that are needed by a particular Philippine rice cultivar for a given yield target. However, due to the complexity of using the mathematical model manually, automating the entire computation process of the model has been deemed necessary, hence, the MOET 3-in-1 Android App was created in 2013. To evaluate the App's effectiveness as a fertilizer recommendation tool, yield trials were conducted in 2014. These trials aimed to compare yield outputs of NSIC Rc216 fertilized via the MOET 3-in-1 Android App recommendation, MOET kit fertilizer guideline and farmers' practice. Results of the yield trial showed significant advantages in yield as well as in other agronomic parameters of NSIC Rc216 fertilized via the MOET 3-in-1 Android App. The MOET 3-in-1 Android App was also evaluated in terms of yield target probability and deviation analysis which showed a 92% chance of target yield attainment with a +-16% deviation of the actual yield if its fertilizer recommendations are followed and no biotic or abiotic stress was suffered by the crop. Further, comparison of the target and actual yields via a normalized root mean square error (nRMSE) showed that the yield setting capability of the MOET 3-in-1 Android App was found 'fairly acceptable'.

INFORMATION PROCESSING; INFORMATION TECHNOLOGY; INFORMATION SYSTEMS; MATHEMATICAL MODELS; YIELDS; TECHNOLOGY TRANSFER; FERTILIZER APPLICATION; NUTRIENT AVAILABILITY; EXPERIMENTATION;

Extension delivery system before and after devolution, Calabarzon [Cavite, Laguna, Batangas, Rizal, Quezon] Philippines. **Lalican, N.M., Gesmundo, I.M., Elliot, F.P., Barcial, P.M., Beltran, M.M., Semiano, S.C., Natural, H.G.Jr., Tenorio, M.A**. *Philippine Journal of Crop Science (Philippines) v 38 (3) p.46-53 (Dec 2013)*.

In 1967, the extension delivery system in the Philippines was decentralized from the national government to the provincial units based on Republic Act 5185. However, a radical institutional shift on the extension delivery system was made in 1991 through the devolution of extension workers to the local government units. In 2008, the government proposed the centralization once more of the extension delivery system under the national government for efficiency and effectiveness. This study showed how extension services were delivered before 1991 and 15 years after the devolution of extension workers to the local government units. The points of view of the clients and the change agents, involving 170 farmers and 48 extension workers from five Calabarzon

[Cavite, Laguna, Batangas, Rizal, Quezon, Philippines] provinces with representation from the five classes of municipalities were included. The study revealed that change agents regardless of municipality class performed their function well as attested by the farmer respondents. Extension methods implemented within the municipality classes did not differ. The devolution empowered farmers by financing the activities of their farm, one-third received full or partial support from the municipal government and by increasing their level of participation in project management. Extension workers wanted centralization because of the motivation factors available before devolution, like the acknowledgment and recognition of superior institution, free hand over his time, and self fulfillment in helping the target group. Clients and the beneficiaries of the extension delivery system after assessing the situation prefer the condition after the devolution due to the following reasons: there were consultation in planning and decision making and programs implemented were more effective in giving solutions to problems. Extension delivery system should be placed in the hands of the local government units whose priority is the empowerment of its clients.

ADVISORY OFFICERS; FARMERS; LOCAL GOVERNMENT; DECENTRALIZATION; EXTENSION PROGRAMMES; DIFFUSION OF INFORMATION; PHILIPPINES

Reaching farmers through high quality seed multiplication and dissemination in Nueva Ecija, Iloilo, and Bohol [Philippines]. **Manigbas, N.L., Badajos, A.T.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 26-34 (Dec 2018).*

Increasing rice production and income of small farmers is always a challenge in Philippine agriculture. New approaches have to be explored so that farmers themselves can work together to achieve their goal of increased productivity and income. High quality seeds in one of the most important needs of farmers especially those who could not afford to buy. To address this problem, the Korea Program on International Agriculture (KOPIA) in collaboration with the Philippine Rice Research Institute (PhilRice), LGUs [Local government units] and DA [Department of Agriculture] Regional Offices, implemented the seed multiplication and dissemination project to guarantee farmer's access to high quality seeds. The strategy involves lending farmers high quality seeds of the variety they chose at the start of planting season and after harvest they will return the equivalent cash of PhP1,000.00 per sack to the cooperative where they belong. The amount generated becomes the seed money of the cooperative which members can borrow to help finance their farm operations. Four years after the implementation of the collaborative study, the Bantug Primary Multi-Purpose Cooperative, in the Science City of Munoz, Nueva Ecija [Family] generated PhP1,279.050.00 and farm machines. Meanwhile, Bohol Farmers Multi-Purpose Cooperative in Pilar, Bohol generated PhP1,257,271.08 and a milling machine whereas the Sinibaan Farmers' Association in Dingle, Iloilo generated PhP 479,000.00 and irrigation facilities that service nearly 100 ha of rice field. Capacity enhancement through farmers' trainings on each site and free educational tour to South Korea were conducted to increase their knowledge on new technologies. Overall, this collaborative study is geared towards helping the government in achieving rice security and in helping farmers and their cooperative to increase income and capacity to expand rice farming operations.

SEED; RICE; QUALITY; PLANT PRODUCTION; FARMERS; FARMERS ASSOCIATIONS; INCOME; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES; PHILIPPINES

Sustainable upland farming through the establishment of 'Barangay [village] Sagip Saka' (Conservation Farming Villages project – CFVs) in General Nakar, Quezon [Philippines]. **Cruz, R.V.O., Carandang, W.M.,**

Astejada, J .F., Aumentado, M.J., Gevana, D.T., Pilas, M.T., Galapia, G.A., Astreda, J., Ojeda, M.N., Aguilon, B.C., Magno, G.V. *2011 TR-1802*.

The Conservation Farming Villages (CFV) is a modality for improving human lives through better livelihoods, agricultural productivity, and environmental security of communities living in the marginal sloping lands to the prevailing climate changes. It aimed to help upland farmers improve their economic conditions by strengthening their capacities to manage natural resources thereby protecting their communities against environmental degradation while sustaining their sources of livelihood. The program adopted the community-based participatory approach to technology development, promotion and utilization; and multi-level technology promotion mechanism that would capacitate local extension/change agents. Such strategies would ensure sustainability of efforts in promoting upland farming technologies and approaches, and would strengthen the 'multiplier effect' of existing technology diffusion processes at the local level. CFV in Genral Nakar was implemented in three upland barangays/villages namely: Magsikap, San Marcelino and Minahan Norte. The project included the empowerment of farmer volunteers enabling them to become vanguards of sloping land resources by providing them with skills and knowledge in food, wood and fiber production and resource management; tapping the active leadership and participation of the local government units (municipal, barangay) in carrying out program activities down to the barangays level such as extension work, community organizing and facilitating market linkages and other support services; and provision of technical expertise and guidance of a state university/college in the province or the nearest site, in this case, the University of the Philippines Los Baños. A total of three farming villages having 15 farmer volunteers participated in the implementation in 15 model farms. A total of 56 hectares of sloping lands were initially developed by the project using participatory approach. A total of nine training courses were conducted resulting in participation of 410 participants. Three training shelters cum training and technology centers have been established in each of the barangays halls. The project had also produced 10 trainers from collaborative groups and institutions, especially those from the office of the Municipal Environment and Natural Resources Office of General Nakar. CFV involves the empowerment of farmers to become vanguards of sloping land resources by providing them with skills and knowledge in food and fiber production and resources management; tapping the active leadership and participation of the local government units (municipal and barangays) in carrying out program activities down to the barangays level as extension work, community organizing, and facilitating market linkages and other support services; and provision of technical expertise and guidance by the state university/college in the province or nearest site.

FARMLAND; FARMERS; DEVELOPMENT PROJECTS; SUSTAINABILITY; HIGHLANDS; UPLAND CROPS; COMMUNITY DEVELOPMENT; LIVING STANDARDS; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

Young allies of agricultural extension : the infomediary campaign in Aurora, Philippines. *Manalo, J.A. IV, Balmeo, K.P., Domingo, O.C., Saludez, F.M.*

There is a dearth of literature on how to engage the youth in agriculture as opposed to the innumerable of work probing into their massive migration away from the farm. While scholars have excessively examined the problem on youth outmigration from rural areas, little has been said about keeping them engaged. This paper addresses how young people can be engaged in agriculture using insights from the 'Sagot ko ang magulang ko! Isang kampanya upang hikayatin ang mga kabataang maging informediaries' (read, Surf, and Text for your parents!: a campaign to mobilized the youth as infomediaries) project implementation in the Bayanihan and Ma. Aurora National High School in Aurora province [Philippines]. Infomediaries are people who facilitate

access of information. Empirical data used in this study were drawn from field work campaign cum research project, done in the two schools from April 2012 to March 2013. Participant observation, key informant interviews, focus group discussions, in-depth individual interviews and survey were used in data collection. The Actor-Network Theory and the Capability Approach provided good lenses in analyzing and properly situating the campaign. A mix of online initiatives, exposure and hands-on experience, and creative and motivational activities work in engaging young people. Study tours may help shape their minds to pursue agriculture in college. Issues on proficiency and access of young people to information and communication technology should be attended to. The school can serve as one nucleus of youth engagement in agriculture.

YOUTH; ADVISORY OFFICERS; AGRICULTURAL EXTENSION; MIGRATION; AGRICULTURE; EDUCATION; DIFFUSION OF INFORMATION; PHILIPPINES

D- ADMINISTRATION AND LEGISLATION

D50 Legislation

Ten years of genetically modified crop regulation in the Philippines. **Halos, S.C., Soriano, T.** *Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 41-51 (Apr 2014).*

The Philippines established the final phases of a regulatory system for genetically modified (GM) crops in 2002 that provided access by small corn farmers to the GM crop technology. This paper describes the system, management and processes of Philippine GM crop regulation in relation to features of transparency, predictability, science-based decision, manageability and adaptability. It presents the problems encountered and solutions adopted. Information and data were gathered from the Bureau of Plant Industry (BPI), the Office of Policy and Planning, Department of Agriculture (DA), Biotechnology Coalition of the Philippines (BCP), and relevant websites. In 10 years, there were 2 changes in national leadership, 4 Philippines Congresses, 5 changes of department leadership, 5 changes in leadership at the BPI and various changes in local government leaderships with local elections occurring every year. Demands to ban genetically modified organisms (GMOs) and field trials or reverse decisions are made now and then. and two court cases have also been brought against the system. Nevertheless, with minimum resources, the GM crop regulatory system has stabilized due to clear implementable policies brought about by a close working relationship between policy making and implementation, support from affected sectors, the continuity in office of key individuals in the system, science-based decisions and manageability. The policies and practices ensure transparency and predictability. policy making is responsible to issues that arise during implementation and to trade issues. In policy and in practice, the system is participatory and socio-culturally sound. Compared with the additional income earned by Filipino GM corn farmers, government investments in establishing and maintaining the regulatory system is minimal and worth the investment.

CROPS; ZEA MAYS; GENETICALLY MODIFIED FOODS; REGULATIONS; POLICIES; GOVERNMENT; PHILIPPINES

E- AGRICULTURAL ECONOMICS, DEVELOPMENT AND RURAL SOCIOLOGY

E10 Agricultural economics and policies

Analysis of the value addition and distribution in the rice value chain in the Philippines. **Mataia, A.B., Beltran, J.C., Manalili, R.G., Francisco, N., Flores, A.C., Catudan, B.M.** 48. Crop Science Society of the Philippines

Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science v.43 (Supplement no. 1) p. 129-130 (Jul-2018)*.

Farmers are often the marginalized actors in the rice value chain (VC), who participate as palay producers only, and allegedly, received less of the total value addition. This study aimed to identify and analyze the distribution of added value in the rice VC, assess how much value is created by the chain, who are the chain actors benefiting from this added value, and how much of the value is distributed to rice farmers in particular. Field survey was conducted to sample VC actors in top 20 rice-producing provinces and major demand centers in the country using different sets of structured questionnaires. Cost and return analysis and relative financial distribution of added cost, profit, and price of milled rice per function in the rice VC, respectively. The rice VC consists of core functions from input provision and production, paddy aggregation, rice processing, and marketing performed by VC actors: farmers, paddy traders, rice millers, wholesalers and retailers, respectively. Results showed that from palay production to marketing of milled rice, the total value added cost was PhP 31.33/kg, of which farmers received the highest profit share of 58%. Miller-traders obtained a profit share of 9%; retailers had 11%, while paddy traders and wholesalers got the lower profit share of 58%. Miller-traders obtained a profit share of 9%; retailers had 11%, while paddy traders and wholesalers got the lower profit share of 5% and 6%, correspondingly. However, on the average, farmers produce only 8 tons/year and trade small marketable surplus, and profit is earned from a 4-month cropping period. Conversely, the other VC actors' profits are increased by volume, fast stocks turnover, integration of functions, and investments for quality improvement. Empowering farmers by integrating them into rice VC will capture the total value addition and consequently increase their income.

RICE; MARKETING; FARMERS; INCOME; MARKETING CHANNELS; VALUE ADDED; PROFIT; COSTS; ECONOMIC ANALYSIS; PHILIPPINES

Economic potential of small-scale citronella (Cymbopogon winterianus) production in the Philippines. **Camacho, S.C., Carandang, A.P., Camacho, L.D., Gevaña, D.T., Carandang, M.G., Lorida, R.E., Bandian, Ma.N.P.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 73-81 (Dec 2015)*.

The economic potential of establishing smallholder citronella grass (Cymbopogon winterianus) plantation for essential oil production was assessed. Data were gathered through key informant interviews, field visits and observations of citronella plantation and processing activities of the University of the Philippines Laguna-Quezon Land Grant (UP-LQLG). The various activities involved in essential oil production include: site preparation (e.g. brushing and clearing, cultivation of soil, holing, planting, and fertilizing); maintenance and protection; harvesting and hauling; and, processing of citronella grass. By estimate, 96 L ha sup -1 was produced per harvest which has a gross revenue of PhP115,200.00. With three harvests during the first year, the gross revenue was PhP 345,600.00. Considering all costs, the total net revenue of oil production during the first year of harvest was PhP135,562.20. Results also showed that pursuing such enterprise could be economically viable since its Net Present Value (NPV) in 10 years can reach as much as PhP2.891 M at 12% discount rate. This can be translated to PhP240.917 NPV/ha. The projected internal rate of return for the same period is around 91%, a fairly attractive return on investment. The overall employment generation potential of the venture is also fairly attractive with an average of 936 MD/ha/ 1 yr. One problem encountered that hindered the profitability of citronella production is that the UP-LQLG was not able to acquire an efficient extractor with which efficiency of oil extraction depends.

CYMBOPOGON; SPECIES; ESSENTIAL OILS; EXTRACTION; EXTRACTS; PRODUCTION; PROFITABILITY; COSTS; COST BENEFIT ANALYSIS; PHILIPPINES

Oil palm agroforestry yield and financial estimation modeling. **Sundawati, L., Kuncahyo, B.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 15.*

Development of oil palm plantation in Indonesia is often blamed by international society as the major cause of tropical rainforest deforestation. On the other hand, oil palm industry in Indonesia related to livelihood of about 16 million people who depended on oil palm from upper to downstream industries and in which from 11.6 million hectare oil palm plantation about 41% are smallholders. Long-term research collaboration between Indonesian universities (Bogor Agricultural University, Jambi University and Tadulako University) and Goettingen University of Germany has been started since 2012 in which a sub-project on Biodiversity Enrichment Experiment in Oil Palm Plantation is conducting to find out among any others a solution for the establishment of oil palm plantation that ecologically friendly and economically beneficial. The experiment is established at the oil palm plantation of a private company - PT Humusindo in Jambi Province of Sumatera Island, in which 52 plots (48 plots planted with tree species and 4 plots are control) in sizes of 25m2, 100 m2, 400m2 and 1600m2 were established and placed systematically at distance about 100 m to each other over about 250 Ha oil palm plantation. There were 6,354 trees of 6 species (Parkia speciosa, Durio zibethinus, Archidendron pauciflorum, Peronema canescen, Shorea leprosula, Dyera polyphylla) planted in 48 plots with 0, 1, 2, 3, and 6 diversity levels, created tree islands on the sea of oil palms. This paper will present the modeling based financial analysis to find out the best agroforestry model that combined tree species with oil palms. Tree yields (timber and fruits) were estimated using LISTREL program and agroforestry financial is analyzed using criteria of Net Present Value, Benefit Cost Ratio and Internal Rate of Return. About 3 years after planting it was observed that 3 out of 6 tree species planted in the plots showed very good growth performance, i.e. Peronema canescen, Archidendron pauciflorum, and Parkia speciose, so the agroforestry model used these 3 species which were analyzed financially. Research results shows that at the age of 25 years, Peronema canescen is estimated to reach an average diameter of about 41 cm, average height of about 25 m and will yield wood about 2.37 m3. Parika speciose is estimated to starting produce fruits at 5 years old and reached the peak at 11 years old with fruit production about 24 kg/tree. While Archidendron pauciflorum will start to produce fruits at 5 years old too and reach the productivity peak at 10 years old and produce fruits about 24.15 kg/tree. Establishment and maintenance of tree islands as biodiversity enrichment experiment will not increase the cost of plantation at PT. Humusindo in the long run (25 years oil palm cycle). The low maintenance of trees compare to oil palms especially in the fertilizer application reduced the total cost for about 22.12%. Biodiversity enrichment in oil palm using high economic value tree species in island plots of 1600 m2 at every 3 ha oil palm plantation area give higher benefits, not only ecological benefits but also economic benefits. Enrichment oil palm plantation with Peronema canescen, Archidendron pauciflorum, and Parkia speciose, give higher Net Present Value, Benefit Cost Ratio and Internal Rate of Return compare to monoculture oil palm.

OIL PALMS; PARKIA; SPECIES; TREES; AGROFORESTRY; BIODIVERSITY; ECONOMIC ANALYSIS; FINANCING; MODELS

Tales of two agricultures: Philippines and Vietnam. **Dy, R**. *Agriculture (Philippines) v. 23 (4) p. 22-23 (Apr 2019)*.

RICE; LAND; FARM AREA; PRODUCTION; PRODUCTIVITY; EXPORTS; DIVERSIFICATION; CROP YIELD; PHILIPPINES; VIET NAM

Technical efficiency analysis of flint-type white corn production in Quezon and Cagayan Provinces in the Philippines. **Elca, C.D., Lapiña, G.F., Velasco, D.M., Salazar, F.J.D., Pajadan, K.M., Ceguerra, K.L.P.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 27-37 (Aug 2018).*

Rice, white corn, saba, sweet potato and cassava are the Philippines' major food staples. Filipino consumers, however, generally prefer rice and so the country's farmers give it preference in land allocation. One way to address the Philippines' need for self-sufficiency is to promote the consumption and production of alternative staples like white corn, thus it is important to understand the condition of the country's white corn supply. Toward this end, this study estimated the technical efficiency of white corn and its corresponding determinants using econometric models. The goal was to assess whether there is room to improve productivity, which is essential in increasing the supply, so that it matches efforts to promote white corn consumption. The study used a cross-section of farm-level data on input and output coefficients and the socio-economic characteristics of 80 and 76 randomly selected flint-type white corn farmers in Quezon and Cagayan [Philippines], respectively. The production models were estimated using the maximum likelihood method to generate: parameter estimates; socio-economic factors affecting technical efficiency; and minimum, maximum, and mean technical efficiency scores. Productivity of flint-type white corn production in Quezon and Cagayan was found to be positively influenced by the amount of seed used, level of nitrogen fertilizer applied, and labor devoted to postharvest activities. This finding is consistent across the three production functions (i.e., Quezon, Cagayan, and pooled models). The mean technical efficiency score of farms is 64% in Quezon and 54% in Cagayan. Technical efficiency can be improved by increasing the percentage allocation of produce sold to the market in Quezon and Cagayan. These results indicate that white corn productivity can potentially be improved in the Philippines. In essence, there is a need to close the gap between the minimum and maximum technical efficiencies of white corn farms in Quezon and Cagayan through technology-driven interventions.

ZEA MAYS; MAIZE; VARIETIES; EFFICIENCY; PRODUCTIVITY; FOOD SUPPLY; PRODUCTION; MODELS; PHILIPPINES

E14 Development Economics and Policies

Addressing food and nutrition security through promotion, production and distribution of IPB Var 6 corn grits and seeds. **Sachez, M.A.B., Salazar, A.M., Matanguihan, L.G., Rodriguez, F.M., Geronimo, B.C., Purificacion, M.V., Gabatin, A.L.G., Labe, C.V., Manguiat, P.H., Beltran, A.K.M., Dumandan, M.J.C., Sazon, L.A.R., Abagat, R.F.D., Laude, T.P., Pua, L.B., Beltran, M.M., Cia, B.S.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 128 (Jul-2018)*.

IPB Var 6 is a white-flint open pollinated variety. It is a quality protein maize (QPM) that is high yielding and high in lysine, with 66.2% higher lysine content than normal corn. Utilization of this variety as food staple

complementary to rice could address food and nutrition security of the country. However, nationwide adaption of this technology is being hindered by people's perception that it is food for the poor. Hence, promoting the nutritional attributes of this QPM variety is necessary to enhance its adoption. Availability of quality white corn grits should also be sustained therefore seeds as planting materials should be available in order to sustain higher corn production. Since the variety had been approved by the National Seed Industry Council in 2008, more than 45,000 bags of IPB Var 6 had been produced and distributed to different Department of Agriculture (DA) Regional Field Units, Local Government Units and local and international Non-Government Organizations. These agencies subsequently distribute the seeds to corn farmers nationwide. Farmer's corn grain harvests are being milled to produce corn grits using the portable corn mill. Different print, audio and video materials had been developed to promote the nutritional attributes of the variety. Cooking demonstration using different food preparations aside from the rice-corn blend are conducted in different provinces as well. Feeding program at BN Calara and Bambang Elementary School in Los Baños, Laguna had been supplied by this product. Result showed that higher weight gain was observed in children fed with rice-corn blend compared to rice alone. All these efforts will hopefully contribute to the government's rice self-sufficiency program by decreasing rice consumption while increasing corn grits utilization. And with the recent launching of DA Rice-Corn Blend Program, these initiatives can help address food and nutrition security of the country.

ZEA MAYS; MAIZE; VARIETIES; SEED; PROTEINS; PROCESSED PRODUCTS; FOODS; TECHNOLOGY; TECHNOLOGY TRANSFER; FOOD SECURITY; HUMAN NUTRITION

Bioethanol production from macroalgae and socio-ecological implications. **Fernandez, P.R.,Jr, Demafelis, R.B., Geganzo, L.G.L., Subade, R.F., Napilan-Espectato, L., Santiago, D.E.O., Movillon, J.L., Hourani, K., Gatdula, K.M., Magadia, R.V.Jr.** *TR-1732 2016 .*

SARGASSUM; ALGAE; SPECIES; ETHANOL; GASES; BIOFUELS; PRODUCTION; LAW; POLICIES; SOCIAL INDICATORS

Bioethanol production from macroalgae and socio-ecological implications: Project 1: socio-ecological assessment and analysis for algal biomass production, development and promotion. **Fernandez, P.R.,Jr, Geganzo, L.G.L., Subade, R.F., Napilan-Espectato. L.** Bioethanol production from macroalgae and socio-ecological implications. Fernandez, P.R.Demafelis, R.B.Geganzo, L.G.L.Subade, R.F.Napilan-Espectato, L.Santiago, D.E.O.Movillon, J.L.Hourani, K.Gatdula, K.M.Magadia, R.V.Jr.- College, Laguna (Philippines), *2016. TR-1732.- p. 1-71 .*

This study focuses on three parts: the overview and review of biofuel law, policy and promotion in the Philippines, the bioethanol industry stakeholder analysis, and the mapping of Sargassum (brown algae) as feedstock for the third generation of bioethanol. The literature review focuses on the main legal and institutional framework for bioenergy promotion and development in the Philippines in the last decade. The first legal instrument is Republic Act No. 9367 or the Biofuels Act of 2007. The law provides fiscal incentives and mandates the use of biofuel. The law imposes mandatory requirements to blend biofuels with gasoline and diesel in the transport sector, thus supporting the development of alternatives to fossil fuels. The second legal instrument is Republic Act 953 or the Renewable Energy (RE) Act of 2008. It was passed with the objective of specifically promoting the development of renewable resources of energy. It basically created a framework for the commercialization of renewable energy, aiming to accelerate the use of other forms of

bioenergy. Other relevant laws and policies are also highlighted. An analysis of the legal framework for the promotion and development of biofuel in the Philippines is then pursued, together with additional insights on our future trends. The industry stakeholder analysis looks into the roles and participation of different actors in the society in the bioethanol industry, as well as their relationships with each other. Their optimism in the development of the industry were sought through a devised Industry Optimism Scaling and it appeared that in general, stakeholders are confident on the future biofuels. The results of the analysis were utilized to make recommendations on the improvement of the relationships among actors to facilitate advancement and growth in the industry. The study also looked into the areas where Sargassum could be found in the Philippines. Through community participatory mapping and thorough confirmation tests, the research team was able to come up with prevalence maps of the brown algae species in six different sites in the country. However, due to some regulation on the restriction gathering, harvesting and cultivation of such species, the research team recommended several measures and studies for the Department of Energy in the future before going into a full-scale production.

SARGASSUM; ALGAE; BIOFUELS; INDUSTRY; PRODUCTION; BIOMASS; LAW; POLICIES; PHILIPPINES

Bioethanol production from macroalgae and socio-ecological implications Project 2: process economic analysis, energetic and GHG reduction potential of bioethanol production from macroalgae. **Demafelis, R. B., Santiago, D.E.O., Movillon, J.L., Hourani, K.A., Gatdula, K.M., Magadia, R.V.** Bioethanol production from macroalgae and socio-ecological implications, Fernandez, P.R.,Jr, Demafelis, R.B., Geganzo, L.G.L., Subade, R.F., Napilan-Espectato, L., Hourani, K., Gatdula, K.M., Magadia, R.V.Jr. *2016. TR-1732. p. 72-113*.

Macroalgae, being one of the promising feedstocks for ethanol production, was assessed for its process economics, and GHG reduction potential. Two scenarios were explored. Scenario 1 considered cellulose, mannitol and alginic acid as substrates for bioethanol production while Scenario 2 includes the first two including alginic acid. Scenario 1 results show that this may not be feasible for ethanol production both economically and environmentally. However, energetic of Scenario 1 shows a positive outcome having an energy ratio of about 1.81:1. On the other hand, Scenario 2 results show that it has a good potential both in terms of its energetic and GHG reduction potential. Energy ratio for Scenario 2 is found to be 6.53:1. Considering the electricity surplus, its GHG reduction potential based on its annual emissions can be as high as 86.44% and based on gasoline offset, up to 60.33%. Moreover, if electricity surplus is not considered, the GHG reduction potential would still be high at 76.49%based on annual emissions and 68.17% based on gasoline offset. All of these high GHG reduction potentials can be realized by using rice hull as feed for power plant. Still, Scenario 2 is not economically feasible considering the prevailing feedstock cost of PhP8-12/L. this case can still be economically feasible by searching for means to lower the processing cost such as by making the technology of conversion of feedstock to bioethanol more efficient.

SARGASSUM; ALGAE; SPECIES; BIOFUELS; ECONOMIC ANALYSIS; PRODUCTION; ETHANOL; MANNITOL; ALGINIC ACID; REDUCTION

Developing production and post harvest technologies for heirloom rice production in the Cordilleras [Philippines]. **Batcagan, J.D., Credo, R.M.S., Sabigan, N.A., Conception, M.S., Romero, M.V., Ilar, G.Y.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 121 (Jul-2018)*.

Heirloom rice are indigenous cultivars that have been passed down for generations through family members and are normally grown in small farms. They command higher prices in niche market locally/internationally mainly due to their excellent eating quality and nutritional value. However, potential is a lucrative livelihood is hindered by factors such as high labor demand in production and significant postharvest losses. To address such challenges, the Heirloom Rice Project introduced various farm machineries fitted for these small land holdings to mechanize land preparation and threshing operation. Testing and evaluation results of the machines recorded a significant reduction in time and labor. The field capacity of the micro tiller prototype was at 850 meters2/hr as compared to the traditional manual trampling at 50 meters2/hr. Moreover, an improved ouput of 470 kg/hr using the mini thresher was achieved from only 17 kg/hr with manual threshing. Cost analysis indicated that manual land preparation at PhP 2.35/ meters2 can be reduce to Php 0.45/ meters2 with micro tiller. Meanwhile, the cost of PhP 2.57/kg paddy threshing through flailing or manual pounding can be trimmed down to PhP 1.48/kg using the mini thresher. To maximize the usefulness of these equipment, their design should be further optimized in terms of efficiency, ease of use, and portability to suit the Cordillera terrain. Along with mechanization, postharvest technology for heirloom rice was developed through a two-way process. Existing best farming practices were documented while simultaneously identifying areas for improvement. A location-specific package of technology was generated combining such farming practices with recommended methods in each specific postharvest process like proper timing of harvest, appropriate drying practice, milling, proper storage, and packaging techniques. These are now translated into technology flipcharts as an IEC material to facilitate a more efficient transfer of knowledge from development workers to farmer beneficiaries.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; PLANT PRODUCTION; TECHNOLOGY; POSTHARVEST EQUIPMENT; TECHNOLOGY TRANSFER; SITE PREPARATION; TERRACES; PHILIPPINES

Development of a nanoparticle-based portable sensor for the rapid and highly sensitive detection of the dengue virus in mosquito. **Fernando, L., Alocija, E., Ebora, R., Aguilar, Z., Salazar, F., Salangad, O., Contreras, J., Bautista, H.N., Vasher, M., Alcachupas, J., Lantican. M.** *2016 TR-1762.*

CULICIDAE; AEDES AEGYPTI; VIROSES; SENSORS; HUMAN DISEASES; DISEASE CONTROL; TECHNOLOGY TRANSFER; HEALTH PROTECTION; SAFETY

Enhancing the Philippine sea cucumber industry through the development of an appropriate processing technology. **Pangan, R.S., Yaptenco, K.F., Pardua, S.N., Duque, A.C**. Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology Yaptenco, K.F.Pangan, R.S. *2016 TR-1724. p.109-130.*

A hygienic and profitable way of processing sea cucumber was developed which is appropriate for village-level application. The developed processing technology involved the design and fabrication of a preparation table, a boiling apparatus, a cleaning/scraping machine and a dryer. Each of the developed machine/equipment were based from the results of the survey conducted regarding the existing processing activities in different areas of the country. The system was designed to process 100 kilos of fresh sea cucumber in a single batch. As compared to the traditional processing method, product produced is of better quality resulting to a much higher selling price for the farmers. Furthermore, the developed technology complies with the processing standards set by the Bureau of Agriculture and Fisheries Products Standards (BAFPS) wherein, use corals and steel brushes in cleaning were eliminated, smoke contamination was avoided and quality was maintained

wherein no smoke odor, decay and scorch marks are present in the product. The increase in income of the farmers as well as the detailed cost-benefit analysis of using the developed technology is likewise shown in this paper. The developed technology is very simple to operate and the machines are very easy to fabricate even in small shops.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRYING; DRYERS; DRIED PRODUCTS; PROCESSED PRODUCTS; FOOD TECHNOLOGY; TECHNOLOGY TRANSFER; INNOVATION; COST BENEFIT ANALYSIS; PHILIPPINES

Engaging legislators in rice and rice-based technology promotion. **Ulay, C.M.M., Acierto, A.J.B., Malonzo, O.C.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 123 (Jul-2018)*.

To create more impact in rice farming communities, the Philippine Rice Research Institute (PhilRice) - Isabela Branch Station, through its project titled, 'Promotion of Rice and Rice-based Technologies in Northeast Luzon, started to engage all potential partners in the area to serve as allies in rice technology promotion. The Sangguniang Panlalawigan/Bayan- Committee on Agriculture members were identified as one group of primary movers. This committee is expected to work in coordination with the Municipal Agriculture Office in planning and implementing agriculture related projects and activities. Thus, to become more effective technology promotion partners, series of Science and Technology Updates for Legislators were conducted to educate them with the latest technologies related to rice and rice-based farming . An analysis of the participants' profile showed that across sites, majority of the Legislators who participated in the said activity were male at 95% while 5% were women. Majority of them were Bachelor of Science in Agriculture degree holders which affirms their qualifications to be in the committee. However, there were 20% legislator-participants who have no background on agriculture. They were the same participants who expressed their interest to have follow-up training activities involving the farmers in their localities. All legislator-participants claimed that the activity gave them ideas on how they could better deliver their roles as chairs of the committee on agriculture and at the same time legislators to benefit their respective farmers. Majority of the participants have selected the top three most useful topics as follows: 1) Overview of the PalayCheck System, 2) ICT Tools, and 3) Climate-Smart Technologies. The participants altogether requested for the conduct of next training activities to include the Committee on Agriculture chair, Municipal Agriculturist, and Planning Officer so that they can be guided in the development of their own municipal agriculture programs.

ORYZA SATIVA; PLANT PRODUCTION; FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION

Ex-ante analysis of PCARRD'S [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [Science and Technology] plans (ISPS) for tropical fruits. **Sumalde, Z.M., Quilloy,K.P., Lontoc, C.G.** *2016 TR-1748*.

One of the activities of the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) to contribute to the achievement of society's development goals is the creation of the Industry Strategic S and T Plans (ISPs). These ISPs aim 'to (1) set the vision and direction for S and T for the agriculture, fishery, forestry and natural resources sectors, and (2) influence other National Innovation System (NIS) actors to align their collective efforts towards such S and T vision' (PCAARRD, n.d.)'. Each ISP describes the targets for the industry and the specific interventions relating to the following four banner programs of

the Council: strategic research and development (R and D; policy analysis and advocacy; technology transfer; and capacity building. Among the sectors that are major concerns in this regard are crops. The commodities that have been identified as potential key contributors in this area are: abaca, banana, coconut, coffee, legumes (peanuts and mungbeans), mango, rice, root crops (sweet potato), sugarcane, tropical fruits (jackfruit, papaya, durian, queen pineapple), and vegetables. This reports covers the ISPs for tropical fruits specifically durian, papaya and queen pineapple. Research proposals for specific S and T interventions to improve these tropical fruits have been submitted and approved. Some activities have even already commenced. Goal s and targets of these strategies that have been identified in particular industries include increasing yield/production, improving product/by-product recovery,and reducing postharvest losses, among others. The ISP for durian generally aims to increase yield from 3 MT/ha, reduced Phytophthora infection on seedlings by 90%, reduced postharvest losses from 28% to 22%, and increased percentage marketable fruits from 90-95% by 2020. For papaya, the ISP aims to increase yield by 95% (from 22.51 MT/ha) and reduced postharvest losses by 50% (from 40% to 20%). For Queen Pineapple, the goals are to increase yield from 41% to 71.5% (from 24.7 MT/ha in Camarines Norte and 30 MT/ha in Leyte to 42.36 MT/ha), reduction in pest and disease damage from 20-35% through policy on grading and standards. The baseline, benchmarks and targets for each of the fruit trees included in the Tropical Fruits ISPs were also validated from secondary data and experts' opinion. Results of the validation showed that the baseline have to be revised to reflect regional differences and area specific, since the national average masked area specificity. For the benchmark, it was suggested that the ISP manager review the data for the Philippines since there are farmers and areas where the yields were already high even compared with the targets. In addition, data from foreign countries are not comparable with the situation in the Philippines. For example, in the case of durian, the benchmark is Thailand and the yield are based on open areas or pure durian, while in the Philippines durian is intercropped with other fruit trees. Results of the analysis showed that the ISPs on tropical fruits are worth pursuing. At 6% discount rate the NPV for the whole tropical fruits ISPs from 2013-2025 would amount to Php 1,228.9M with an overall IRR of 49.50% and average payback period of 5.27 years, which is within the period covered in the analysis. In terms of NPV, Bundle 1 (Regional Durian R and D for Southern Mindanao) with NPV of Php 172.75M, would have the major contribution to the aggregate NPV for Tropical Fruit. This is followed by Bundle 3 (Improvement of Productivity and Quality of Queen Pineapple) with NPV of Php 105.65M. On the other hand, Bundle 2 (Production of Good Quality Planting Materials of Papaya Hybrid and OPV) yielded the highest IRR of 92% while Bundle 1 would have IRR of 54%. Bundle 4 (Processing of Queen Pineapple farm wastes appears to have the lowest values of NPV and IRR and longest payback period.

DURIO ZIBETHINUS; PAPAYAS; PRODUCT DEVELOPMENT; TROPICAL FRUITS; PINEAPPLES; EX-ANTE IMPACT ASSESSMENT; YIELD INCREASES; POSTHARVEST CONTROL; PRODUCTION INCREASE; DEVELOPMENT POLICIES; MARKETING TECHNIQUES; FARM PLANNING; RESEARCH

Extension with a higher mission: improving crop productivity in drought-prone rainfed lowlands in the Philippines. **Santos, R.C., Corales, A.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 124 (Jul-2018).

The drought-prone rainfed lowland rice areas in the Philippines are associated with a number of biotic, abiotic, production, social, and economic constraints. Despite the many released rice varieties and technologies in the

country adapted to this ecosystem, adoption by farmers remain low, partly due to lack of access to seeds and information. Besides, most rice farmers still prefer the use of varieties intended for irrigated areas. In 2015, the Consortium for Unfavorable Rice Environments (CURE) actively promoted the use of drought-tolerant rice varieties intended primarily for rainfed rice lowlands. The project used the strategy of mobilizing Local Farmer Technicians (LFTs) together with selected seed growers who served as intermediaries to advance dissemination of technologies in the rainfed ecosystem. Targeted farmers were provided with timely access to seeds and information through Lakbay Binhi, Farmers Field School (FFS), Demonstration Trials and Field Days. Within a period of two years, the project made a remarkable progress in enhancing the diffusion of sahod ulan seeds and information for more than 3000 farmers covering 52 municipalities in the Ilocos Region. Farmer-partners got an average yield of 4.21 t/ha which was 1.14 t/ha more from what they normally produce. Furthermore, a total of 1,723 farmer participants were trained and obtained an average of 36.38% gained in knowledge and skills. With the initial results of the project, the farmer-participants hope to enhance crop establishment and intensification in the future through mechanization, thereby enhancing productivity and income.

ORYZA SATIVA; VARIETIES; PLANT PRODUCTION; PLANT ESTABLISHMENT; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; DROUGHT; RAINFED FARMING; LOWLAND; PHILIPPINES

Farmers experience 'a whole new world' with the help of a Disney-inspired startup company. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 20-23 (Aug 2019)*.

AGRICULTURAL PRODUCTS; MARKETS; DEMAND; POSTHARVEST TECHNOLOGY; FOOD PROCESSING; TECHNOLOGY; URBAN AGRICULTURE; PLANTING; VEGETABLES

Farmers grow recommended cacao varieties through CPAR [Community-based Participatory Action Research]. *Agriculture (Philippines) v. 23 (4) p. 18 ; 20 (Apr 2019)*.

THEOBROMA CACAO; VARIETIES; CROP MANAGEMENT; TECHNOLOGY; HARVESTING; CULTURAL METHODS; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS; COMMUNITY INVOLVEMENT; SOCIAL PARTICIPATION; RESEARCH

Impact of Farmer Field School-Palaycheck sup R in the irrigated rice areas in the Philippines. **Mataia, A.B., Olivares, R.O., Manalili, R.G., Malasa, R.B., Litonjua, A.C., Redondo, G.O., Relado, R.Z., Paran, S.J., Tolentino, C.M.A.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 49-61 (Dec 2015).*

The Farmer Field School-PalayCheck sup R (FFSP) is a knowledge and learning-based approach that aims to improve yield and income of farmers through the adoption of PalayCheck sup R platform, a dynamic rice crop management system that presents the best key technology and management practices as key checks. It was implemented in 2010 by the Philippine Rice Research Institute (PhilRice) in support to the 100% rice self-sufficiency target of the government. The FFSP was operationalized through the deployment of Rice Self-Sufficiency Officers (RSOs) in 24 provinces with yields below 4 t/ha in irrigated areas. This study assessed the impacts of the FFSP using the 2009 two season baseline and 2010 seasonal monitoring survey data. Impacts of the project were measured using descriptive statistics, costs and returns analysis, and frontier production function adopting the before and after project evaluation approach. Results showed positive impacts of the project in 2010 relative to 2009. More farmers adopted different combinations of the 8 key checks with 18% completely adopting, resulting in an improved technology adoption, management practices and technical

efficiency scores of farmers. Adoption of key checks increased yield by 9% (0.33 t/ha), and reduced per unit production cost by 2.82% (PhP0.23/kg), which translates to a notable increase in net income by 25% (PhP3,907/ha) and returns to investment by 18%. Total rice areas covered by the project generated an incremental palay output of 3,457 t with 0.022% share to domestic total production in 2010. The FFSP is a good extension approach for capacitating farmers and has the potential to shift the yield from low to high level. The following are recommended to achieve significant impact: enhance TE level of farmers; establish more field demonstrations to facilitate PalayCheck sup R dissemination and diffusion; expansion of areas to cover more farmers; and periodic monitoring and feedback for its sustainability and improve implementation.

ORYZA SATIVA; IRRIGATED RICE; CROP MANAGEMENT; FARMERS; IMPACT ASSESSMENT; PHILIPPINES; TECHNOLOGY; TECHNOLOGY TRANSFER; INNOVATION ADOPTION; DIFFUSION OF INFORMATION

Livelihood potentials and environment protection**.** **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (07) p. 40-41 (Jul 2019)*.

AGROFORESTRY; BIODIVERSITY; NATURE CONSERVATION; ORGANIC AGRICULTURE; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS

Mangyan [indigenous groups of Mindoro, Philippines] mothers learn farming skills to jumpstart community on the road to self-sufficiency. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 48-49 (Apr 2019).*

ORGANIC AGRICULTURE; COMPOSTING; OLIGOCHAETA; TECHNOLOGY; TECHNOLOGY TRANSFER; COMMUNITY DEVELOPMENT; ETHNIC GROUPS; PHILIPPINES

Mushroom production: a strategic approach in enhancing the entrepreneurial spirit in rural communities. **Corales, A.M., Corales, R.G., de Gracia, G.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine *Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 126 (Jul-2018)*.

The Philippines produces 15.2 million tons of rice that leave behind 11.3 million tons of rice straw every year (PhilRice, August 2012). Despite its many known uses, bulk of the rice biomass is still being disposed indiscriminately. The availability of abundant biomass resources such as rice straw as substrate in mushroom production and processing opens up opportunities for the development of commercial scale production in the Philippines. In 2017, market scanning was conducted in the Science City of Muñoz to determine rice straw's potential in mushroom due to its nutritional value as perceived by the target clientele. With possible alternative income, the Palayamanan Plus Project trained 28 potential men and women entrepreneurs of Kababaihang Kinikilala ng Lungsod Agham (Maligaya Chapter) and Bantug Primary Multi-Purpose Cooperative on June 2017. The training on mushroom production and processing aimed to build the capacity of entrepreneurs in agri-business ventures and enhance their participation in economic development. With PhilRice's assistance, initial materials were provided to start-up the business. Members initially sold 0.5-2kg/day within the barangay [village], and from the sales, P120.00 was divided among the producers for profit sharing and the rest goes to the seller. Moreover, mushroom production activities also created job opportunities for the members and neighboring individuals. The investment cost was recovered immediately after only five months of operation amounting to P30,411.00 and P20,691.50, respectively. Aside from additional household income, the cooperative allocated 35% of the revenue to other businesses and projects.

Trained members expanded the production into their houses to support the demand of the market. Furthermore, the members were strengthened through various activities, sharing experiences, and enabling them to engage in the market. With sustainability, mushroom production can offer significant opportunities in developing rural economies, diversifying business, and empowering women on the countryside.

EDIBLE FUNGI; PRODUCTION; AGROINDUSTRIAL SECTOR; WOMEN; ROLE OF WOMEN; TECHNOLOGY; TECHNOLOGY TRANSFER; RURAL COMMUNITIES; RICE STRAW; CULTURE MEDIA

Rice technologies showcased in varietal derby. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 10 (Apr 2019).*

ORYZA SATIVA; RICE; VARIETIES; FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER; CROP PERFORMANCE; AGRONOMIC CHARACTERS; CULTURAL METHODS; MECHANIZATION

Strengthening the promotion of direct seeded rice culture: strategy for climate change adaptation and cost reducing technology. **Alasaas, D.G., Pasicolan, H.R., Gawat, N.R., Acierto, A.J.B.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 125 (Jul-2018).*

The effect of climate change in rice production is detrimental to our country's rice self-sufficiency. However, there are already technologies that can mitigate its effects. One is the use of direct seeding technology. Direct seeding has resulted to reduced methane emissions due to shorter flooding period and decreased soil disturbance compared to transplanted rice. Also, 60% of energy (diesel) is decreased because or elimination of field preparation for seedbed, pudding. DSR can also save 40% on labor cost required for seed bedding, pulling and transplanting. However despite these advantages, adoption remains low in Isabela. Thus, promotion of DSR through technology demonstration farms and trainings were conducted. In 2017 wet and dry seasons, demonstration farms established in Villafuerte and Daramuangan Norte, San Mateo, Isabela to showcase and localize the DSR technology. This project was conducted in collaboration with NIA-MARIIS and LGU-San Mateo. After which, selection and validation of demonstration sites, cooperators and participants for the conduct of season long farmers' field school was done. To improve awareness on DSR, project briefing, ceremonial seeding and field days were also conducted in both sites. Based on the results, the demonstration sites in Villafuerte and Daramuangan Norte obtained yield of 5.7 and 6.7 t/ha with a net benefit of Php 48,985.00, and PhP 87,904.52, respectively. For 12 adopters with 6.43 hectares, yield obtained was 3.4 to 8.5 t/ha with net benefit ranging from PhP 33,685.00 to PhP 115, 468.00 per hectare during WS 2017. For DS 2018, another demonstration farm was established at Victoria, San Mateo, Isabela. There were 25 participants in the season-long farmers' field school. At present, 26.47 hectares were planted using DSR for the 20 adopters. There should be a continuing promotional activity of DSR to further increase awareness of farmers within the municipality of San Mateo, Isabela.

ORYZA SATIVA; VARIETIES; TECHNOLOGY; TECHNOLOGY TRANSFER; FARMERS; CLIMATIC CHANGE; ADAPTATION; DIFFUSION OF INFORMATION; DIRECT SOWING; CROP YIELD

Strengths and challenges of Philippine coffee production. **Papa, A.G**. *Agriculture (Philippines) v. 23 (3) p.62-64 (Mar 2019)*.

COFFEA; VARIETIES; PLANTING; PLANT PRODUCTION; SUPPLY BALANCE; RESEARCH; TECHNOLOGY; SCIENTISTS; LOCAL GOVERNMENT; EDUCATIONAL INSTITUTIONS; PHILIPPINES

Sustainable upland farming through the establishment of 'Barangay [village] Sagip Saka' (Conservation Farming Villages project – CFVs) in General Nakar, Quezon [Philippines]. **Cruz, R.V.O., Carandang, W.M., Astejada, J .F., Aumentado, M.J., Gevana, D.T., Pilas, M.T., Galapia, G.A., Astreda, J., Ojeda, M.N., Aguilon, B.C., Magno, G.V.** *2011 TR-1802*.

The Conservation Farming Villages (CFV) is a modality for improving human lives through better livelihoods, agricultural productivity, and environmental security of communities living in the marginal sloping lands to the prevailing climate changes. It aimed to help upland farmers improve their economic conditions by strengthening their capacities to manage natural resources thereby protecting their communities against environmental degradation while sustaining their sources of livelihood. The program adopted the community-based participatory approach to technology development, promotion and utilization; and multi-level technology promotion mechanism that would capacitate local extension/change agents. Such strategies would ensure sustainability of efforts in promoting upland farming technologies and approaches, and would strengthen the 'multiplier effect' of existing technology diffusion processes at the local level. CFV in Genral Nakar was implemented in three upland barangays/villages namely: Magsikap, San Marcelino and Minahan Norte. The project included the empowerment of farmer volunteers enabling them to become vanguards of sloping land resources by providing them with skills and knowledge in food, wood and fiber production and resource management; tapping the active leadership and participation of the local government units (municipal, barangay) in carrying out program activities down to the barangays level such as extension work, community organizing and facilitating market linkages and other support services; and provision of technical expertise and guidance of a state university/college in the province or the nearest site, in this case, the University of the Philippines Los Baños. A total of three farming villages having 15 farmer volunteers participated in the implementation in 15 model farms. A total of 56 hectares of sloping lands were initially developed by the project using participatory approach. A total of nine training courses were conducted resulting in participation of 410 participants. Three training shelters cum training and technology centers have been established in each of the barangays halls. The project had also produced 10 trainers from collaborative groups and institutions, especially those from the office of the Municipal Environment and Natural Resources Office of General Nakar. CFV involves the empowerment of farmers to become vanguards of sloping land resources by providing them with skills and knowledge in food and fiber production and resources management; tapping the active leadership and participation of the local government units (municipal and barangays) in carrying out program activities down to the barangays level as extension work, community organizing, and facilitating market linkages and other support services; and provision of technical expertise and guidance by the state university/college in the province or nearest site.

FARMLAND; FARMERS; DEVELOPMENT PROJECTS; SUSTAINABILITY; HIGHLANDS; UPLAND CROPS; COMMUNITY DEVELOPMENT; LIVING STANDARDS; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

Thinking out of the box-innovations for sustainable vegetable sufficiency in our community. **Barcelona, A.** *Agriculture (Philippines) v. 23 (4) p. 26-29 (Apr 2019).*

VEGETABLES; PRODUCTION; TECHNOLOGY; MARKETING; MARKETS; CREDIT; COOPERATIVES; FARMERS; INNOVATION ADOPTION; SUSTAINABILITY

E20 Organization, administration, and management of agricultural enterprises of farms

Bukid [farm] Amara: a new level of farm experience. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (5) p. 56-57*.

FARMS; RURAL AREAS; TOURISM; FLOWERS; VEGETABLES; CROPS; CROP MANAGEMENT

Documentation of the green practices by the selected cooperatives in Laguna [Philippines]. **Quicoy, A.R., Lawas, T.P.** *2016. TR-1793.*

Cooperative is a form of people's organization with primary goals of helping its members to help them attain their economic and social aspirations. The last PNoy's administration believes that cooperative is a good strategy for poverty alleviation and sustainable development. For cooperatives to be truly a strategy for sustainable development, it must not only be vehicle for their members' economic and social aspirations, but must also be a vehicle for environmental protection and resource conservation. This study was conducted to gather the 'green' practices of the cooperatives in Laguna [Philippines]. Specifically, the objectives were to: 1) Describe the profile of the cooperatives that perform 'green' practices; 2) Identify the bio-enterprises engaged in by the selected cooperatives and describe the processes and 'green' practices in their conduct; 3) Narrate and document the circumstances that led the cooperative to undertake measures and processes that are healthy to the environment; and 4) Identify issues/constraints/problems encountered by the cooperatives in the adoption of environment-friendly practices. It was found that not many cooperative s were consciously doing green practices and sustainably doing it yet. Six cooperatives were found to have been doing green practices that were documented in the video presentation and brochures. They serve as the outputs of the research that would inspire and motivate other cooperatives to follow. The common practices were doing organic farming, the construction of 'green' building and other simple office resource-conservation practices such as rain-water collection, water and energy conservation practices (use of LED lights, limiting the use of air-conditioning units). For transport service cooperative, it was the use of signages in the jeepneys like 'No Smoking', 'Bawal Magtapon ng Basura sa Labas ng Sasakyan', the putting of trash can inside the jeepney, and the use of bio-diesel fuel. It is the authors recommendation for the CDA or Cooperative-in-charge offices to include in their trainings/capacity-building program topics on environment to raise the cooperatives level of awareness on environment. The cooperatives can also do 'green' projects with the use of their CEDF fund thus also practicing the 7th principle of 'Concern for the community.

FARMS; COOPERATIVES; ENVIRONMENTAL PROTECTION; SUSTAINABLE DEVELOPMENT; RESOURCE CONSERVATION; COMMUNITY INVOLVEMENT; ORGANIC AGRICULTURE; WASTE MANAGEMENT; POLLUTANTS; PHILIPPINES

Ex ante evaluation of the industry strategic S and T [Science and Technology] plans (ISPs) of the forestry sector: Ex ante evaluation of the industry strategic S and T [Science and Technology] plans (ISPs) for bamboo. **Depositario, D.P.T., Reyes, G.U., Aquino, D.R.G.** *2016 TR-1768.*

This report covers three objectives. The first one is to validate the assumptions related to the indicators used in the proposed specific interventions of bamboo. Indicators for culm yield such as baselines and benchmarks indicators were found to be achievable given certain management practices, site quality and species. Additional yield indicators were also set to take into account local variations in yield while indicators for hectarage were set based on current area covered with bamboo. Further, achievable targets were set taking into consideration the current production and potential of the industry. The second objective is to trace and analyze the pathways by which the S and T interventions will, individually and collectively, result in the projected changes in the bamboo industry. Pathways of the respective projects and of the Bamboo ISP as a whole were mapped and analyzed and it was found out that interventions utilizing mature technologies

generated returns whereas those project which developed and/or are still developing new technologies will require some time before their target benefits are realized. Moreover, projects in the technology generation stage will require technology transfer activities to facilitate the dissemination and eventual utilization of outputs of target-end users. The last objective of this research is to identify, quantify and estimate in monetary terms where possible, the likely benefits and costs of the interventions for bamboo.Using benefit-cost analysis, the values for benefits and costs were estimated the Bamboo and projected. The study found that the Bamboo ISP is worth investing in since it will yield positive net benefits in the future. It was also revealed that by taking into account environmental benefits in the analysis, prospective returns from an intervention increase significantly. Moreover, it was found that projects turn out to be more economically viable when a project's design is such that a production-oriented project is simultaneously conducted with a processing- and/or marketing-related projects. Further, it was analyzed that by focusing only on the potential returns from farmer-adoptors alone and not on the potential benefits to other players in the industry (e.g., processors) of an intervention, there could be an underestimation of the net economic benefits from the public investments.

BAMBOOS; PRODUCTION; COST BENEFIT ANALYSIS; ECONOMIC VALUE; POSTHARVEST CONTROL; QUALITY ASSURANCE; WOOD TECHNOLOGYFarm resort encourages value-added farming by turning bananas into banana chips. **Tan, Y.** *Agriculture (Philippines) v. 23 (07) p. 58-60 (Jul 2019)*.

BANANAS; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; FARMS; RURAL AREAS; TOURISM; MARKETING

Financial crises was a blessing in disguise. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (5) p. 54-55 (May 2019)*.

PLANTS; FLOWERS; FARMS; PLANT EXTRACTS; ESSENTIAL OILS; ENTERPRISES

Forest wood garden: farm tourism destination with a culinary twist. **Urlanda, R.V**. *Agriculture (Philippines) v. 23 (07) p. 54-56 (Jul 2019)*.

FRUIT TREES; FOREST TREES; BAMBOOS; CROPS; FARMS; RURAL AREAS; TOURISM; INDIGENOUS KNOWLEDGE; FOOD PROCESSING

E21 Agro-industry

Calamansi industry in Mindoro [Oriental Mindoro, Philippines] analyzed. **Anon**. Agriculture *(Philippines) v. 23 (1) p.40-41 (Mar 2019)*.

CALAMONDINS; PRODUCTION; INDUSTRY; MARKETS; MARKETING; PHILIPPINES

Economic potential of small-scale citronella (Cymbopogon winterianus) production in the Philippines**. Camacho, S.C., Carandang, A.P., Camacho, L.D., Gevaña, D.T., Carandang, M.G., Lorida, R.E., Bandian, Ma.N.P**. *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 73-81 (Dec 2015)*.

The economic potential of establishing smallholder citronella grass (Cymbopogon winterianus) plantation for essential oil production was assessed. Data were gathered through key informant interviews, field visits and observations of citronella plantation and processing activities of the University of the Philippines Laguna-Quezon Land Grant (UP-LQLG). The various activities involved in essential oil production include: site preparation (e.g. brushing and clearing, cultivation of soil, holing, planting, and fertilizing); maintenance and protection; harvesting and hauling; and, processing of citronella grass. By estimate, 96 L ha sup -1 was

produced per harvest which has a gross revenue of PhP115,200.00. With three harvests during the first year, the gross revenue was PhP 345,600.00. Considering all costs, the total net revenue of oil production during the first year of harvest was PhP135,562.20. Results also showed that pursuing such enterprise could be economically viable since its Net Present Value (NPV) in 10 years can reach as much as PhP2.891 M at 12% discount rate. This can be translated to PhP240.917 NPV/ha. The projected internal rate of return for the same period is around 91%, a fairly attractive return on investment. The overall employment generation potential of the venture is also fairly attractive with an average of 936 MD/ha/ 1 yr. One problem encountered that hindered the profitability of citronella production is that the UP-LQLG was not able to acquire an efficient extractor with which efficiency of oil extraction depends.

CYMBOPOGON; SPECIES; ESSENTIAL OILS; EXTRACTION; EXTRACTS; PRODUCTION; PROFITABILITY; COSTS; COST BENEFIT ANALYSIS; PHILIPPINES

Ex-ante analysis of PCAARD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [science and technology] plans for crops, livestock and inland aquatic resources: Ex-ante analysis of PCAARD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [science and technology] plan (ISP) for livestock (Native Chicken). **Arapoc, J.A., Jimenez, C.D.** *2014 TR-1737.*

This study conducted an ex-ante analysis of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry Strategic S and T [science and technology] Plan for Native Chicken that aims to validate the baselines and benchmark set for the program, to map the programs adoption and impact pathway, and lastly to conduct a Benefit Cost Analysis to assess the viability of the program for each implementation sites (Bicol, Bohol, and Zamboanga Peninsula [Philippines]). By conducting a series of Key informant interviews, focus group discussions, and field surveys, the research managed to realize its objective. Upon validation of the initially set benchmarks and baselines for the Native Chicken ISP, it was discovered that these benchmarks and baselines are unfitting for the program since the data used to set them are only applicable for broiler types. The study provided a new set of benchmarks and baselines through the help of several industry and technical experts. The study also mapped the program's adoption and impact pathway in order to establish linkage between the program's expected output and target outcome. In addition, issues and challenges faced by the program were also identified and discussed. Meanwhile, results of the Benefit Cost Analysis suggest that the program is indeed viable for all the implementing sites with the assumption of an ideal scenario. The study provided evidences that among the three implementation sites, the program implemented in Bohol is expected to generate the highest returns. However, upon performing sensitivity analysis, the study found out that the viability of the program can be easily affected by alternative state-of-the-worlds which includes following: (1) adoption of POT 1 to 3 only; (2) adoption of POT 1 and 4 only; and (3) reduction of adoption rate by 50%. The simulation of BCA for each scenario resulted in mix outcomes.

CHICKENS; INDIGENOUS ORGANISMS; COST BENEFIT ANALYSIS; LIVESTOCK MANAGEMENT; ANIMAL HEALTH; EX-ANTE IMPACT ASSESSMENT; ANIMAL PRODUCTION

Ex-ante analysis of PCARRD'S [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [Science and Technology] plans (ISPS) for tropical fruits. **Sumalde, Z.M., Quilloy,K.P., Lontoc, C.G.** *2016 TR-1748*.

One of the activities of the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) to contribute to the achievement of society's development goals is the creation of the Industry Strategic S and T Plans (ISPs). These ISPs aim 'to (1) set the vision and direction for S and T for the agriculture, fishery, forestry and natural resources sectors, and (2) influence other National Innovation System (NIS) actors to align their collective efforts towards such S and T vision' (PCAARRD, n.d.)'. Each ISP describes the targets for the industry and the specific interventions relating to the following four banner programs of the Council: strategic research and development (R and D; policy analysis and advocacy; technology transfer; and capacity building. Among the sectors that are major concerns in this regard are crops. The commodities that have been identified as potential key contributors in this area are: abaca, banana, coconut, coffee, legumes (peanuts and mungbeans), mango, rice, root crops (sweet potato), sugarcane, tropical fruits (jackfruit, papaya, durian, queen pineapple), and vegetables. This reports covers the ISPs for tropical fruits specifically durian, papaya and queen pineapple. Research proposals for specific S and T interventions to improve these tropical fruits have been submitted and approved. Some activities have even already commenced. Goal s and targets of these strategies that have been identified in particular industries include increasing yield/production, improving product/by-product recovery,and reducing postharvest losses, among others. The ISP for durian generally aims to increase yield from 3 MT/ha, reduced Phytophthora infection on seedlings by 90%, reduced postharvest losses from 28% to 22%, and increased percentage marketable fruits from 90-95% by 2020. For papaya, the ISP aims to increase yield by 95% (from 22.51 MT/ha) and reduced postharvest losses by 50% (from 40% to 20%). For Queen Pineapple, the goals are to increase yield from 41% to 71.5% (from 24.7 MT/ha in Camarines Norte and 30 MT/ha in Leyte to 42.36 MT/ha), reduction in pest and disease damage from 20-35% through policy on grading and standards. The baseline, benchmarks and targets for each of the fruit trees included in the Tropical Fruits ISPs were also validated from secondary data and experts' opinion. Results of the validation showed that the baseline have to be revised to reflect regional differences and area specific, since the national average masked area specificity. For the benchmark, it was suggested that the ISP manager review the data for the Philippines since there are farmers and areas where the yields were already high even compared with the targets. In addition, data from foreign countries are not comparable with the situation in the Philippines. For example, in the case of durian, the benchmark is Thailand and the yield are based on open areas or pure durian, while in the Philippines durian is intercropped with other fruit trees. Results of the analysis showed that the ISPs on tropical fruits are worth pursuing. At 6% discount rate the NPV for the whole tropical fruits ISPs from 2013-2025 would amount to Php 1,228.9M with an overall IRR of 49.50% and average payback period of 5.27 years, which is within the period covered in the analysis. In terms of NPV, Bundle 1 (Regional Durian R and D for Southern Mindanao) with NPV of Php 172.75M, would have the major contribution to the aggregate NPV for Tropical Fruit. This is followed by Bundle 3 (Improvement of Productivity and Quality of Queen Pineapple) with NPV of Php 105.65M. On the other hand, Bundle 2 (Production of Good Quality Planting Materials of Papaya Hybrid and OPV) yielded the highest IRR of 92% while Bundle 1 would have IRR of 54%. Bundle 4 (Processing of Queen Pineapple farm wastes appears to have the lowest values of NPV and IRR and longest payback period.

DURIO ZIBETHINUS; PAPAYAS; PRODUCT DEVELOPMENT; TROPICAL FRUITS; PINEAPPLES; EX-ANTE IMPACT ASSESSMENT; YIELD INCREASES; POSTHARVEST CONTROL; PRODUCTION INCREASE; DEVELOPMENT POLICIES; MARKETING TECHNIQUES; FARM PLANNING; RESEARCH

E40 Cooperatives

Reaching farmers through high quality seed multiplication and dissemination in Nueva Ecija, Iloilo, and Bohol [Philippines]. **Manigbas, N.L., Badajos, A.T.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 26-34 (Dec 2018).*

Increasing rice production and income of small farmers is always a challenge in Philippine agriculture. New approaches have to be explored so that farmers themselves can work together to achieve their goal of increased productivity and income. High quality seeds in one of the most important needs of farmers especially those who could not afford to buy. To address this problem, the Korea Program on International Agriculture (KOPIA) in collaboration with the Philippine Rice Research Institute (PhilRice), LGUs [Local government units] and DA [Department of Agriculture] Regional Offices, implemented the seed multiplication and dissemination project to guarantee farmer's access to high quality seeds. The strategy involves lending farmers high quality seeds of the variety they chose at the start of planting season and after harvest they will return the equivalent cash of PhP1,000.00 per sack to the cooperative where they belong. The amount generated becomes the seed money of the cooperative which members can borrow to help finance their farm operations. Four years after the implementation of the collaborative study, the Bantug Primary Multi-Purpose Cooperative, in the Science City of Munoz, Nueva Ecija [Family] generated PhP1,279.050.00 and farm machines. Meanwhile, Bohol Farmers Multi-Purpose Cooperative in Pilar, Bohol generated PhP1,257,271.08 and a milling machine whereas the Sinibaan Farmers' Association in Dingle, Iloilo generated PhP 479,000.00 and irrigation facilities that service nearly 100 ha of rice field. Capacity enhancement through farmers' trainings on each site and free educational tour to South Korea were conducted to increase their knowledge on new technologies. Overall, this collaborative study is geared towards helping the government in achieving rice security and in helping farmers and their cooperative to increase income and capacity to expand rice farming operations.

SEED; RICE; QUALITY; PLANT PRODUCTION; FARMERS; FARMERS ASSOCIATIONS; INCOME; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES; PHILIPPINES

E50 Rural sociology and social security

Development of a nanoparticle-based portable sensor for the rapid and highly sensitive detection of the dengue virus in mosquito. **Fernando, L., Alocija, E., Ebora, R., Aguilar, Z., Salazar, F., Salangad, O., Contreras, J., Bautista, H.N., Vasher, M., Alcachupas, J., Lantican. M.** *2016 TR-1762.*

CULICIDAE; AEDES AEGYPTI; VIROSES; SENSORS; HUMAN DISEASES; DISEASE CONTROL; TECHNOLOGY TRANSFER; HEALTH PROTECTION; SAFETY

Socio-economics survey of the local community in Mrs. Palay-Palay/Mataas na Gulod Protected Landscape, Southern Luzon, Philippines. **Ching, J.A., Mercurio, A.L., Salibay, C.C., Torres, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 17*.

Mts. Palay-palay/Mataas-na-Gulod Protected Landscape is a biologically-rich protected landscape (PL) located in the provinces of Cavite and Batangas, Luzon island in the Philippines. It represents a priceless conservation

area with its densely stocked forest cover and unique wildlife resources. The PL hosts some rare species and vulnerable species endemic to the country. In this study, the plant and animal forest resources utilized by the members of the local community were identified vis-a-vis and their perceived constraints to economic activity. The level of conservation awareness and attitudes in relation to the conservation program implemented in the protected landscape was also determined. Information on the community's socio-economic condition, awareness and attitude conservation was collected by using the Household Survey Questionnaire (HSQ) modified. Forest resource utilization survey through personal interviews and household views were conducted to gather in-depth information on preference and utilization of forest by the community with the validation of some respondents' responses to the HSQ used. Area visitations using direct observation were also performed for confirmation and proper documentation of the forest resources. Based on the findings, the members of the community prefer 55 plant and 14 animal species they directly utilized from MPPMGPL both for subsistence and income generation. The manner of resources utilization is tied to both sustainable, such as the habit of soil composting, and destructive activities, such as involvement to large scale charcoal-making action. The members of the community exhibit high socio-economic dependence to MPPMGPL with more than half of their average monthly household earning linked to forest resources utilization. Bamboo stick production, agroforest farming including livestock and charcoal-making activities appear to be important income generating activities in the area. The members of the local community seem to acquire high level of positive biodiversity conservation attitude but low level conservation awareness.

PROTECTED FORESTS; RESOURCE MANAGEMENT; BIODIVERSITY; NATURE CONSERVATION; INDIGENOUS ORGANISMS; RURAL COMMUNITIES; HOUSEHOLDS; INCOME; PHILIPPINES

Traditional lodge stays in Banaue [Philippines] let tourists experience the life of rice farmers. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (06) p. 56-57 (Jun 2019)*.

FARMERS; INDIGENOUS KNOWLEDGE; ETHNIC GROUPS; BUILDINGS; TOURISM; RURAL AREASRICE; TERRACES; PHILIPPINES

E70 Trade, marketing and distribution

Analysis of the value addition and distribution in the rice value chain in the Philippines. **Mataia, A.B., Beltran, J.C., Manalili, R.G., Francisco, N., Flores, A.C., Catudan, B.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science v.43 (Supplement no. 1) p. 129-130 (Jul-2018)*.

Farmers are often the marginalized actors in the rice value chain (VC), who participate as palay producers only, and allegedly, received less of the total value addition. This study aimed to identify and analyze the distribution of added value in the rice VC, assess how much value is created by the chain, who are the chain actors benefiting from this added value, and how much of the value is distributed to rice farmers in particular. Field survey was conducted to sample VC actors in top 20 rice-producing provinces and major demand centers in the country using different sets of structured questionnaires. Cost and return analysis and relative financial distribution of added cost, profit, and price of milled rice per function in the rice VC, respectively. The rice VC consists of core functions from input provision and production, paddy aggregation, rice processing, and marketing performed by VC actors: farmers, paddy traders, rice millers, wholesalers and retailers, respectively. Results showed that from palay production to marketing of milled rice, the total value added cost was PhP

31.33/kg, of which farmers received the highest profit share of 58%. Miller-traders obtained a profit share of 9%; retailers had 11%, while paddy traders and wholesalers got the lower profit share of 58%. Miller-traders obtained a profit share of 9%; retailers had 11%, while paddy traders and wholesalers got the lower profit share of 5% and 6%, correspondingly. However, on the average, farmers produce only 8 tons/year and trade small marketable surplus, and profit is earned from a 4-month cropping period. Conversely, the other VC actors’ profits are increased by volume, fast stocks turnover, integration of functions, and investments for quality improvement. Empowering farmers by integrating them into rice VC will capture the total value addition and consequently increase their income.

RICE; MARKETING; FARMERS; INCOME; MARKETING CHANNELS; VALUE ADDED; PROFIT; COSTS; ECONOMIC ANALYSIS; PHILIPPINES

Farmers experience 'a whole new world' with the help of a Disney-inspired startup company. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 20-23 (Aug 2019)*.

AGRICULTURAL PRODUCTS; MARKETS; DEMAND; POSTHARVEST TECHNOLOGY; FOOD PROCESSING; TECHNOLOGY; URBAN AGRICULTURE; PLANTING; VEGETABLES

KOICA [Korea International Cooperation Agency] project eyed to resolve Panay [Philippines] upland farmers' marketing problem. **Toreno, S.M.H**. *Agriculture (Philippines) v. 23 (3) p.56-57 (Mar 2019)*.

AGRICULTURAL PRODUCTS; MARKETING; HIGHLANDS; FARMERS; COOPERATIVES; PHILIPPINES

Postharvest system improvement–best practices in fresh and dried chili in Southeast Asia: quality and safety aspect. **Esguerra, E.B., Absulio, W.L.** *2016 TR-1716*.

Chili (Capsicum frustescens), popularly known as bird's eye chili or 'siling labuyo' in the Philippines, is one of the most popular spices grown in the country. Chilies are commonly used during meals as condiment to add flavor and spice to local viands. Chilies are produced across the country mostly for domestic consumption but some are also exported. Fortunately, the chili industry has no rejection notifications and has great potential to expand. To develop GAP on fresh chili and GMP on dried chili aiming for high value domestic and export markets and to develop supply chain management in postharvest, available data and information on chili were gathered. Likewise, interview of chili growers and processors and production site visits were conducted. Different supply chains were drawn from the interviews wherein the growers/processor, buyer/trader/assembler, wholesaler, retailer, and consumers are the main players. Quality and safety issues along the value chain were identified and the main concerns were on the non-compliance to GAP, lack of knowledge on the specific chili variety planted, fluctuating market price, and marketing. Along with these, best practices and other suggestions were given to improve the current state of the chili value chain. Compliance and implementation of national GAP and other standards will greatly enhance production and postharvest practices to reduce problems on quality and safety of produce. Compliance will also be enhanced if 'price premiums' are given to complying farmers. For the processing aspects, compliance with GMP and standards will improve the operation and management of the processing plants and broaden their market potentials locally and internationally. Lastly, with government's intervention, a shorter supply chain can be developed by linking growers directly to specific trading centers and/or institutional buyers to address marketing issues, and to mediate in the relationship of farmer and buyers/traders to provide security and to avoid price distortions.

Government support are also needed to initiate research activities to provide reliable data and information to further support development of best practices for production, postharvest and processing of chili.

CHILLIES; CAPSICUM FRUTESCENS; VARIETIES; SAFETY; QUALITY; PRODUCTION; PROCESSING; POSTHARVEST TECHNOLOGY

Market pathways of smallholder rice farmers in San Mateo, Isabela [Philippines]. **Melegrido, R.S., Malonzo, O.C., Adolfo, J.V.E., Javier, L.C.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 129 (Jul-2018)*.

The Rice Business Innovation System (RiceBIS) is the banner development program of the Philippine Rice Research Institute, which was launched in 2017. It envisions to increase yield, lower production cost, and to link farmers to the market by engaging individual farmers into group marketing. To realize these goals, one important activity was conduct of market chain study on fresh palay to analyze the movement of the commodity from the farmers' field to consumers to determine their advantage. Data were gathered from 68 cluster members of the RiceBIS community in San Mateo, Isabela and other chain actors through Key Informant interviews and field observations. Results showed that majority of the farmers sold their harvest to local Palay Buying Stations in San Mateo, Isabela while there were few who sold their harvest to 'biyaheros' or traders from nearby provinces such as Pangasinan and Nueva Vizcaya. Farmers preferred to sell their produce individually as fresh palay owing to lack of drying and storage facilities to process and keep their harvest. The local Palay Buying Stations immediately sell what they have consolidated from farmers to their network of millers in San Mateo and in nearby municipalities. The millers process and produce milled rice for delivery to their market network in Metro Manila, Bulacan, La Union, and other provinces. Results therefore indicate that there is a ready and strong market of fresh palay in San Mateo, Isabela. Moreover, in terms of profit, there is no difference when farmers market their palay individually or in group as price is controlled by the traders. Farmers though, may create an advantage by specializing in the development of rice and rice-based products with defined market outlets.

RICE; MARKETING; MARKETING CHANNELS; FARMERS; MARKETING TECHNIQUES; DEVELOPMENT PROJECTS; CONSUMERS; PHILIPPINES

Research to revenue: the feasibility of brown rice cracker ice cream sandwich. **Ballesteros, J.F., Labargan, E.S.A., Maraois, R.V., Morales, A.V., Abilgos-Ramos, R.G.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 130 (Jul-2018)*.

Brown rice cracker ice cream sandwich (BRICS), made from nutritious brown rice and buffalo's milk, is one of the rice-based value-added products that was developed by PhilRice [Philippine Rice Research Institute] to provide additional source of income and nutrition for the rice-based farm communities. To ensure marketability and profitability of the BRICS, a pre-feasibility study was conducted. Consumer acceptability of the BRICS and the feasibility of its commercialization were determined. Results showed that the respondents (n=100, 15-30 y old) rated BRICS with ''like very much'' (x raise to negative power = 8.40 plus minus 0.8; 1-dislike extremely to 9-like extremely) and 100% of them were willing to buy BRICS once available in the market. Pre-feasibility study forecasted that if 1% and 2% of the target number of consumers (n=611,473) will

buy the product, the potential market demand will be 10,546 and 21,093 BRICS every month, respectively. Further, it was found that the most feasible commercialization scenario for the product is at 2% of the target number of consumers at PhP 30.00 (approx 50% mark-up) per piece. Projected 5-year financial statements showed that if the product is commercialized for 5 years, it will generate positive net profits and net cash flows with a payback period 2.4 years, a positive net present value of PhP 688, 422.80, and an internal rate of return (37.5%) higher than the projected 12% loan interest rate for the capital. This means that the value of investment on BRICS will increase and profits will be earned even if the cost of operation will likewise increase over this period. Thus, BRICS has a high market potential and is profitable if introduced in the market at 2% market share, PhP 20.30 cost per piece, and approx 50% mark-up in selling price.

RICE; VARIETIES; MARKETS; MARKETING; FEASIBILITY STUDIES; EVALUATION; FOOD TECHNOLOGY; PROCESSING; PROCESSED PRODUCTS

Sweet potato for Max's resto chain. **Roa, J.R.** *Agriculture (Philippines) v. 23 (3) p.46-47 (Mar 2019)*.

IPOMOEA BATATAS; SWEET POTATOES; VARIETIES; MARKETS; SUPPLY BALANCE; FOOD INDUSTRY

F- PLANT SCIENCE AND PRODUCTION

F01 Crop husbandry

9 tips for keeping on urban garden well-watered despite El Niño. **Villa, J**. *Agriculture (Philippines) v. 23 (07) p. 34-35 (Jul 2019)*.

URBAN AGRICULTURE; GARDENS; WATERING; MULCHES; MULCHING; WATER SUPPLY; WATER USE

12 tons of expensive mushrooms produced every day. **Sarian, Z.B**. *Agriculture (Philippines) v. 23 (07) p. 46-48 (Jul 2019)*.

EDIBLE FUNGI; VARIETIES; FARMS; PRODUCTION; FOOD PROCESSING; PROCESSED PLANT PRODUCTS

Amazing revival in the cultivation of tropical fruit trees. **Pamplona, P.P.** Agriculture *(Philippines) v. 23 (08) p. 44-47 (Aug 2019)*.

DURIO ZIBETHINUS; MANGOSTEEN; GARCINIA MANGOSTANA; LANSIUM; FOREST TREES; PLANTING; COVER PLANTS; REFORESTATION; TECHNOLOGY; INCOME

Art and business of landscaping. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (07) p. 52-53 (Jul 2019)*.

ORNAMENTAL PLANTS; HORTICULTURE; LANDSCAPING; CROP MANAGEMENT; PLANT ESTABLISHMENT; GARDENS

Baguio City [Philippines] peak strawberry picking. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 12 ; 14 ; 16 (Apr 2019)*.

FRAGARIA; STRAWBERRIES; VARIETIES; PLANTING; PLANT ESTABLISHMENT; FERTILIZER APPLICATION; TRICKLE IRRIGATION; PHILIPPINES

BGC [Bonifacio Global City, Philippines] school's gardening initiatives helps mold kids into global citizens. **Tan, Y.** *Agriculture (Philippines) v. 23 (08) p. 8; 10; 12; 14 (Aug 2019)*.

GARDENING; CHILDREN; TEACHERS; HERBACEOUS PLANTS; VEGETABLES; FRUIT TREES; INDIGENOUS ORGANISMS; PLANTING; PLANTS; WATERING; WEEDING; EDUCATIONAL INSTITUTIONS

Bukid [farm] Amara: a new level of farm experience. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (5) p. 56-57*.

FARMS; RURAL AREAS; TOURISM; FLOWERS; VEGETABLES; CROPS; CROP MANAGEMENT

Can he [Edward Uy] grow Longkong in Pangasinan [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (4) p. 54-55 (Apr 2019)*.

LANSIUM DOMESTICUM; VARIETIES; CROP MANAGEMENT; PLANT ESTABLISHMENT; FERTILIZER APPLICATION; ORGANIC FERTILIZERS; WEED CONTROL; PHILIPPINES

Capacitating the farmers of the rice terraces of Ifugao on organic heirloom rice production through Farmers's Field School. **Credo, R.M.S., Batcagan, J.D., Sabigan, N.A., Miranda, R.B.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 127 (Jul-2018).

The Heirloom Rice Project is an initiative under the Food Staples Sufficiency Program of the Department of Agriculture (DA). With support from the various agencies of the DA and the International Rice Research Institute, this collaborative project aims to enhance the productivity and enrich the legacy of heirloom rice through empowered communities in unfavorable rice-based ecosystems. To realize these goals, Season Long Training on Heirloom Rice Production focusing on Enterprise development and PalayCheck System Technology were conducted. From 2015 to 2016, two training batches were conducted involving 56 farmers from Banaue and Hungduan municipalities of Ifugao. These capacity enhancement trainings were conducted in collaboration with partner stakeholders from PLGU-PAENRO of Ifugao and MGLU-OMAG of the two municipalities. A written community consent through the intervention of the National Commission on Indigenous People was secured prior to project implementation since the participants are indigenous people with their own culture and traditions. Final analysis results showed that 55% of the participants are indigenous of the participants achieved 8 keyChecks with 2.84 tons/ha; 30% achieved 7 KeyChecks with 1.92 tons/ha; 11% achieved 6 KeyChecks with 1.44 tons/ha, and 4% achieved 5 KeyChecks with 1.20 tons/ha. Through participatory discussion during the final analysis session, the learning groups proved the implied technology theory that the more KeyChecks achieved, the higher the yield is. Results also indicated the willingness of the heirloom farmers to gradually adopt new technologies which could improve the yield both in quantity and quality. In addition, the project documented researchable areas which need to be addressed to improve productivity and profitability in the highlands. Identified challenges included ways to organically restore nutrient depleted terraces, natural controls of fungal and bacterial disease, the emerging threats of increasing aquatic worm populations, and reduce the labor cost through introduction of customized mechanical interventions.

ORYZA SATIVA; RICE; VARIETIES; INDIGENOUS ORGANISMS; ORGANIC FOODS; FARMERS; DIFFUSION OF INFORMATION; TECHNOLOGY TRANSFERTERRACES; EXTENSION ACTIVITIES

Cocktail of plant growth stimulants gives high yields. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (6) p. 28-29 (Jun 2019).*

VEGETABLE CROPS; PLANT GROWTH STIMULANTS; CROP YIELD; FORMULATIONS; APPLICATION METHODS

Couple's curiosity led to a full-scale mushroom business. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 48-50 (Aug 2019)***.**

PLEUROTUS OSTREATUS; EDIBLE FUNGI; VARIETIES; GROWING MEDIA; FOOD PROCESSING; FOOD TECHNOLOGY; PROCESSED PRODUCTS; PROCESSING; ENTERPRISES

Cucumber has its advantages as a money maker. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.8-9 (Mar 2019)*.

CUCUMIS SATIVUS; LYCOPERSICON ESCULENTUM; MOMORDICA CHARANTIA; VARIETIES; CUCUMBERS; INTERCROPPING; CROP MANAGEMENT

Direct seeding can save a lot for farmers. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (08) p. 38-39 (Aug 2019)*.

ORYZA SATIVA; RICE; HYBRIDS; DIRECT SOWING; TECHNOLOGY; CROP YIELD; YIELD INCREASES; AGRONOMIC CHARACTERS; FARMERS

Documentation and assessment of socio-cultural aspects of organic agriculture. **Nelson, G.L.M., Abrigo, G.N.A., Ocampo, J.A., De Guzman, L.E.P.** *2015 TR-1520.*

The socio-cultural aspects of organic agriculture (OA) in the nine provinces in the Philippines – Tarlac, Quezon, Camarines Sur, Iloilo, Negros Occidental, Negros Oriental, Cebu, Bukidnon, and Davao was documented and assessed based on the data gathered from FG, KII and survey. There were 11 focus groups conducted among the representatives of various OA farming organizations, while there were 37 interviews to various experts: farmers, technicians, traders, representatives of NGOs and LGUs. In the survey, gender relations, labor dynamics and market systems, perceived attitudes on the social cost and benefits of organic agriculture to the farmers were determined. The findings showed that OA in the nine provinces started between 1960 and 1980. It was then known as natural farming. The active promotion of OA was after the promulgation of Republic Act 10068 or 'Organic Agriculture Act of the Philippines'. It was promoted thru conduct of trainings, meetings, lectures, farm visits and fora that are centered on the production of organic fertilizers (concoctions), pesticides and vermicompost. The motivating factor for conversion to OA is mainly for economic, health, and environmental reasons. Organic farming (OF) does not involve synthetic inputs which is the reason why the fertility of the soil is restored. With continuous practice of OF, it can help mitigate the effect of global warming. Furthermore, compared to inorganic farming, there is less expense for farm inputs and yet organic products are even sold at higher price than inorganic. OA was also found to be a family activity where members are involved from land preparation to marketing. The farmers make their own fertilizers using a variety of techniques such as composting, vermicomposting, bokashi, using microorganisms (IMO, EM), and making concoctions (foliar and liquid fertilizers). There were also some who practice integrated farming, which involves a combination of crops, vegetables, livestock and fishpond. The farmers sold a variety of organic products such as rice, vegetables, fruits, herbs, fish and livestock, and vermicast. Organic products are typically sold to farmers' neighbors, direct buyers, organic farmers'; organization, and middlemen. Some products are also sold the local public markets and supermarkets. The challenges encountered by organic farmers are related to organic farming operations, government support, and organic certification. Though certification is deemed important to farmers for it guarantees that products are truly organic, they suggest the use of Participatory Guarantee System (PGS) instead of the institutionalized certification. The findings of the

study can be use d to craft policies on marketing of organic products. Organic agriculture is a way of life, and is a means to promote good health, to attain sustainable income for the farmers and to achieve quality environment.

ORGANIC AGRICULTURE; SOCIOCULTURAL ENVIRONMENT; DOCUMENTATION; FARMING SYSTEMS; COST BENEFIT ANALYSIS; FARMERS; PHILIPPINES

East-West seed's strategy makes home gardening easy. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 52-53 (Apr 2019)*.

VEGETABLES; ORNAMENTAL PLANTS; HERBACEOUS PLANTS; DOMESTIC GARDENS; GARDENING

Farmers grow recommended cacao varieties through CPAR [Community-based Participatory Action Research]. *Agriculture (Philippines) v. 23 (4) p. 18 ; 20 (Apr 2019)*.

THEOBROMA CACAO; VARIETIES; CROP MANAGEMENT; TECHNOLOGY; HARVESTING; CULTURAL METHODS; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS; COMMUNITY INVOLVEMENT; SOCIAL PARTICIPATION; RESEARCH

Field performance of blonde red rice inoculated with actinomycetes (S. mutabilis Nb3) in Brgy. [barangay:village] Oma-Oma, Ligao, Albay [Philippines]. **Albao, J.G., Cruz, J.A., Chavez, J.R.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 131 (Jul-2018)*.

Upland rice production can contribute in attaining rice self-sufficiency in areas where there is limited irrigation water. But due to environmental constraints, upland rice production is still marginal. Moreover, supplementation by synthetic fertilizers is usually practiced. Actinomycete inoculation is considered as a strategy that could enhance crop production, and at the same time lessen the use of synthetic fertilizers. The study was conducted to assess the growth (plant height and tiller number) and yield performance of Blonde Red rice (weight of 1000 grain, panicle number and grain yield at 14% moisture content) inoculated with actinomycete inoculants/ CRHBCAI combined with 30kg/ha NPK (T5) produced the most average number of panicles, outnumbering T1 (30kg/ha NPK). Treatments inoculated with actinomycetes (except for T4, CRHBCAI), with or without fertilizer were able to produce comparable number of panicles to T1. With regards to the number of grains per meter square and grain yield at 14% moisture content, results revealed that T1, T3 (soil based carrier actinomycete inoculants/SBCAI + 30 kg/ha) and T2 (SBCAI) were the top three ranking treatments. In addition, grain yield at 14% moisture content obtained from T2 was significantly higher than T4 and significantly different to T1. It concurs with the study of Cruz (2014), wherein actinomycete inoculant with fertilizer increases grain yield. Actinomycetes is a microbial inoculants that stimulated the plant height, tiller number, panicle production and yield in Blonde Red rice. It can be a potential substitute or can be combined with synthetic fertilizers to lessen the use of inorganic inputs. Further investigations on actinomycetes' effect on other crops or other upland rice varieties can be explored.

ORYZA SATIVA; RICE; VARIETIES; COLOUR; UPLAND RICE; CROP PERFORMANCE; ACTINOMYCETALES; INOCULATION

Food quality and safety evaluation of organically grown crops versus conventionally grown crops in two types of soil. **Trinidad, L.C., Lat, E.C., Fabro, L.M., Jr, Mejia, W.B., Dino, C.P.A., Magnaye, M.J.F.A.** *2014 TR-1819.*

The quality and safety of organic and conventional produce were evaluated. The study involved two problem soil types: acidic, clay and the lowland lahar-laden soil. Soil sampling and analyses for the selected sites were done prior to planting selected crops: lettuce (Lactuca sativa cv. Orija de mulo), tomato (Solanum melongena), okra (Abelmoschus esculentus), and string beans (Vigna sesquipedalis) for Pampnga [Philippines]. Physico-chemical analyses of soil samples from both organic and conventional sites (nitrogen, potassium, phosphorus, organic matter, moisture content, and pH) showed improvement on the soil they had been treated. However, depletion is evident as it i s picked up by the plants or washed away by heavy rains. Chromium nickel, mercury, and cadmium were not detected on the soil samples. Lead was detected, however special precautions are needed to prevent accumulation. As for the vegetables samples, chromium, nickel, lead, mercury, cadmium and pesticide residues are not detected. Microbiological analyses of both organic and conventional vegetable samples indicated the presence of Salmonella and E.coli O157:H7 in presumptive tests. However, further testing revealed that the identities of these presumptive E.coli 0O157:H7 are Stenotrophomonas maltophilia, Pseudomonas, and Pantoea while the presumptive Salmonella colonies are Citrobacter youngae, Pantoea, and Enterobacter cloacae. Thus, there is no incidence of the mentioned microbial pathogens in both organic and conventional soils and produce from the two farm sites.

LACTUCA SATIVA; LETTUCES; TOMATOES; LYCOPERSICON ESCULENTUM; CUCUMBERS; CUCUMIS SATIVUS; SWEET PEPPERS; CAPSICUM ANNUUM; MOMORDICA CHARANTIA; AUBERGINES; SOLANUM MELONGENA; OKRAS; ABELMOSCHUS ESCULENTUS; KIDNEY BEANS; VIGNA UNGUICULATA SESQUIPEDALIS; ORGANIC AGRICULTURE; SOLANUM; QUALITY; SAFETY; CLAY SOILS; SOIL ANALYSIS; SOIL CHEMICOPHYSICAL PROPERTIES; MOISTURE CONTENT; MICROBIOLOGICAL ANALYSIS; MICROORGANISMS; HEAVY METALS; PATHOGENS

Former police officer is now a square foot garden advocate. **Tan, Y**. *Agriculture (Philippines) v. 23 (07) p. 28-29 (Jul 2019)*.

VEGETABLES; GARDENING; FARMS; CROP MANAGEMENT; CROP ROTATION; RURAL AREAS; TOURISM

Formulating a healthy soil mix for your cacti. **Necessario, N.** *Agriculture (Philippines) v. 23 (07) p. 57 (Jul 2019).*

CACTACEAE; ORNAMENTAL PLANTS; COMPOSTS; RICE HUSKS; SOIL ORGANIC MATTER; INGREDIENTS; NUTRIENTS

Fruiting caimito in a container. **Anon**. *Agriculture (Philippines) v. 23 (3) p.54 (Mar 2019)*.

FRUIT TREES; PLANTING; SEEDLINGS; GROWING MEDIA; PLANT CONTAINERS; FERTILIZER APPLICATION; ORGANIC FERTILIZERS

Grafted ampalaya gives 37 harvests vs. 15-18 of ungrafted. **Anon**. *Agriculture (Philippines) v. 23 (5) p. 42-43 (May 2019)*.

MOMORDICA CHARANTIA; SEEDLINGS; GRAFTING; TRANSPLANTING; HARVESTING; CROP YIELD; MOMORDICA CHARANTIA

Hydroponics is profitable: even a small space can produce good income. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (07) p. 4-6 (Jul 2019)*.

LACTUCA SATIVA; LETTUCES; HYDROPONICS; PLANTING DATE; INCOME; PLANT PRODUCTION

It takes sense to plant large planting materials. **Anon**. *Agriculture (Philippines) v. 23 (3) p.58 (Mar 2019)*.

FRUIT TREES; PLANTING; PROPAGATION MATERIALS; FERTILIZER APPLICATION; WEED CONTROL

Livelihood potentials and environment protection**.** **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (07) p. 40-41 (Jul 2019)*.

AGROFORESTRY; BIODIVERSITY; NATURE CONSERVATION; ORGANIC AGRICULTURE; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS

Lubang's [Island in Occidental Mindoro, Philippines] edible gold mine. **Urlanda, R.V**. *Agriculture (Philippines) v. 23 (3) p.20-21 (Mar 2019)*.

ALLIUM SATIVUM; GARLIC; VARIETIES; PLANTING; CROP YIELD; CROP MANAGEMENT; PHILIPPINES

Luxury integrated resort lakes steps toward sustainability. **Taculao, P.B.S.** *Agriculture (Philippines) (Jun 2019) v. 23 (6) p. 12; 14*.

CULINARY HERBS; PLANTING; OLIGOCHAETA; COMPOSTING; ORGANIC FERTILIZERS; ORGANIC WASTES

Mangosteen in summer: it's not magic, its's science. **Provido. N.T.** *Agriculture (Philippines) v. 23 (6) p. 8 (Jun 2019)*.

GARCINIA MANGOSTANA; MANGOSTEEN; OFF SEASON CULTIVATION; OUT OF SEASON PRODUCTS; INDUCED FLOWERING; TEMPERATURE; DROUGHT STRESS; FARMERS

Mangyan [indigenous groups of Mindoro, Philippines] mothers learn farming skills to jumpstart community on the road to self-sufficiency. **Anon.** *Agriculture (Philippines) v. 23 (4) p. 48-49 (Apr 2019).*

ORGANIC AGRICULTURE; COMPOSTING; OLIGOCHAETA; TECHNOLOGY; TECHNOLOGY TRANSFER; COMMUNITY DEVELOPMENT; ETHNIC GROUPS; PHILIPPINES

Millennial-led hydroponic farm grows vegetables right in the middle of new Manila [Philippines]. **Tan, Y.** *(Jul 2019) Agriculture (Philippines) v. 23 (07) p. 8; 10; 12 (Jul 2019).*

VEGETABLES; CULINARY HERBS; HYDROPONICS; GROWING MEDIA; CROP MANAGEMENT; PLANT ESTABLISHMENT; FARMS; PHILIPPINES

Millenial sees farming as his first choice. **Anon**. *Agriculture (Philippines) v. 23 (3) p. 22-23 (Mar 2019)*.

SEED; QUALITY; PLANT PRODUCTION; SEED PRODUCTION; QUALITY; FARMING SYSTEMS; FARMERS; TECHNOLOGY

Mint protects Arugula from insects. **Anon.** *Agriculture (Philippines) v. 23 (08) p. 39 (Aug 2019)*.

HERBACEOUS PLANTS; MINT; PLANTING; PLANTS; PEST CONTROL; GROWING MEDIA

Mt. Data [Philippines] radish: P1-M gross from half hectare. **Sarian, Z.B**. *Agriculture (Philippines) v. 23 (3) p.10; 12 (Mar 2019)*.

RAPHANUS SATIVUS; VARIETIES; PLANTING; FARMYARD MANURE; PROFIT; INCOME

Mushroom production: a strategic approach in enhancing the entrepreneurial spirit in rural communities. **Corales, A.M., Corales, R.G., de Gracia, G.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine *Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 126 (Jul-2018)*.

The Philippines produces 15.2 million tons of rice that leave behind 11.3 million tons of rice straw every year (PhilRice, August 2012). Despite its many known uses, bulk of the rice biomass is still being disposed indiscriminately. The availability of abundant biomass resources such as rice straw as substrate in mushroom production and processing opens up opportunities for the development of commercial scale production in the Philippines. In 2017, market scanning was conducted in the Science City of Muñoz to determine rice straw's potential in mushroom due to its nutritional value as perceived by the target clientele. With possible alternative income, the Palayamanan Plus Project trained 28 potential men and women entrepreneurs of Kababaihang Kinikilala ng Lungsod Agham (Maligaya Chapter) and Bantug Primary Multi-Purpose Cooperative on June 2017. The training on mushroom production and processing aimed to build the capacity of entrepreneurs in agri-business ventures and enhance their participation in economic development. With PhilRice's assistance, initial materials were provided to start-up the business. Members initially sold 0.5-2kg/day within the barangay [village], and from the sales, P120.00 was divided among the producers for profit sharing and the rest goes to the seller. Moreover, mushroom production activities also created job opportunities for the members and neighboring individuals. The investment cost was recovered immediately after only five months of operation amounting to P30,411.00 and P20,691.50, respectively. Aside from additional household income, the cooperative allocated 35% of the revenue to other businesses and projects. Trained members expanded the production into their houses to support the demand of the market. Furthermore, the members were strengthened through various activities, sharing experiences, and enabling them to engage in the market. With sustainability, mushroom production can offer significant opportunities in developing rural economies, diversifying business, and empowering women on the countryside.

EDIBLE FUNGI; PRODUCTION; AGROINDUSTRIAL SECTOR; WOMEN; ROLE OF WOMEN; TECHNOLOGY; TECHNOLOGY TRANSFER; RURAL COMMUNITIES; RICE STRAW; CULTURE MEDIA

Oldest Thai seed company is newest player in the Ph [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (07) p. 18-20 (Jul 2019).*

VEGETABLE CROPS; HYBRIDS; SEED; FIELD EXPERIMENTATION; CROP PERFORMANCE; CROPS; AGRONOMIC CHARACTERS

PCC [Philippine Carabao Center] exec's advise to rice farmers: integrate carabao dairying. **Roque, A.S.** *Agriculture (Philippines) v. 23 (06) p. 58-59 (Jun 2019)*.

WATER BUFFALOES; DAIRY INDUSTRY; MILK PRODUCTION; ORYZA SATIVA; RICE; CROP MANAGEMENT; SUBSISTENCE FARMING; COOPERATIVES; COOPERATIVE ACTIVITIES; PHILIPPINES

Perante: an orange you'd love to eat and grow. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (5) p. 44 (May 2019)*.

SWEET ORANGES; VARIETIES; PLANTING; CROP MANAGEMENT; FERTILIZER APPLICATION; PROPAGATION MATERIALS

Pilot scale production of nanoencapsulated plant growth regulator (BIOTECH Nano-Plant Growth Regulator) for the production of high value crops. **Fernado, L.M., Paterno, E.S., Violanta, R.P., Atienza, Ma.T.J.A., Parami, J.M.K., Bautista, H.N.F., Mendoza, D.J.R.** *2017 TR-1812*.

The pilot scale production of nano-plant growth regulators (HomoGroe) was explored in the study. The production of the plant growth regulators (PGRs) such as indole-3-acetic acid (IAA), Gibberellin-like substance (GA) and cytokinin (CK) by locally isolated plant growth promoting bacteria (PGPB) was evaluated and optimized. Parametric and optimization studies determined the optimum conditions for the production of IAA by PGPB1. Preliminary evaluation of the IAA production of PGPB1 showed that 511.78 ± 26.76 mg I AA equivalent can be produced for 24 hours per L of culture medium. Results also showed that sucrose and baker's yeast were the most favorable and cost-effective carbon and nitrogen sources, respectively for the bacterial production of IAA. Parametric studies revealed that L-tryptophan concentration, inoculation ratio, trace elements concentration, initial pH, and yeast extract concentration significantly affect the production of IAA. Numerical optimization using response surface methodology generated mathematical models that describe the interactions of the significant factors and predict corresponding IAA concentration based on given conditions. Spectrophotometric analyses revealed that significant amounts of GA (1605.47 ± 46.69 mg GA3 equivalent/L culture medium) can be produced by PGPB4. Radish cotyledon bioassay also showed that PGPB2, PGPB23, and B31 exhibited cytokinin-like bioactivity suggested that these PGPBs are potential sources of cytokinin. Phospholipids, which serve as wall materials in nanoencapsulation, were extracted from soy lecithin in a 10.67% yield. FT-IR analyses showed that phospholipids were successfully isolated and that phosphatidylcholine may be one of the major components of the phospholipid mixture. Plant growth regulators were encapsulated in liposomes using a thin-film hydration method. Encapsulation of IAA, GA and CK afforded a yield of 9.20 g, 1.0 g and 30.78 g per liter culture medium, respectively. Scanning electron microscopy (SEM) analyses showed that the Nano-Plant Growth Regulators are less than 100 nm in particle size. A pilot line for the extraction of plant growth regulators was developed in collaboration with All Trade Marketing and Manufacturing (ATMM). In particular, a pilot line for IAA was designed as model for the extraction of plant growth regulators. The line was divided into three parts, namely: (1) bacterial inoculation and auxin production, (2) liquid-liquid extraction of auxin from the inoculation media, and (3) solvent evaporation. Efficacy trials on different high value crops and ornamentals showed that Nano-Plant Growth Regulators could serve as alternative to commercial and/or synthetic plant hormones. Treatment of tomato seedling with 30 ppm Nano-IAA resulted in 50% increase in root dry weight. Incorporation of 10 ppm Nano-GA in the tissue culture of banana enhanced its survival rate and plant height by 32%. Nano-IAA also enhanced the shoot and root emergence of coffee nodal cuttings by 16% and the survival rate by 50%. Treatment of cassava with 10 ppm Nano-IAA resulted in 14% increase in yield. Preliminary results showed that the cacao trees grown in very hot conditions, when treated with Nano-GA, can survive and produce cacao fruits. Efficacy trials on the marcotting of very-hard-to-root variety of gumamela showed that Nano-IAA enhanced the root emergence by 75%. A 161% increase in plant weight was observed in aster plants treated with 100 ppm Nano-GA. Economic analyses revealed that the total investment to establish the manufacturing facility and the

working capital requirement to produce the product is around Php 29,563,854.60, with a corresponding return on investment (ROI) of 169.26%. In addition, eggplant applied with Nano-IAA brought positive increase in income amounting to Php 7,696.50 and Php 5,687.00 per hectare as compared to the yield of control crops and treated with commercially available auxin, respectively. Coffee seedlings treated with Nano-IAA showed 29.62% reduction in mortality relative to untreated coffee seedlings, which is equivalent to 2,962 saleable seedlings or an additional income of Php 14,781.50.

IAA; CYTOKININS; GIBBERELLIC ACID; BIOTECHNOLOGY; PHOSPHOLIPIDS; LIPOSOMES (ORGANELLES); ENCAPSULATION; ANALYTICAL METHODS

Prediction of maize (Zea mays L.) yield under moderately waterlogged condition using agronomic traits measured prior to harvesting. **Paril, J.F., Sanchez, M.A.B., Salazar, A.M.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 82-89 (Dec 2015).*

Maize production in the Philippines is facing constraints brought about by more intense and frequent rainfall resulting to excess soil moisture stress or waterlogging. Identification and assessment of agronomic traits related to waterlogging are keys to the development of tolerant cultivars. S1 families from high yielding open-pollinated maize cultivars, IPB VAR6 (high lysine and tryptophan contents, also known as quality protein maize cultivar) and IPB VAR13 (hybrid maize alternative of poor Filipino farmers), were evaluated under normal field soil moisture and moderate waterlogging conditions. Yield was used as the indicator of stress tolerance. For each cultivar, 20 S sub 1 families were selected based on best linear unbiased yield predictors, estimated from models accounting for treatment, S sub 1 family, and interaction effects. Correlation analysis indicated that anthesis-silking interval and adventitious root growth were not significantly correlated with yield. Yield prediction models utilizing 10 agronomic traits measured prior to harvesting as explanatory variables, were used to complement the correlation analysis. The models showed 69.1% and 73.1% adjusted R sup 2 under normal field soil moisture and moderate waterlogging conditions, respectively. These models have potential applications in early yield prediction and in predicting yield when empirical yield data for some entries are lost due to inclement weather, pests, diseases and data mishandling.

ZEA MAYS; MAIZE; HIGH YIELDING VARIETIES; WATERLOGGING; AGRONOMIC CHARACTERS; SOIL WATER CONTENT; HARVESTING

Prestigious world food prize awarded to East-West seed founder Simon N. Groot. **Anon**. *Agriculture (Philippines) v. 23 (07) p. 50-51 (Jul 2019)*.

VEGETABLE CROPS; SEED; INDUSTRY; SCIENTISTS; FARMERS; TECHNOLOGY; TECHNOLOGY TRANSFER

Regenerative farming: the secret is in the soil. **Aberasturi, P.Z.** *Agriculture (Philippines) v. 23 (5) p. 22;24;26;28-29 (May 2019).*

ORGANIC AGRICULTURE; SOIL FERTILITY; CROP MANAGEMENT; COMPOSTING; MULCHING; MULCHES; GREEN MANURES; COVER PLANTS

Rice technologies showcased in varietal derby. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 10 (Apr 2019).*

ORYZA SATIVA; RICE; VARIETIES; FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER; CROP PERFORMANCE; AGRONOMIC CHARACTERS; CULTURAL METHODS; MECHANIZATION

Small farmers start hailing the 'Queen' [pineapple]. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (4) p. 46-47 (Apr 2019)*.

ANANAS COMOSUS; PINEAPPLES; PLANT PRODUCTION; PROPAGATION MATERIALS; FERTILIZER APPLICATION; INTERCROPPING ; CROP YIELD; SPACING; FARMERS

Senior citizen establishes a farm at the age of 80. **Rubio, R.M.** *Agriculture (Philippines) v. 23 (07) p. 38-39 (Jul 2019).*

ORGANIC AGRICULTURE; FRUIT TREES; PLANTING; FARMS; FOOD TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; ADULTS

Strengthening the promotion of direct seeded rice culture: strategy for climate change adaptation and cost reducing technology. **Alasaas, D.G., Pasicolan, H.R., Gawat, N.R., Acierto, A.J.B.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 125 (Jul-2018).*

The effect of climate change in rice production is detrimental to our country's rice self-sufficiency. However, there are already technologies that can mitigate its effects. One is the use of direct seeding technology. Direct seeding has resulted to reduced methane emissions due to shorter flooding period and decreased soil disturbance compared to transplanted rice. Also, 60% of energy (diesel) is decreased because or elimination of field preparation for seedbed, pudding. DSR can also save 40% on labor cost required for seed bedding, pulling and transplanting. However despite these advantages, adoption remains low in Isabela. Thus, promotion of DSR through technology demonstration farms and trainings were conducted. In 2017 wet and dry seasons, demonstration farms established in Villafuerte and Daramuangan Norte, San Mateo, Isabela to showcase and localize the DSR technology. This project was conducted in collaboration with NIA-MARIIS and LGU-San Mateo. After which, selection and validation of demonstration sites, cooperators and participants for the conduct of season long farmers' field school was done. To improve awareness on DSR, project briefing, ceremonial seeding and field days were also conducted in both sites. Based on the results, the demonstration sites in Villafuerte and Daramuangan Norte obtained yield of 5.7 and 6.7 t/ha with a net benefit of Php 48,985.00, and PhP 87,904.52, respectively. For 12 adopters with 6.43 hectares, yield obtained was 3.4 to 8.5 t/ha with net benefit ranging from PhP 33,685.00 to PhP 115, 468.00 per hectare during WS 2017. For DS 2018, another demonstration farm was established at Victoria, San Mateo, Isabela. There were 25 participants in the season-long farmers' field school. At present, 26.47 hectares were planted using DSR for the 20 adopters. There should be a continuing promotional activity of DSR to further increase awareness of farmers within the municipality of San Mateo, Isabela.

ORYZA SATIVA; VARIETIES; TECHNOLOGY; TECHNOLOGY TRANSFER; FARMERS; CLIMATIC CHANGE; ADAPTATION; DIFFUSION OF INFORMATION; DIRECT SOWING; CROP YIELD

Sunflowers of Quezon [Philippines]. **Urlanda, R.V.** *Agriculture (Philippines) v. 23 (3) p.44-45 (Mar 2019).*

HELIANTHUS ANNUUS; VARIETIES; FLOWERS; PLANTING; RURAL AREAS; TOURISM; PHILIPPINES

Taiwan mushrooms processed into high-value products. **Sarian, Z.B**. *Agriculture (Philippines) v. 23 (4) p. 4; 6-7 (Apr 2019)*.

EDIBLE FUNGI; SPECIES; PRODUCTION; PROCESSING; PACKAGING; MARKETING

Thinking out of the box-innovations for sustainable vegetable sufficiency in our community. **Barcelona, A.** *Agriculture (Philippines) v. 23 (4) p. 26-29 (Apr 2019).*

VEGETABLES; PRODUCTION; TECHNOLOGY; MARKETING; MARKETS; CREDIT; COOPERATIVES; FARMERS; INNOVATION ADOPTION; SUSTAINABILITY

Urban garden in Pampanga [Philippines] grows fresh herbs for the culinary scene. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (07) p. 30-32 (Jul 2019)*.

CULINARY HERBS; GREENHOUSES; URBAN AGRICULTURE; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

Winning traits of successful agri people. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (08) p. 4; 6-7 (Aug 2019)*.

CROPS; PLANT ESTABLISHMENT; FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER

F02 Plant propagation

Fact sheet of feeds and feeding technologies for organic production of poultry and livestock. **Mateo, C.D.** *2016 TR-1818*.

POULTRY; LIVESTOCK; FEEDS; FEED ADDITIVES; PROXIMATE COMPOSITION; FEEDING EQUIPMENT

Identification of unapproved rice varieties used by farmers in Negros and Bohol Islands [Philippines]. **Cordova, J.A., Etchon, M., Seville**, **C**. 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 124-125 (Jul-2018).*

Based on feedbacks of development workers, local government units (LGUs), and agricultural extension workers, there are rice varieties unregistered to National Seed Industry Council (NSIC) and Philippine Seed Board (PSB). Some of these varieties are widely used by farmers and being preserved for years while others are introduced by fellow farmers from nearby Barangays [villages]. This study aims to identify unregistered rice varieties circulating in Negros and Bohol Islands, to document farmers’ reasons and socio-economic factors in using these varieties, and to collect seed samples for demonstration and classification study. Thirty-eight unregistered rice varieties were found in Negros and Bohol Islands and 52.63% of these varieties are used in Negros Oriental, 28.95% in Negros Occidental, and 18.42% in Bohol. The major reasons of farmer-users include resistance to insect pests and diseases, good eating quality and good germination. Minor reasons are higher grain weight, less fertilizer requirement, and tillering ability. Main and least socio-economic factors of using these varieties are easy accessibility and recommended by millers/traders having 61% and 2%, respectively. It is concluded that there are many unregistered rice varieties circulating and being used by the farmers in Negros and Bohol Islands. It is recommended that these varieties should be analyzed and characterized to check if these varieties are unique, NSIC and PSB released, or promising lines that were collected during field testing.

ORYZA SATIVA; VARIETIES; IDENTIFICATION; FARMERS; SEED PRODUCTION; PHILIPPINES

In vitro root and shoot formation of Rosa centifolia using plant growth regulators. **Akhtar, G., Sajjad, Y., Akram , A., Farooq, A., Rasool. G.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 63-70 (Aug 2018).*

Rosa centifolia is one of the most economically important floriculture crops that is grown and used for oil extract which has various applications in pharmaceutical industries. It is commercially propagated through cuttings, but low rooting percentage has always been a problem since rose species are difficult to root. To address this problem, a protocol was developed to meet the growing demands for R. centifolia through in vitro propagation technique. Nodal segments were used as an explant and were cultured in a MS medium supplemented with different concentrations (0.2, 0.4, 0.6 and 0.8muM) of Benzylaminopurine (BAP) and Kinetin (KIN), alone and in combination of both, for induction of shoots. For root induction, different concentrations (0.2, 0.4, and 0.6muM) of Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) were used in a 1/2 strength MS medium. BAP at 0.2muM concentration produced the highest number of shoots (1.93) and longest shoot elongation (5.55cm) vis-a-vis other concentrations. Moreover, minimum number of days (10.2) to shoot induction was observed at (0.4muM of BAP in combination with 0.2muM of KIN. On the other hand, IBA at 0.4muM had the minimum number of days (10.07) to produce roots, highest number of roots (2.47), and longest root elongation (4.21cm) among other concentrations. Thus, it is concluded that BAP at 0.2muM and IBA at 0.4muM concentration are effective for shoot and root formation of R. centifolia, respectively.

ROSA; SPECIES; IN VITRO; SHOOTS; ROOTS; IBA; CULTURE MEDIA

Millenial sees farming as his first choice. **Anon**. *Agriculture (Philippines) v. 23 (3) p. 22-23 (Mar 2019)*.

SEED; QUALITY; PLANT PRODUCTION; SEED PRODUCTION; QUALITY; FARMING SYSTEMS; FARMERS; TECHNOLOGY

Region-specific rice varieties: next-gen releases. **Padolina, T.F., Canilang, P.A.C., Manangkil, O.F., Braceros, R.C., Pamplona, A.M., Argayoso, M.A.C., Cappleman, L.D.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 110 (Jul-2018)*.

The participatory varietal selection (PVS) is conducted across the country with the 16 RFOs in both DS and WS to test newly-released varieties, fine-tune new technologies, and determine the variety suited for a specific region. Simultaneously, PVS-RM (research managed) trial sites conduct field days with varietal selection (preference analysis) and sensory evaluation of PVS entries. Yield stability, pest and disease resistance, and grain quality were the main criteria used for varietal competitiveness. Through the PVS, NextGen recommended varieties according to the results of the National Cooperative Tests for rice (NCT), farmers' preference (from regional coordinators' reports), value chain analysis project, and the rice seed system workshop output. The most adapted irrigated inbred varieties across regions are: PSB Rc10, Rc18, Rc82, NSIC Rc158, Rc218, Rc224, Rc226, Rc298, Rc302, Rc308, Rc352, Rc354, Rc356, Rc358, Rc360, Rc394, Rc400 and Rc402 with an average yield range of 5.0-6.2 tha-1 for transplanted and 5.1-5.5 t/ha for transplanted and 8.0-14.0 t/ha when direct seeded. Registered seeds of the 3-5 most preferred and adapted varieties in the PVS are provided to accredited seeds produced are supervised by the Bureau of Plant Industry's National Seed Quality Control Services (NSQCS), and are available for the farmers.

ORYZA SATIVA; RICE; VARIETIES; SELECTION; TESTING; SEED PRODUCTION; DIFFUSION OF INFORMATION

Somatic embryogenesis from cell suspension cultures of banana (Musa sp. 'Lakatan') and somatic embryo germination and regeneration in banana and abaca (Musa textilis Nee 'Inosa') Phase V and Phase V-extension. **Aspuria, E.T., Silva, T.M.B., Caliwagan, S.M.** *2015 TR-1764*.

Meristematic buds (scalps) of banana 'Lakatan' were inoculated initially to full strength liquid MS + 1.11 mg/L 2,4-D + 0.22 mg/L zeatin. However, due to the delayed globule formation in scalps of 'Lakatan', another set of scalp cultures were transferred to full strength liquid MS + 1 mg/L 2,4-D + 1 mg/L biotin + 100 mg/L glutamine + 100 mg/L malt extract + 4.5% sucrose (M2) (Coteet al., 1996) to induce globule formation until sufficient number of cell suspension cultures were obtained. Cell suspension cultures were transferred to liquid embryogenesis media (EM) (1/2 MS + 2.20 mg/L zeatin and 1/2 MS + 2.20 mg/L zeatin + 2 mg/L BA). Cell clusters observed under the microscope have dense cytoplasm, indicative of embryogenic nature of the somatic embryo-like structures. Another set of globule cultures of 'Lakatan' were individually picked and plated on germination media composed of MS basal salts + N and N vitamins + 0.18 mg/L IAA + 100 mg/L glutamine + 100 mg/L malt extract and with one level of BA (5 mg/L). Globules formed root-like structure in germination medium without BA while white protrusions and h embryogenic complex were observed in germination media with 5 mg/L BA. For the induction of somatic embryogenesis in abaca 'Inosa', two media formulations were adopted for the embryogenic cell suspension cultures (i.e. GFMM-B and M2). GFMM-B derived cell cultures were observed under microscope to be elongated in shape with dense cytoplasm and were induced to undergo somatic embryogenesis in ½ MS + 2.20 mg/L zeatin + 2 mg/L BA. M2-derived cell cultures produced spherical shaped cells with dense cytoplasm and were continuously induced in the same medium formulation devoid of 2,4-D but with addition of 1000 mg/L myo-inositol. The putative somatic embryos were plated onto two different germination media: (A) MS basal salts N & N vitamins + 0.18 mg/L IAA + 100 mg/L glutamine + 100 mg/L malt extract + 2.5 mg/L BA produced moderately profuse greenish round proembryo masses. After 3 months in culture these proembryos were transferred to MS + 3 mg/L BA and turned black after 4 weeks of continuous incubation and (B) MS basal salts + N & N vitamins + 0.18 mg/L IAA + 100 mg/L glutamine + 100 mg/L malt extract + 5 mg/L BA, where faster proliferation and more profuse proembryos were observed than in (A). Development of shoot-like and root like structures started to regenerate 4 weeks after it was transferred in MS + 3 mg/ L BA. On the other hand, embryogenic calli were induced from shoot tips of banana 'Lakatan' in two semi-solid media formulations (Ganapathi et al., 2001) and were found most favorable in MS + 2 mg/L picloran than in SH + 2 mg/L 2, 4-D + 0.2 mg/L zeatin. These embryogenic calli were induced to undergo somatic embryogenes in two (2) types of media formulations consisting (A) semi-solid MS + 1 mg/l 2 ,4-D + 1 mg/L biotin + 100 mg/L glutamine + 100 mg/L malt extract which produced profuse pro-embryo masses and (B) MS + 1 mg/L 2,4-D + 0.2 mg/L zeatin + 1 mg/L biotin + 100 mg/L l-glutamine + 100 mg/L malt extract which produced less profuse proembryo masses showing less synergistic relationship between 2,4-D and zeatin in inducing somatic embryos in 'Lakatan'.

MUSA (BANANAS); VARIETIES; MUSA TEXTILIS; ABACA; SOMATIC EMBRYOGENESIS; GERMINATION; CELL CULTURE

Survey and collection of unclassified rice planted in Central Luzon [Philippines]. **Alfonso, D.O., Santiago, J.C., Bulatao, R.M., Rañeses, M.A.M., Ferrer, M.C., Duldulao, M.D., Castro, J.R., Regalario, J.B., Nombrere, J.M.Z., Noines, J.M., Caguiat, X.G., Cantilla, A.Y., Abdula, S.E.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, ,

Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 123-124 (Jul-2018)*.

In the Philippines, Central Luzon has the most number of rice growing provinces and most of number of seed growers with nationwide coverage. Despite the numerous release of new varieties, farmers continuously cultivate unclassified rice varieties for various reasons. These unclassified rice are those planted that did not passé the formal seed system under National Seed Industry Council (NSIC) or possibly a sort of marketing or branding scheme to increase revenue of accredited or non-accredited seed growers and seed companies. This study aimed to survey, collect and document unclassified rice among the six rice-growing provinces in Central Luzon through key informants (KIs), focus group discussions (FGD) and Interview with local extension focal persons for each municipality in the province. A total of 28 unclassified rice were collected, with Nueva Ecija having the most unclassified rice (29%) while both Bataan and Zambales had the least (7% each). Thirty-six percent of the unclassified rice had unknown origin according to the farmers. The main reason for using these unclassified rice according to conducted KI and FGD was because of its high-yielding and good eating quality while, in some areas the reasons include the available free seeds and for trial. Among the unclassified rice, 'Diamond X' and 'Double Diamond X' topped the list in terms of frequency being planted. Results showed the existence of unclassified rice area planted and distributed in Central Luzon. Increase in monitoring and regulation of these unclassified rice is necessary and sanctions to any entity or distributing company should be enforced. Consequently, there is a need for more stringent policies in branding and distribution of seeds among the farmers. The presence of such unclassified seeds in the seed system jeopardize the efforts of breeders and extension workers in promoting the use of registered seeds and technologies that comes with them in order to achieve a rice secure Philippines.

ORYZA SATIVA; RICE; SEED PRODUCTION; SURVEYS; COLLECTIONS; REGULATIONS; LEGISLATION; PHILIPPINES

F04 Fertilizing

Development and promotion of new and enhanced biofertilizers, biostimulants, and biopesticides for improved crop productivity: development and field testing of endophytic bacterial inoculants as new biofertilizer for improved production of egpplant (Solanum melongena) and sugarcane (Saccharum officinarum L.). **Padilla, V.M., Marfori, E.C., Roxas, D.M.A., Masilungan, G.D.** *2015 TR-1793.*

Two of the major crops contributing to the Philippine economy are eggplant (Solanum melongena and sugarcane (Saccharum officinarum L.). These plants especially sugarcane require large amount of inorganic fertilizer to attain high yields. The ever increasing price of inorganic fertilizers is impelling to search for alternative source of nutrients to reduce dependence from the use of imported fertilizers. Biofertilizer technology such as endophytic bacterial inoculants is a new strategy that could reduce the use of chemical fertilizers. Hence, this research was conducted to develop, formulate and field test a new biofertilizer product utilizing endophytic bacterial inoculants for improved production of eggplant and sugarcane. Collection of 15 and 26 purified endophytic bacterial isolates for eggplant and sugarcane, respectively, followed by selection of effective bacterial inoculants (EBI) were done. Molecular characterization and identification of two (2) selected EBI isolates for eggplant and sugarcane were made. The EBI E3 isolated from the root of eggplant was identified as Enterobacter ludwigii. For sugarcane, EBI S18 isolated from the leaf sheath was identified as Enterobacte spp. These two selected EBI were examined microscopically. The possible mode of action of the identified EBI inoculants for sugarcane and eggplant are biological nitrogen fixation as indicated by the

presence of NifH gene detected and the production of growth promoting indole acetic acid. (IAA). Scanning electron microscopy indicated that the possible entry of the EBI is from the stomatal opening or breakages of the plant tissues. The effective endophytic bacterial (EB) inoculants Nutrio TM for eggplant and sugarcane indicated that both EBI S18 and EBI E3 are fast growing endophytes. The shelf life of Nutrio TM foliar biofertilizer at room temperature with cell population from 1010 to 106 cells per gram inoculants was determined. Bioefficacy trials and farmers field trial indicated that 1/2 recommended rate of fertilization (1/2 RRF) +EBI E3 for eggplant and EBI S18 for sugarcane have shown consistent results based on yield of the plants. For eggplant, foliar application of EBI E3 alone can significantly improve the cumulative marketable and total (marketable + non marketable) yield in terms of number of fruit and weight. For sugarcane, both bioefficacy and farmer's field trials have shown that yield (Tcane/ha) and sugar yield (Lkg/ha) were consistent with 1/2 RRF + inoculation with EBI S18. The results implied that fertilization with 1/2 RRF + inoculation with EBI 3 or EBI S18 can improve the yield of eggplant and sugarcane with corresponding 50% reduction on the use of inorganic chemical fertilizer. The cost benefit analysis of using 1/2 RRF + Nutrio TM (EBI E3) for eggplant and for sugarcane (EBI S18) proved to be beneficial for eggplant and sugarcane production. Nutrio TM is an approved trade name from the Intellectual Property Office of the Philippine (IPOPhil).

SACCHARUM OFFICINARUM; SUGARCANE; SOLANUM MELONGENA; AUBERGINES; PLANT PRODUCTION; BIOFERTILIZERS; INORGANIC FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; ENDOPHYTES; KEEPING QUALITY; COST BENEFIT ANALYSIS

Development of sustainable technologies and approaches for adaptive rice-based agricultural systems (DSTAR): influence of organic/bio-organic fertilizers on populations of arthropods (pests/natural enemies) and major diseases in irrigated/rainfed rice. **Sinohin, A.M., Gonzales, P.G.** *2014 TR- 1704*.

Field experiments were conducted at CES [Central Experimentation Station]-UPLB [University of the Philippines Los Baños] and farmer's rainfed rice field in Barangay [village] San Jose, San Antonio, Quezon [Philippines] to compare the effect of bio-organic fertilizer and biocon agents on rice sheath blight severity, arthropods count (pests/natural enemies), agronomic character and grain yield. During the dry season 2014, generally, more natural enemies were counted on Biocon and Bio N treated plants. Under CES-UPLB condition, the dry and wet season trial showed that grain yield of Biocon and Bio N treatments were comparable with inorganic fertilizer treatment. Sheath blight severity Biocon and Bio N treatments were comparable with inorganic fertilizer but significantly low compared with the untreated control. Generally, the profitability with bio-organic fertilizer and biocon agent usage can still be realized. Only 50% of the required inorganic fertilizer was applied with Bio N and Biocon treatments with grain yield comparable with inorganic fertilizer alone. However, the possible net return and return on investment does not include the external, off-farm costs of environmental damage caused by chemical fertilizer.

ORYZA SATIVA; RICE; ORGANIC FERTILIZERS; ARTHROPODA; NATURAL ENEMIES; PESTS OF PLANTS; DRY SEASON; WET SEASON; AGRONOMIC CHARACTERS

Efficacy of the different levels of vermipellets on the growth of pechay (Brassica pekinensis L.). **Pioquinto-Lagardia, L.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Changing Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 19*.

The study determined the effects of the different levels of vermipellets on the growth of Pechay (Brassica pekinensis Linn.). Six parameters were used to access the response of Pechay on the different levels of vermipellets added in the potting media such as percent survival, height, green weight, number of leaves, leaf area, root length and ovendry plant biomass. The study also determined which level of vermipellet would give the best growth of potted Pechay (Brassica pekinensis Linn.). The study was laid out in a Completely Randomized Designed (CRD) with five treatments and three replications per treatment. Each treatment had twelve plants, which had a total of sixty plants. The different treatments were, 4 grams of vermipellet, 1kg san (T1), 6 grams of vermipellet, 1 kg sand (T2), 8 grams of vermipellet, 1kg sand (T3), 10 grams of vermipellet, 1kg sand (T4), No vermipellet, Pure sand (T5). The parameters measured in the study were subjective to Analysis of Variance (ANOVA) to determine the effects of different levels of vermipellet on the growth performance of Pechay (Brassica pekinensis Linn.).; the Duncan's Multiple Range Test (DMRT) was used to test the significant differences among the treatment means. The statistical analysis of data collected from the study using the potted Pechay grown in different levels of vermipellet revealed significant differences in height, plant green weight, number of leaves, leaf area and ovendry bioimass. Only root length and plant percent survival were not affected by the applied vermipellet. Results of the statistical analysis of data on plant height of Pechay showed effect of vermipellet on the potting media (Table 1). Comparison between treatment means revealed that the shortest height of Pechay was attained in those grown with pure sand with no vermipellet (T5) with 12.77 cm. The highest height was achieved by Treatment 2 (6 g of vermipellet and 1 kg sand) with 17.38 cm. The number of leaves of Pechay was improved as a result of the treatment. Those grown in potting medium with vermipellet had a higher number of leaves. Treatment 3 gave the highest number of leaves. In this research, it was found out that treatment 2 yielded better ovendry biomass, plant green weight, 100% plant survival and plant height. The result of the study has shown a good survival of Pechay which is between 83.33% and 100% (Table 1) within two-month duration of all the treatments. The lowest survival rate was observed in T4 (83.33%) while the highest rate was recorded in T1, T2 and T3 (100%). Leaf area of Pechay was affected by the vermipellet added to the potting media. There was a great improvement in the leaf of Pechay when applied with vermipellet. The added vermipellet gave higher leaf area over the treatment with no vermipellet. Treatment 3 had the highest leaf area of 40.62 cm 2 as compared to those grown in pure sand only. Other treatments resulted also to improved leaf area. Finally the different amount of vermipellet applied to Pechay improved its growth but the best growth was attained using 6 g of vermipellet and 1kg sand (T2).

BRASSICA CHINENSIS; GROWTH; LEAF AREA; COMPOSTING; OLIGOCHAETA; APPLICATION RATES; ORGANIC FERTILIZERS; FERTILIZER APPLICATION;

Endophytic bacteria (EBI) as inoculants for improved yield of eggplant (Solanum melongena L.). **Padilla, V.M., Masilungan, G.D., Roxas, D.M.A.** Development and promotion of new and enhanced biofertilizers, biostimulants, and biopesticides for improved crop productivity: development and filed testing of endophytic bacterial inoculants as new biofertilizer for improved production of egpplant (Solanum melongena) and sugarcane (Saccharum officinarum L.), Padilla, V.M.Marfori, E.C.Roxas, D.M.A. Masilungan, G.D..- College, Laguna (Philippines), UP REPS 2nd Annual Scientific Conference, Tagaytay City (Philippines), 26-27 Mar 2015. *TR-1722. p. 119-124*

Eggplant (Solanum melongena L.) is number one vegetable crop in the Philippines with fertilizer requirement of 90-60-60 kg NPK per hectar (Full NPK). The use of endophytic bacterial inoculants (EBI) is one of the strategy to reduce the independence on expensive inorganic fertilizer such as nitrogen, phosphorus and potassium.

Two separate experiments were conducted on new endophytic bacterial inoculants (EBI) for growth and yield of eggplant (Solanum melongena L.) The first screening of seven (7) new EBI for eggplant was conducted from November 2012 to May 2013. The second experiment was conducted to confirm the potential of the three new EBI for eggplant from October 2013 to March 2014. The first and second experiments were consisted of ten treatments and 12 treatments respectively, with four replications. Each of the EBI was sprayed separately to the plants either singly or in combination with 90-60-60 kg NPK /ha (Full NPK) or 45-30-30 kg NPK /ha (1/2 NPK) fertilization. The treatments for both experiment also included the control, full NPK or 1/2 NPK alone. Both experiments were implemented at BIOTECH experimental area and laid out in a randomized complete block design (RCBD). In the first experiment, the results showed that higher marketable fruits yields were obtained from eggplant fertilized with 45-30-30 kg NPK/ha and inoculated with EBI 3 (Enterobacter ludwigii) (59%) and EBI 5 (Bacillus sp.)(49%) compared with 45-30-30 kg NPK inorganic fertilizer alone. In terms of total cumulative fruit yield, EBI 3 and 5 with 45-30-30 kg NPK/ha gave 75% and 72% increase in yield respectively, compared with 45-30-30 alone. Plants inoculated with EBI 3 and 5 in combination with 45-30-30 kg NPK/ha produced 129% and 114% higher marketable yield compared with full rate of NPK (90-60-60 kg NPK/ha). Apparently, the performance of either EBI 3 or 5 with 45-30-30 kg NPK/ha is comparable with 90-60-60 kg NPK per hectare. Based on these results, EBI E3 or E5 are potential inoculants for improving the yield of eggplant in combination with 45-30-30 kg NPK/ha under field conditions.

SOLANUM MELONGENA; AUBERGINES; CROP YIELD; ENTEROBACTER; BACILLUS; ENDOPHYTES; INOCULATION; INORGANIC FERTILIZERS; FERTILIZER APPLICATION; PLANT DISEASES; APPLICATION RATES

Field promotion of radiation-modified Kappa Carrageenan as inducer of resistance against major pests and diseases in rice. **Magsino, G.L.** *2016 TR-1789*.

Farmer's field days were conducted successfully at Pulilan, Bulacan, Pototan, Iloilo CES, UPLB, and Pagadian, Zamboanga del Sur [Philippines] few days before harvesting multiloc trials in the area. Farmers from different organizations along the area were invited to demonstrate carrageenan performance on the farmer's field results. Inquiries such as but not limited to different aspects of carrageenan use and farming were entertained and discussed among the farmers. Foliar spraying to rice plants of Carrageenan at 200 ppm (3.2 li/ha) 3x(14,30 and 45DAT) per season promoted better crop stand, more productive tillers, better yield grains, thus, resulted to high quality grain yields especially if supplemented to 1/2 RRG (3 bags NPK/ha) or RRG (6 bags NPK/ha). Overall, two cropping seasons and across demo-trial sites (Victoria, Laguna and CES, UPLB, Pulilan, Bulacan, New Lucena and Pototan, Iloilo and Munoz, Nueva Ecija) showed an average higher rice yields (ton/ha) to 1/2 RRG + 200 ppm Carrageenan applied 3x/ha/season of 33.29% than only 1/2 RRG treated plants, likewise, 63.4% better yields than untreated plants while 11.45% higher yields from RRG + Carrageenan (200 ppm) 3x application/ha/season than RRG treated plants. Request for Experimental Use Permit was processed and was awarded last September 23, 2015. Laboratory testing of the fertilizer composition of carrageenan was primarily done, but will be retested in a FPA Accredited laboratory. Evaluation of Carrageenan performance data from two identified sites was done last quarter of 2016. Data gathered on two sites (Laguna and Iloilo) were submitted to FPA for product registration last 5 January 2017.

ORYZA SATIVA; RICE; CROP YIELD; CARRAGEENANS; RADIATION; FOLIAR APPLICATION; CHITOSAN; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES

Fruiting caimito in a container. **Anon**. *Agriculture (Philippines) v. 23 (3) p.54 (Mar 2019)*.

FRUIT TREES; PLANTING; SEEDLINGS; GROWING MEDIA; PLANT CONTAINERS; FERTILIZER APPLICATION; ORGANIC FERTILIZERS

Influence of nitrogen level and water scarcity during seed filling period on seed yield and fatty acid compositions of corn. **Koca, Y.O., Canavar, O., Yorulmaz, A., Erekul, O.** Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 90-97 (Dec 2015).

The study investigated the effect of different nitrogen and irrigation levels during seed filling on per cob yield, grain quality and fatty acid composition of corn oil using two corn hybrids (31G98 and Kermes cv.). The experiment was conducted in Turkey in 2011 and 2012, and was arranged following the split-plot design in RCBD with water levels (W) as main plot and nitrogen (N) levels as subplot. The four water levels were 300 mm (W1), 400 mm (W2), 500 mm (W3) and 600 mm (W4), while the five nitrogen levels were 0 (N1), 80 (N2), 160 (N3), 240 (N4) and 320 (N5) kg/ha. The results indicated that different N levels and water scarcity (W) affected cob yield, protein, oil yield and fatty acid compositions of both corn cultivars. Per cob yield, protein and oil yield increased with N levels until N4 in both years. The highest cob, protein and oil yield were recorded from N4 and W3 in both corn cultivars. N x W interaction also affected all fatty acid components such as palmitic, stearic, oleic, linoleic and arachidic fatty acids in corn oil. However changing climate such as extreme temperatures and rain during the growth period also caused irregular changes in fatty acid compositions of corn oil. Additionally, Oleic and Linoleic were found to be the dominant fatty acids of the corn oil in all treatments. The results of this study suggest that the combination of N4 and W3 level is the most viable option for optimum cob yield, protein and oil yield.

ZEA MAYS; MAIZE; HYBRIDS; FATTY ACIDS; NITROGEN FERTILIZERS; IRRIGATION; DROUGHT STRESS; QUALITY; SEED; CHEMICAL COMPOSITION; WATER LEVELS; YIELDS; MAIZE OIL; SEED FILLING

Luxury integrated resort lakes steps toward sustainability. **Taculao, P.B.S.** *Agriculture (Philippines) (Jun 2019) v. 23 (6) p. 12; 14*.

CULINARY HERBS; PLANTING; OLIGOCHAETA; COMPOSTING; ORGANIC FERTILIZERS; ORGANIC WASTES

Millenial from Rizal [Philippines] creates do-it-yourself vermicomposting kit to help reduce household food waste. **Necessario, N**. Agriculture *(Philippines) v. 23 (08) p. 16; 18 (Aug 2019)*.

COMPOSTING; OLIGOCHAETA; HOUSEHOLD WASTES; FOOD WASTES; URBAN AREAS; PHILIPPINES

Regenerative farming: the secret is in the soil. **Aberasturi, P.Z.** *Agriculture (Philippines) v. 23 (5) p. 22;24;26;28-29 (May 2019).*

ORGANIC AGRICULTURE; SOIL FERTILITY; CROP MANAGEMENT; COMPOSTING; MULCHING; MULCHES; GREEN MANURES; COVER PLANTS

Relationship between chlorophyll meter readings and leaf nitrogen concentration in papaya (Carica papaya L.). **Cavalcante, I.H.L., Da Silva, G.B., Santos, E.M., Lima, A.M.N.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 75-79 (Apr 2016).*

Papaya or pawpaw is native to Central and South America distributed throughout the tropical areas of the worlds, but poorly studied for plant physiology. The portable chlorophyll meter has been used to predict nitrogen (N) requirements to improve N fertilizer management in some fruit crops such as custard apple and

passion fruit. Thus, an experiment was carried out to evaluate the relationship between the readings provided by the chlorophyll index and the leaf nitrogen 9N0 concentration in papaya (pawpaw) applied with different N rates (0, 320, 400 and 560 g N per plant). Positive and highly correlations were found between the leaf chlorophyll reading and N content in pawpaw. The satisfactory validation of the linear relationship indicate the potential use of chlorophyll meter to estimate leaf N status of papaya, showing that plants which contained from 36.00 to 36.56 (leaf chlorophyll a), 11.6-11.96 (leaf chlorophyll b) and 47.65-48-52 (total leaf chlorophyll) are supplied with N adequately.

CARICA PAPAYA; PAPAYAS; CHLOROPHYLLS; LEAVES; NITROGEN FERTILIZERS; PLANT NUTRITION; FERTILIZER APPLICATION; PLANT PHYSIOLOGY; APPLICATION RATES

Site-specific nutrient management for maize production in favorable environments of the Philippines. **Ocampo, A.M., Labios, R.V., Labios, J.D., Lapoot, C.R., Tumamang, S.C., Gines, H.C., Descalsota, J.C., Pasuquin, J.M.C., Witt, C.** *Philippine Journal of Crop Science v. 40 (3) p. 40-48 (Dec 2015)*.

Increasing the productivity and profitability of maize requires the effective use of nutrients from naturally-occurring indigenous and fertilizer sources to achieve high and sustainable yield. On-farm trials were conducted at key production sites in Isabela, Bukidnon, and Nueva Ecija [Philippines] with one or two hybrid maize crops per year within 2005 to 2007 to develop and evaluate a site-specific nutrient management (SSNM) approach for irrigated and favorable rainfed maize in the Philippines. Attainable yields of 7-10 t/ha were obtained in the dry season and 7-8 t/ha in the wet season from treatments supplied with ample fertilizer. Grain yields from omission plots followed the same trends as the attainable yield. Yield response to fertilizer application followed the order N>P=K. Fertilizer recommendations in the SSNM treatment were calculated based on the site-specific attainable yield and yield response to fertilizer application. The SSNM approach increased yield on average by 1.0 t/ha (+21%) compared to the farmer's fertilizer practice (FFP) measured in the same cropping seasons. Yield increase in the SSNM were associated with higher application of fertilizer N (+18%), P (+143%) and K (+135 %). Fertilizer P and K application rates in the SSNM plots accounted for the partial removal of P and K in grain and stover to avoid nutrient depletion in the soil. Fertilizer cost was 55% higher in the SSNM, while profit (gross benefit over fertilizer cost) increased by PhP 5,789/ha sup (+8%) over the FFP.

MAIZE; ZEA MAYS; PLANT PRODUCTION; NUTRITIVE VALUE; CROPPING SYSTEMS; SITE FACTORS; PHILIPPINES

Using the right fertilizer can help cacao farmers cope with changing weather patterns. **Yap, J.P.Jr**. *Agriculture (Philippines) v. 23 (5) p. 38-39 (May 2019).*

THEOBROMA CACAO; FERTILIZER APPLICATION; ORGANIC FERTILIZERS; FOLIAR APPLICATION; WEATHER

F06 Irrigation

Magnet-powered irrigation system that uses no electricity introduced. **Tan, Y.** *Agriculture (Philippines) v. 23 (06) p. 42 (Jun 2019)*.

FARMERS; IRRIGATION SYSTEMS; MAGNETIC PROPERTIES; TECHNOLOGY; INNOVATION ADOPTION; EVAPORATION

Wiser with WAISS [Water Advisory for Irrigation Scheduling System]: introducing SARAI's [Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines] smart irrigation technology. **Domingo, O.F.** *Agriculture (Philippines) v. 23 (06) p. 40-41 (Jun 2019)*.

COMPUTER SOFTWARE; MONITORING; TECHNOLOGY; IRRIGATION SYSTEMS; IRRIGATION SCHEDULING; SENSORS

F08 Cropping patterns and systems

Cucumber has its advantages as a money maker. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.8-9 (Mar 2019)*.

CUCUMIS SATIVUS; LYCOPERSICON ESCULENTUM; MOMORDICA CHARANTIA; VARIETIES; CUCUMBERS; INTERCROPPING; CROP MANAGEMENT

Oil palm agroforestry yield and financial estimation modeling. **Sundawati, L., Kuncahyo, B.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 15.*

Development of oil palm plantation in Indonesia is often blamed by international society as the major cause of tropical rainforest deforestation. On the other hand, oil palm industry in Indonesia related to livelihood of about 16 million people who depended on oil palm from upper to downstream industries and in which from 11.6 million hectare oil palm plantation about 41% are smallholders. Long-term research collaboration between Indonesian universities (Bogor Agricultural University, Jambi University and Tadulako University) and Goettingen University of Germany has been started since 2012 in which a sub-project on Biodiversity Enrichment Experiment in Oil Palm Plantation is conducting to find out among any others a solution for the establishment of oil palm plantation that ecologically friendly and economically beneficial. The experiment is established at the oil palm plantation of a private company - PT Humusindo in Jambi Province of Sumatera Island, in which 52 plots (48 plots planted with tree species and 4 plots are control) in sizes of 25m2, 100 m2, 400m2 and 1600m2 were established and placed systematically at distance about 100 m to each other over about 250 Ha oil palm plantation. There were 6,354 trees of 6 species (Parkia speciosa, Durio zibethinus, Archidendron pauciflorum, Peronema canescen, Shorea leprosula, Dyera polyphylla) planted in 48 plots with 0, 1, 2, 3, and 6 diversity levels, created tree islands on the sea of oil palms. This paper will present the modeling based financial analysis to find out the best agroforestry model that combined tree species with oil palms. Tree yields (timber and fruits) were estimated using LISTREL program and agroforestry financial is analyzed using criteria of Net Present Value, Benefit Cost Ratio and Internal Rate of Return. About 3 years after planting it was observed that 3 out of 6 tree species planted in the plots showed very good growth performance, i.e. Peronema canescen, Archidendron pauciflorum, and Parkia speciose, so the agroforestry model used these 3 species which were analyzed financially. Research results shows that at the age of 25 years, Peronema canescen is estimated to reach an average diameter of about 41 cm, average height of about 25 m and will yield wood about 2.37 m3. Parika speciose is estimated to starting produce fruits at 5 years old and reached the peak at 11 years old with fruit production about 24 kg/tree. While Archidendron pauciflorum will start to produce fruits at 5 years old too and reach the productivity peak at 10 years old and produce fruits about 24.15 kg/tree. Establishment and maintenance of tree islands as biodiversity enrichment experiment

will not increase the cost of plantation at PT. Humusindo in the long run (25 years oil palm cycle). The low maintenance of trees compare to oil palms especially in the fertilizer application reduced the total cost for about 22.12%. Biodiversity enrichment in oil palm using high economic value tree species in island plots of 1600 m2 at every 3 ha oil palm plantation area give higher benefits, not only ecological benefits but also economic benefits. Enrichment oil palm plantation with Peronema canescen, Archidendron pauciflorum, and Parkia speciose, give higher Net Present Value, Benefit Cost Ratio and Internal Rate of Return compare to monoculture oil palm.

OIL PALMS; PARKIA; SPECIES; TREES; AGROFORESTRY; BIODIVERSITY; ECONOMIC ANALYSIS; FINANCING; MODELS

F30 Plant genetics and breeding

Abaca functional genomics: high throughput discovery of genes and molecular markers. **Laurena, A.C.** *2015 TR-1782*.

This research project is the first to establish the genomic resources of the Philippine endemic abaca. This laid down the fundamentals not just of genomics researching in the Philippines, but also answers the questions on genetic, molecular and biochemical mechanisms underlying particular traits in abaca, including fiber quality and disease resistance. The establishment of the genomic resources of abaca has been performed through three-platforms: High-throughout Genome sequencing, High-throughput Transcriptome sequencing and Sanger sequencing of abaca (cv Abuab), pacol and BC2. The first platform, High-throughput Genome sequencing of the exome-filtered whole genome of abaca (cv abuab) has been assembled and annotated. The fir st draft assembly of the abaca genome in the Philippines. From the annotated genome of abaca (cv abuab), putative functions related to fiber quality were elucidated, including 38 genes coding for polysaccharide synthases and glycosyl transferase,93 genes coding for Assembly, Architecture and Growth, 43 genes coding for differentiation and Secondary cell wall formation, and 5 genes coding for structural proteins. The second platform was High-throughput transcriptome sequencing. Three to four month old tissue-culture derived seedlings of BC2A2 hybrids were obtained through RNA-Seq and clustering analysis via K-means method, 349 genes were observed to be differentially expressed and 41 of these re specific genes that are uniquely expressed in each of the five samples relative to all the other samples. The observed occurrence in the abaca backcross hybrid of high amounts of the putative defense response genes that forms the five modes of immunity, directly supports the possibility that these molecular mechanisms play major roles to protect the hybrid against the damaging effects of ABTV infection.The third platform Sanger sequencing lead to he development o SSR-based markers and gene specific markers from the genomic data and Gene-enriched microgenomic DNA libraries. A total of 157 SSR primers were successfully designed. This technique may provide a sample but efficient mean to help find coding regions of large genome plant species and produce more sequences, more quickly, at greater resolution. Using molecular and bioinformatics tool this three-year project has generated enough genomic resources that can be used for association to the traits of economic importance.

MUSA TEXTILIS; INDIGENOUS ORGANISMS; GENETIC MARKERS; GENOMES; GENES; GENETIC RESISTANCE; PLANT FIBRES; DISEASE RESISTANCE; GENE EXPRESSION

Adaptability of traditional rice varieties under PhilRice [Philippine Rice Research Institute] Negros [Philippines]. **Rogeno, L.A., Seville, C.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi

City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 97 (Jul-2018).*

Traditional rice varieties are rarely grown for commercial production because it is usually a low-yielder. These varieties however, possess desirable traits such resistance to pest and disease, tolerance to abiotic stress, aromatic, tastes good and excellent platability. These useful traits are usually transferred to our modern cultivated varieties. To maintain and fully utilize our wide genetic wealth for rice crop improvement, it is important to conserve and characterize these materials. One hundred thirty-six traditional varieties and farmers' selection were established in PhilRice Negros in 2017, wet season to assess its performance and adaptability. Well-performing varieties under PhilRice Negros with 105-30-60 NPK fertilizer rate and 20 cm x 20 cm planting distance are Gift 18, Minerva, Laila, Kosi, Azucena, Libtong, Dinorado and Ginandara with yield of 6.6, 6.2, 6.1, 5.8, 5.5, 5.2, 5.2 and 5t/ha, respectively. With regards to rice tungro virus (RTV) reaction, only few traditional varieties have been infected at below 3% economic threshold level and these are Lubang, Laila, Gift 18, Mukol Azucena, Balatinao, Burit, Cadidit and Calatrava. Ultimately, the varieties that showed resistance to RTV at the same time produced higher yield are Gift 18, Laila and Azucena whereas, varieties which showed RTV tolerance are Minerva, Libtong, Dinorado and Ginandara (3% infection but still attained good yield). These good performing entries can be planted by the farmers with similar climatic and soil condition as PhilRice Negros and can be a good source of tolerance to RTV and other desirable traits.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; ADAPTABILITY; CROP YIELD; CROP PERFORMANCE; RESISTANCE TO INJURIOUS FACTORS; TOLERANCE; PHILIPPINES

AMMI and GGE biplot analyses of multi-environment test in rice (Oryza sativa L.) for irrigated lowland conditions in the Philippines. **Manigbas, N.L., Lambio, L.A.F., Magat, M.B., Bartolome, V.I.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 60-69 (Apr 2016)*.

Genotype by Environment Interaction (GEI) was investigated on grain yield of 10 rice genotypes in 12 lowland rice growing environments in the Philippines. Biplots were used in selecting and recommending the top-performing genotypes on different environments. Additive Main Effect and Multiplicative Interaction (AMMI) and Genotype by Genotype Environment (GGE) models were used in the analyses. The ANOVA for grain yield was significant (P0.05) for genotypes, environments and their interaction. Environments accounted for the greater proportion (80.73%) of variation in grain yield, followed by GEI (12.80%), and genotypes (6.69%), indicating the need for multi-year and multi-location testing of rice varieties. The first two terms of the AMMI models explained 62.10% of the GEI while GGE biplot analysis accounted for 72.4% of the total GEI variation. Based on AMMI and GGE biplots, no single variety has superior performance across environments. However, G2 (PSB Rc82) and G5 (PR37273-5-16-5-2-1-2-1) were the best genotypes having high and stable yields. The GGE model identified Nueva Viscaya State University as the most discriminating environment, while Naujan, Oriental Mindoro as the most representative environment. These environments are good test environments for selecting adapted genotypes. In this study both AMMI and GGE biplots were evaluated as effective tools for the analysis of GEI and visualization of genotype performance under varying test environments. Findings in this study are useful inputs in breeding rice varieties that are adapted to certain recommendation domains.

ORYZA SATIVA; RICE; GENOTYPES; IRRIGATED LAND; LOWLAND; ENVIRONMENTAL FACTORS

Assessment of Musa genetic resources for their host reaction to Fusarium oxysporum f.sp. cubense tropical race 4 (Foc TR4), towards understanding the genetic base of host-pathogen interactions. **Dela Cueva, F.M., Gueco, L.S., Silva, F.F.M.A.** *2016 TR-1776.*

MUSA (BANANAS); GENETIC RESOURCES; HOST PATHOGEN RELATIONS; FUSARIUM OXYSPORUM; GENETIC RESISTANCE; GENOMES; FUSARIUM; WILTS

Bayer's dual trait Arize AZ 8433 DT hybrid rice combats insect pests as well as diseases. **Anon**. *Agriculture (Philippines) v. 23 (5) p. 8-10 (May 2019)*.

ORYZA SATIVA; HYBRIDS; INFESTATION; CROP YIELD; NILAPARVATA LUGENS; PEST RESISTANCE

Bridging past and future of rice germplasm through PhilRice Genebank Collection and Conservation. **Nombrere, J.M.Z., Mananghaya, T.E., Ferrer, M.C., Alvarino, J.B., Mallari, R.P., Newingham, M.C., Suldulao, M., Alfonso, D., Castro, J.R., Niones, J.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 96 (Jul-2018).*

Rice in the Philippines has traversed through ages in the archipelago. As country with extremely varied topography, the Philippines had a diverse reservoir of rice germplasm cultivated. This includes the traditional rice varieties (TRVs) or landraces that contains valuable genes that can be used to develop new varieties with improved yield potential, higher nutritional quality, and higher tolerance of the stresses for future climatic conditions. However, due to changing environmental condition and substitution of TRVs with modern varieties, rice diversity faced extinction through the years. Thus, the collection of rice germplasms has been a part of the continuous conservation effort at the PhilRice [Philippine Rice Research Institute] Genebank. From 2012 to 2017, PhilRice Genebank has managed to collect and conserve 4,053 rice germplasms, where in 49.29% was traditional varieties. It was followed by advanced/improved cultivars, breeding lines. farmer's lines, wild cultivars and unidentified biological classification which were mostly donated by farmers. Most of the collections came from Luzon (1,185) where the province of Nueva Ecija has contributed a total of 387 germplasms. On the otherhand, 443 rice germplasm collected from Mindanao and 135 germplasms from the Visayas. Currently, PhilRice genebank stores 16,298 rice collections, of which 7,129 were assigned as accessions. The collection of traditional cultivars and indigenous germplasm grown in various rice areas and deposited in a national genebak, will facilitate protection of genetic wealth as well as safeguarding Philippine germplasm's rich diversity.

ORYZA SATIVA; GERMPLASM; GERMPLASM COLLECTIONS; GERMPLASM CONSERVATION; RESEARCH INSTITUTIONS

Cherimoya in Taiwan and in the Philippines. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (1) p.64 (Jan 2019)*.

CHERIMOYAS; VARIETIES; TROPICAL FRUITS; WEIGHT; PRICES; KEEPING QUALITY; TAIWAN; PHILIPPINES

Classifying farmer-bred maize (Zea mays L.) varieties into heterotic groups using broad-based testers. **Laude, T.P., Nuñez, J.P.P., Diaz, R.A., Burgonio, J.S., Sanchez, M.A.B., Salazar, A.M.** *Philippine Journal of Crop Science (Philippines) v. 43 (3)p. 57-66 (Dec 2018).*

Through many decades of farmers' selection, the farmer-bred maize varieties (or native varieties) from the Philippines formed unique potential in adaptation and proven to be genetically-diverse. But its utilization in

varietal improvement programs is less explored due to their low yield. Using broad-based elite maize populations as testers, the study aimed in classifying 70 farmer-bred varieties into heterotic groups. Testcross progenies were generated during the 2015 DS followed by field evaluation in replicated trials at Pangasinan, Isabela, and UPLB from 2016-2017. ANOVA revealed significant effects of native (farmer-bred variety), tester, and native x tester interaction for important traits like YIELD, EPP, EL, FW, and GW. Combining ability estimates based on YIELD were used in generating GGE biplots and dendrogram. Three clusters, which are also equivalent to the proposed heterotic groups, explained 61.2% of the variation in combining ability of farmer-bred varieties and testers. Broad-based testers representing each group are chosen and may be used to classify other farmer-bred varieties in the future. Farmer-bred varieties with high GCA are recommended for intra-population improvement, while testcrosses exhibiting high SCA may be directly considered as potential population hybrids. Traits from farmer-bred varieties will also be incorporated to further improve the elite maize populations (used as testers). The study is an effort to manage farmer-bred variety or germplasm through the proposed heterotic groupings, in order to utilize them in maize varietal improvement programs in the country. Further experimentation is needed to validate the proposed heterotic groupings.

ZEA MAYS; MAIZE; VARIETIES; GERMPLASM; CLASSIFICATION; FARMERS; PROGENY; FIELD EXPERIMENTATION; INDIGENOUS ORGANISMS; BREEDING METHODS; PHILIPPINES

Development of molecular markers for the assessment of moisture stress tolerance in eggplant (Phase 2). **Delfin, E.F.** *2016 TR-1809*.

Greenhouse and filed verification trials were conducted to identify drought tolerant eggplant variety/accessions. The greenhouse verification trials identified promising accessions; PHL 12232, PHL 1519 and PHL 4841 which were evaluated under field condition along with other selected eggplant accessions and reference varieties, Mara and Mistisa. Tolerant and intolerant accessions were identifies in the field trial. Drought tolerant entries were PHL 5764, PHL 4841, PHL 2778 while PHL 1602 was identified drought intolerant entry. For the field trial, drought treatment was imposed at 5 weeks after transplanting by withholding irrigation for 2 weeks. Drought treatment was terminated early due to heavy rainfall occurrence at 3 weeks after drought imposition. PHL 2789 produced the highest fruit yield for both the control and drought conditions followed by PHL 2778. The yield of these two entries were significantly higher than the reference varieties, Mistisa, DLP and Mara for both growing conditions. This observation was further observed during the recovery period with PHL 2789 producing significantly higher than the 3 checks while PHL 2778 produce higher yield than Mistisa and DLP. Each genotype showed reductions in yield in both drought and recovery period, with genotypes showing different magnitudes of reduction. In terms, of relative yield, 2 entries PHL 5764 and PHL 484 showed consistently low yield reduction (less than 20%) during drought and recovery period. Further verification of fruit yield of promising accessions showed the adverse effect of drought on fruit field with reductions ranging from 11% to 59%. The trial was also affected by bacterial wilt infection such that yield loss could have been also influenced by the disease occurrence. The promising entries previously selected in terms of yield such as accessions PHL 2789 and PHL 2778 had yield reductions of 25 and 11% respectively. On the other hand, accession PHL 1602 which also had high yield reduction in the previous trial, had yield reduction of 46%. The four selected entries were also subjected to antioxidant activity assay using 2, 2-Diphenyl-1-picryhydrazyl (DPPH). The promising drought tolerant entries showed in increasing trend in terms of percent scavenging activity until the 10th day after drought deposition (DAI) whereas PHL 1602, the drought intolerant accession was observed to have reduced activity at 10 DAI. Polymorphic markers were

identified for the initial selection of PHL 4841 and PHL 2789 and Mara and Mistisa (Female parent). Six polymorphic markers (EM141, EME05B09, EM133, emh11O01, emf21I02 and EM117) were identified for the cross Mistisa x PHL 4841 and four markers (CSM20, eme09E09, EM13 1 and EE063)for the cross Mara x PHL 2789. These 10 primer pairs were used in the hybridity testing of the progenies of the two crosses. The low percentage of SSR marker polymorphism was attribute to the self-pollinating nature of eggplant. Low percent polymorphism was also observed from the selected accessions in the field. The percent polymorphism area follows; 12.4% for the cross PHL x PH5764, 6.8% for PHL 1602 x PHL 4841 and 10.80% for PHL 1602 x PHL 2778. SSR marker screening for PHL 1602 x PHL 2789 cross is not completed yet with only 59 markers screened the low percent polymorphism observed indicate the relatively low genetic diversity among the parental crosses used. The identified SSR polymorphic markers successfully used in hybridity testing of F1 progenies derived from selected eggplant genotypes. For F1s derived from M9stisa x PHL 4841 cross, only markers EM117, emh11O01, emf21I02 and EM141 were able to distinguish hybrids out of the six markers used in this cross. Thus, the efficiency of the marker in terms of identifying hybrids ranged from 36.67%-96.67%. for the cross between Mara PHL 27 89, markers CSM20 and EM131 all 30 progenies exhibited the presence of bands from both parents. Moreover, the six SSR polymorphic markers used in the hybridity testing of progenies from the cross PHL 1602 x PHL 2778 showed 42.86-100% efficiency while percent hybridiy among the 35 progenies tested ranged from 71.43-100 %. The identified polymorphic SS markers were also used to assess the genetic diversity among selected eggplant accessions which exhibited different drought responses. Twenty eggplant accessions from Turkey, China, India Laos, Taiwan, Africa and different provinces of the Philippines were analyzed for genetic diversity.

SOLANUM MELONGENA; AUBERGINES; VARIETIES; GENETIC MARKERS; MOISTURE CONTENT; DROUGHT RESISTANCE; DROUGHT STRESS; TOLERANCE; GENETIC POLYMORPHISM; DNA; EXPERIMENTATION

Development of PRSV-P resistant papaya genotypes by introgression of genes from wild Carica species. **Guevarra, M.L.D., Sison, M.L.J., Siar, S.V.** *2016 TR-1779.*

Papaya is an important fruit commodity in the country. However, production is continuously hampered by Papaya ringspot virus (PRSV), a serious disease which resulted to low fruit quality. This project aims to further evaluate the putative PRSV-P resistant BC3 lines, BC4 lines, and F1 reconstituted 'Sinta' (new hybrid) produced from concluded ACIAR project. Field evaluation for PRSV-P resistance/susceptibility was conducted in 10 BC3 and sib-cross lines, 10 BC4 and sib-cross lines and susceptible check, Davao Solo. In general, there was variation in the rate of symptom development of BC3, sib-cross 3, BC4 and sib-cross 4 from the Davao Solo. The development of the symptoms in the backcross generations was slower than that of the Davao Solo which produced severe symptoms. There were also plants (sib-cross 3 and BC4) that remained symptom free from viral infection even after 11 months of exposure in the field. Furthermore, backcross plants had the ability to recover from infection and produced good and marketable fruits; in contrast to Davao Solo with few, small and unmarketable fruits. Yield trial of 17 backcross lines was also done at IPB Experimental station in Brgy. [village] Tranca, Bay, Laguna [Philippines]. A total of 108 bearing plants generated number of 2,035 fruits for six months and yielded a total of 1,036 kg. Multi-location planting of new hybrid papaya (2 lines) in three papaya growing areas (Cavite, Laguna and Institute of Plant Breeding) [Philippines] had similar response of the backcross to PRSV-P infection. Three pants of new hybrid papaya planted at IPB on 2010 remained visually symptomless after 11 months of exposure to natural infection. New hybrid plants also exhibited high tolerance against PRSV-P; wherein mild to moderately infected plant have the ability to recover from infection

and bear good quality fruits. Fruit qualities of new hybrid papaya were presented. Fruits were generally sweet. The observed sweetness of the fruit could be attributed to V. querciflia since it is known for its high sugar levels. TSS ranged from values 11.3 to 12.30B. The fruit weight ranged from 1,412-1,628 grams and the fruits have firm yellow orange flesh with mild papaya aroma. On-station planting of 2 IPB inbred lines, 10 commercial papaya hybrids, and 4 collected germplasm was also done for extensive hybridization. Continuous selection and crossing/selfing for seed maintenance of selected backcross lines and inbred lines, population development towards red-fleshed and solo-type papaya with PRSV-P resistance/tolerance, and generation advancement of new germplasm and commercial papaya hybrids resulted to a total of 85,547 seeds. Production of new hybrid seeds was also done.

CARICA PAPAYA; PAPAYAS; HYBRIDS; GENES; INTROGRESSION; GENOTYPES; DISEASE CONTROL; PLANT DISEASES; DISEASE RESISTANCE; BREEDING METHODS; SYMPTOMS; INFECTION

Development of sensitive and reliable detection of Banana bunchy top virus in abaca (Musa textilis Nee) by polymerase chain reaction. **Piamonte, R.T. Sta. Cruz, F.C.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 12-19 (Aug 2018)*.

In the current abaca rehabilitation and virus resistance breeding programs, it is crucial that sensitive and reliable diagnostics is established for virus indexing of abaca planting materials and for virus resistance screening. This study was conducted to develop a sensitive and reliable detection of Banana bunchy top virus (BBTV) by polymerase chain reaction (PCR) in abaca plant. The conditions for virus detection by PCR were optimized in template DNA extracted by Dellaporta, Sarkosyl and CTAB methods and in varying amounts (undiluted, 1000, 100, 10, 1, 0.1, 0.01 and 0.001 ng) using different primers. Detection of BBTV was most sensitive using template DNA extracted by Dellaporta compared with Sarkosyl and CTAB methods. The detectable at various concentrations up to 0.001 ng. Dellaporta extracted DNA but can be efficiently (100%) detected from 0.1 to 100 ng. The virus was also detectable at 0.001 ng but efficiency was lower with Sarkosyl (0.1 to 10 ng) and CTAB (1 to 100 ng) extracted DNA. The presence of inhibitors prevented the amplification of BBTV in the highly concentrated (undiluted and 1000 ng) Sarkosyl and CTAB but not Dellaporta extracted DNA. Dilution of the template DNA increased the sensitivity of detection. The Musa sequence was amplified in more concentrated DNA (undiluted and 1000 ng) extracted by Dellaporta but not Sarkosyl and CTAB methods, suggesting that Dellaporta extracted contained lesser amount of inhibitors. Detection of BBTV was most consistent using the BBT1/BBT2 primer pair which amplifies the DNA-R component (replicase) of the viral genome. Amplification of an internal control DNA using the Musa tagged microsatellite primers AGMI025 and AGMI026 confirmed the reliability of BBTV detection by PCR.

MUSA TEXTILIS; ABACA; BANANA BUNCHY TOP VIRUS; PCR; DIAGNOSIS; SENSORS; DNA; GENES; GENETIC MARKERS

Diversity analysis of Philippine citrus collection using simple sequence repeat markers. **Tonogbanua, K.A., Espino, R.R.C., Espino, M.R.M**. *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 47-56 (Dec 2018)*.

Genetic diversity analysis of 44 citrus varieties in the Philippines using 44 SSR markers was done to assess the degree or relatedness and elucidate genetic relationship between and within species. Markers used were characterized and optimized resulting to 248 clear amplicons and at most 14 diverse banding patterns. Polymorphism information content (PIC) values were 0.31-0.98, proving the effectivity of SSR in variability detection. All the varieties were distinct from one another with at most 77% similarity. Two types of clusters

were observed with bootstrap values 89-100, clusters with C. grandis and clusters with mixed members (mostly C. sinensis and C. reticulata). Monoembryonic species have a narrow genetic base as compared to the polyembryonic species and thus clustered exclusively.

CITRUS GRANDIS; CITRUS; VARIETIES; CITRUS RETICULATA; CITRUS SINENSIS; GENETIC VARIATION; POLYEMBRYONY; GENETIC MARKERS; PHILIPPINES

DNA fingerprinting and genetic diversity analysis of Philippine saba and other cultivars of Musa balbisiana Colla using simple sequence repeat markers. **Doloiras-Laraño, A.D., Garcia, R.N., Sandoval, C.M.C., Lalusin, A.G., Gueco, L.S., Huelgas, V.C., Tecson-Mendoza, E.M.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 1-11 (Aug 2018).*

Recognizing the importance of the indigenous Philippine cultivars of Musa balbisiana Colla, which include the popular Saba varieties, it is essential to correctly identify these cultivars for various applications. Simple sequence repeat markers were used to generate DNA fingerprints and characterize the genetic diversity among 13 Philippine Musa balbisiana Colla cultivars and 5 other banana cultivars. Fifty-one primer pairs (45 from Musa and 6 from other species) were screened for PCR amplification and polymorphism across 18 cultivars. Fourteen primers were found to be polymorphic markers. A total of 49 alleles were generated, with a mean of 3.77 alleles per locus, ranging from 1-8 alleles. The resolving power of molecular markers measured as the Polymorphism Information Content (PIC) ranged from 0.23 to 0.80. Mean gene diversity ranged 0.08 to 0.49 indicating high density. The dendrogram using UPGMA-SAHN cluster analysis based on microsatellite polymorphism showed that the Saba cultivars clustered into two groups at 56% similarity level. Cluster analysis separated the cultivars of Musa balbisiana Colla from the other genotypes of Musa acuminate Colla and M. textilis. The 13 polymorphic SSR primers were shown to be able to identify and differentiate the 13 cultivars suitable for specific needs of the industry.

MUSA BALBISIANA; MUSA (BANANAS); VARIETIES; INDIGENOUS ORGANISMS; GENETIC RESOURCES; DNA FINGERPRINTING; GENES; GENETIC MARKERS; GENETIC VARIATION

Fine mapping of bacterial stalk rot resistance loci in tropical white maize. **Canama, A.O., de Vera, M.L., Frankie, R.B**. *2015 TR-1745*.

The research project aimed to address the limitation of the existing QTL map for maize bacterial stalk rot resistance (BSRR). Although a major QTL for BSRR was identified in chromosome 2 of the maize genome, the flanking markers are not yet tightly linked (5 cM) to be useful for MAS. The general objective of the project was to fine-map the bacterial stalk rot resistance (BSRR) quantitive trait loci (QTL) regions with DNA markers. Specifically, the research project aimed to 1)screen new polymorphic simple sequence repeat (SSR) and resistance gene analog (RGA) markers by bulk segregant analysis (BSA); b)saturate the QTL for BSRR in P8 x YIF62 cross with SSR and RGA markers and 3)re-map/analyze the QTLs using the saturated linkage/QTL map. The research have significant accomplishments/findings. In DNA marker polymorphism survey, a total of 99 SSR and RGA primer pairs were screened for polymorphism between P8 and YIF62 parental genotypes and BSR resistant and susceptible DNA bulks and 8(23%) SSR markers were polymorphic between the parental inbred lines. No SSR markers were identified to be polymorphic between the DNA bulks. A total of 57 RGA primers were screened for polymorphism between the parental lines and 12 were polymorphic between the BSR tail DNA bulks. In DNA marker segregation and linkage analysis, of the 23 (2 SSR and 21 RGA) polymorphic markers, 17 (74%) followed the expected Mendelian segregation ratios. The remaining six markers 26%

showed distorted segregation at 0.01P0.05. A total of 23 (2 SSR and 21 RGA) markers were added to the previous 77 marker loci analyzed wherein 14 linkage groups were established. Eleven of these linkage groups were assigned to each corresponding chromosome number of the maize genome. In the mapping of BSRR-QTL regions, single marker analysis detected putative QTLs for BSRR in chromosome 2. Sux of (2 SSR and 4 RGA) the eight markers were significantly associated with BSRR. Based on composite interval mapping (CIM), at a very high LOD of approx 9, two putative QTLs were identified in chromosomes 2. The flanking markers detected in chromosome 2 are not yet tightly linked (5 cM) to be useful as starting points to clone and characterized the underlying resistance genes.

ZEA MAYS; MAIZE; VARIETIES; DISEASE RESISTANCE; GENOMES; QUANTITATIVE TRAIT LOCI; DNA; GENETIC MAPS; GENETIC MARKERS; GENETIC POLYMORPHISM

Genetic analysis for heat tolerance and early morning flowering traits at flowering stage in rice (Oryza sativa L.). **Baliuag, N.N.A., Redoña, E.D., Hernandez, J.E., Sta. Cruz, P.C., Ye, C.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 62-72 (Dec 2015).*

Genetic factors for heat tolerance and early morning flowering (EMF) in rice were evaluated as part of rice genetic improvement under heat stress condition. Qualitative trait loci (QTL) linked to heat tolerance and early morning flowering (EMF) were analyzed by selective genotyping of phenotypic extremes in 235 BC1F1 plants derived from the cross PSB-Rc82/PSB-Rc82/WAB56-125 under controlled high temperature and 684 BC1F2 plants under glasshouse conditions using single marker analysis (SMA). For heat tolerance, data of pollen fertility and spikelet fertility of BC1F1 plants under high temperature were gathered and analyzed. For EMF, four parameters of flower opening to closing were determined, namely: time when flowers start to open (FOT), time of peak flowering (PFT), time when most of the flowers are closed (FMCT), and time when all of the flowers are closed (FCT). SMA revealed three markers on chromosomes 2, 3, and 8 are possibly linked to pollen fertility, while two markers on chromosomes 7 and 8 are possibly linked to spikelet fertility under high temperature. SMA for EMF revealed three markers on chromosomes 5, 7, and 9 are possibly linked to FOT, while six markers on chromosomes 5, 7, 8, 9, and 11 are possibly linked to PFT, FMCT and FCT. In general, markers on chromosomes 7 and 8 could be linked to QTLs controlling both heat tolerance and EMF at flowering stage in rice. The results could be useful for further fine mapping and marker-aided selection for heat-tolerant and heat escape in rice genotypes in the future.

ORYZA SATIVA; GENETIC MARKERS; GENETIC MAPS; BREEDING METHODS; FLOWERING; HEAT TOLERANCE; HEAT STRESS

Genetic diversity of pigmented rice accessions as revealed by morpho-agronomic characters. **Alfonso, D.O., Castro, J.R., Regalario, S.B., Nombrere, J.M.Z., Caguiat, X.G.I., Ferrer, M.C.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, , Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 9 (Jul-2018).*

The Philippines is endowed with a great diversity of rice germplasm in its territorial land area. Part of these thousands germplasm are pigmented rice that are currently conserved at PhilRice [Philippine Rice Research Institute] Genebank. Pigmented rice accession are known for its great health promoting benefits. Various studies indicated that red and black rice possess better healthy components compared to the common white rice. However, studies on the diversity of these pigmented rice has not been explored. Understanding the population structure and range of diversity in available germplasm is fundamental for varietal improvement

programs. Thus, this study was conducted to characterize selected pigmented rice accessions stored at PhilRice Genebank using the standard descriptors for cultivated rice. Among the 362 pigmented rice accessions assessed, 85% were red, 5% were purple, and 10% were variable purple. Most of the pigmented germplasms have intermediate endosperm. Moreover, Lagage-N has the heaviest grain, Binibe has the most number of filled grains, and Palawenyo has the longest panicle among the rest of the accessions. Generated data from this study will identify the potential germplasm with desirable traits for direct and indirect utilization. Furthermore, this will contribute towards creating genetic database for breeding programs strategies in the region.

ORYZA SATIVA; VARIETIES; GERMPLASM; GENETIC VARIATION; PIGMENTATION; AGRONOMIC CHARACTERS

Genetic fingerprinting of onion (Allium cepa L.) varieties using simple sequence repeat markers. **Almontero, C.C., Espino, R.R.C**. *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 22-32 (Apr 2016)*.

Thirty bulb onion microsatellites were screened for PCR amplification in 20 varieties of bulb onions including 3 shallot and 3 leek varieties. The study tried to establish the DNA profiles of onion varieties grown in the Philippines using microsatellites or simple sequence repeat markers (SSRs), and identify SSR marker applicable for variety identification. All of the screened primers generated a total of 88 alleles with an average of 2.93 alleles per locus. Ten of these primers showed high degree of polymorphism. The number of alleles observed per polymorphic locus ranged 2-6. The PIC value ranged 0.40-0.83. Resulting banding patterns for all of the markers used ranged 2-8 with molecular sizes ranging 75 to 650 bp. Among the polymorphic markers, AMS02 which amplified the highest number of alleles (6), also generated the highest number of banding pattern and exhibited more unique bands at some particular loci that can be used as marker for variety identification. This marker can identify 'Red Hawk', 'Super Creole', 'Superex' and 'ON-10-364'. Marker AMS23 also amplified distinct band for variety 'ON-10-364'. Amplification of the marker AMS05 and AMS15 revealed a distinct band pattern in the genotypes 'Red Express' and 'Yellow Granex', respectively. Primer AMS21 produced specific bands for the variety 'Yellow Granex' and 'Red Hunter'. 'Batanes Jumbo' and 'Red Hunter' can be identified by using the marker AMS08. Profiles of the bands from all the polymorphic markers were used to group the varieties analyzed using UPGMA-SAHN cluster analysis. Cluster analysis showed that onion varieties cluster into two groups at 0.90 similarity level which separated the red onions from white, shallot and leek types. This study provides genetic information that can delineate onion cultivars. Results proved the usefulness of microsatellites in establishing the DNA fingerprints of onion varieties that can be used as reference for future genetic studies such as construction of genetic maps. Identified polymorphic SSR markers also revealed their potential use of rapid identification of onion genotypes.

ALLIUM CEPA; ONIONS; VARIETIES; GENETIC MAPS; GENETIC MARKERS; DNA FINGERPRINTING; POLYMORPHISM; GENES

Genetic variability and multivariate analyses of floral traits related to outcrossing in rice (Oryza sativa L.). **Dela Rosa, D.G.M., Hernandez, J.E., Solis, R.O.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 99-100 (Jul-2018)

A detailed morphological characterization of 16 outcrossing-related floral traits of 70 cultivated rice parental lines was conducted in the screenhouse in Calauan, Laguna [Philippines] in 2016 dry season. The study was

conducted to estimate the genetic parameters that can provide information towards floral trait improvement and to determine the association among the floral traits and among the rice parental lines based on their floral trait profiles. Stigma size (STGS), style length (STYL), total stigma exsertion rate (TSER), single stigma exsertion rate (SSER) and double stigma exsertion rate (DSER) showed high genetic advance as percentage of mean (%GA) coupled with high heritability (H2), which implies that considerable improvement could be achieved in these traits by simple phenotypic selection. Results of phenotypic correlation analysis show that TSER was positively and significantly correlated with stigma + style length (0.67) and spikelet length (0.84). Significant positive correlation (0.96) between pollen count per anther (POLC) and anther length (ANTL) was also obtained. Principal component analysis (PCA) on 10 floral parameters measured on 70 lines resulted in three principal components that accounted for 85% of total data variability. The loading plot showed the distinct aggregation of stamen traits POLC and ANTL as well as the pistil traits STGL, STYL, SPKL, SPKS and TSER. Moreover, the association of lines revealed by the score plot could allow identification and selection of superior rice lines for the parameters of interest.

ORYZA SATIVA; FLOWERS; GENETIC VARIATION; OUTBREEDING; HERITABILITY; SPIKELETS; GYNOECIUM; DRY SEASON

God's crown (Phaleria macrocarpa (Scheff.) Boerl: Thymelaceae): an introduced fruit with pharmaceutical potential in the Philippines. **Magdalita, P.M., San Pascual, A.O., Coronel, R.E.** (Dec 2018)

The God's crown (Phaleria macrocarpa (Scheff.) Boerl) tree also known as Makhota Dewa is a member of the Thymelaceae family. It was introduced from Indonesia by the late Dr. Roberto E. Coronel in 2009. The tree fruited for the first time in 2014. Morphological characterization of the tree, leaf, fruit, seed and seedlings was conducted for 2 yr. A fruiting God's crown tree is 165.5 +- 6.37 cm high with a canopy spread of 156.5 +- 9.19 cm. It produces fruit all year round, but the peak of harvest season occurs in February. The trunk has a diameter of 20.25 ± 0.21 mm. The mature leaves are green, narrow ovate, glabrous with very short petioles. Fruits are globose to heart shape, small sized (21.16 +- 12.04 g), with red (RHCC 46C) and thin peel, white flesh (RHCCN155B) that is dry with mild aroma. It has high flesh portion of 79.56 +- 5.45% and with 1 to 2 small, brown (RHCC 200B) seeds.

THYMELAEACEAE; SPECIES; DRUG PLANTS; MEDICINAL PROPERTIES; CHEMICAL COMPOSITION; FRUITING; FRUITS

Identification of heterotic CMS-based rice hybrids and superior parent lines at the testcross nursery. **Luciano, V.P., Duran, P.L.H., Ablaza, M.S.F., Waing, F.P., Gramaje, L.V., Caguiat, J.D.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, , Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 98 (Jul-2018).*

Evaluating the performance of upcoming parent lines and its hybrids is exceptionally useful in a hybrid rice breeding program and in developing superior varieties. The study was conducted PhilRice CES. Specifically, it aimed to (a) nominate effective CMS and restorer lines, (b) measure the level of heterosis and (c) identify the heterotic hybrids generated. A total of 624 male parents and five known CMS lines were assembled. Single-crossed hybrids were generated from selected parents from different breeding ecosystems such as Tropical japonica (TJ) with 239, 18 Double Haploid lines (DH), 192 Hybrid nursery (HBC), 68 genome wide assisted selection lines (GWAS), 34 Saline (SAL), 2 Direct seeded (DS), 42 heat tolerance (HT), 15 Uniform restorer (RU), 14 irrigated lowland (IL) and five WA-CMS (IR58025A, PR15A, PR15A, PR21A, PR27A and PR19A) as testers.

Hybrids and parents were evaluated for yield and yield related traits along with the inbred and hybrid checks (PSB Rc82, NSIC Rc222, Metiso 19, and Metiso 20). Analysis of variance revealed significant differences between lines, testers, and hybrids. As product of elite restorer and good CMS tester, crossed of IR58025A x TCN-694 got the highest yield of 14.3 t/ha during the 2017 DS. In wet season, cross combinations of PR15A x PR15A x PR40496-55-2-1-4 and PAR19A x PR39500-8-5-49 yielded 6t/ha and 5.5 t/ha respectively. Yield advantage ranged from 4.71% tp 29.43% over the check varieties. For parent lines, 64 restorer and 53 maintainers were nominated. Testcross performance and phenotypic acceptability showed that IR58025A, PR29A and PR15A were identified to be good combiners for dry and PR 19A for wet season. In this study, the use of diverse parental lines from different breeding programs and elite lines from improvement nurseries can contribute to the development of high yielding hybrid and good combiner parents.

ORYZA SATIVA; HYBRIDS; IDENTIFICATION; PROGENY; HETEROSIS; CROP PERFORMANCE

Identification of quantitative trait loci for seedling stage salinity tolerance using NSIC RC222 x Jumbo Jet BC1F2 Population. **Ordonio, J.L., Vergara, G.V., Diaz, Ma.G.Q., Gregorio, G.B., Hernandez, J.E.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 101 (Jul-2018)*.

Salt tolerance is a quantitative trait controlled by multiple genes (QTL) acting together, making it difficult to understand the mechanisms underlying them. The complexity of these traits therefore become a problem in conventional breeding and has been one of the reasons for the breeders' increased interest in molecular breeding methods. The use of modern molecular genetic techniques and powerful statistical methods can provide insights on the genetic basis of such complex traits. By applying the procedure of QTL analysis in a particular population, the genetic control of quantitative traits can be dissected into its component parts. In this study, 184 BC1F2-JJ29-P1 lines derived from the cross between a salt-sensitive high yielding variety (NSIC Rc222) and a local landrace (Jumbo Jet) that shows high salinity tolerance at reproductive stage were grown under normal condition. Leaf samples were collected from the lines and their parents for DNA extraction and infinium SNP chip was used for SNP genotyping. Their genotype was used to correlate with the morphological and physiological traits of the 184 BC1F3-JJ29-P1 lines evaluated at seedling stage under salinized condition with an electrical conductivity (EC) of 12 dS/m. Exactly 194 markers were used to construct the genetic linkage map using inclusive composite interval mapping (ICIM) software version 4.1. The linkage map has a total length of 397.45 cM with an average interval size of 2.05 cM. Only one QTL (qSES1.2) that is associated with salinity evaluation score was identified with an LOD of 3.08 explaining 7.83% of the phenotypic variation under salt stress. It is recommended that fine-mapping of the identified QTL be conducted to help identify closely linked markers for use in marker-assisted backcrossing.

ORYZA SATIVA; VARIETIES; SEEDLINGS; SALT TOLERANCE; GENES; LOCI; IDENTIFICATION; GENETIC MAPS; BREEDING METHODS; GENETIC MARKERS

Improving the bacterial blight resistance of Mestiso hybrid rice through gene pyramiding. **Tabanao, D.A., Unay, J.J., Waing, F.P., Domingo, J.M., Rico, E.P.Jr., Garcia, N.S., Espejo, E.O., Borines L.M**. *Philippine Journal of Crop Science (Philippines) v 38 (3) p.10-17 (Dec 2013)*.

The success of hybrid rice in increasing grain yield is hampered by its susceptibility to bacterial blight, which causes significant reduction in grain yield. This study aimed to determine the presence of introgressed

resistance gene in improved maintainer and restorer parent lines: assess the genetic similarity of the improved parent lines to the original Mestizo 1 and Mestiso 2 parent lines; and evaluate disease resistance, grain quality and agronomic performance of the improved hybrids. With target gene selection 21 backcross lines were confirmed to have 2-3 Xa genes, exhibiting high levels of resistance. Most of these improved maintainer and restorer lines had recovered at least 80% of the recurrent parent genome based on-wide marker assay using simple sequence repeats. Cytoplasmic male-sterile lines were improved through repeated backcrossing to maintainer lines, with target gene selection and pollen sterility evaluation at each cycle. On-station and on-farm yield trials showed that the improved hybrids were disease resistant and comparable to the original hybrids with respect to morpho-agronomic traits and grain physico-chemical properties. The agreement between genotype and phenotype data indicated that resistance genes were successfully incorporated and the genetic background of recurrent parents were sufficiently recovered.

ORYZA SATIVA; RICE; HYBRIDS; GENES; BREEDING METHODS; BLIGHT; PLANT DISEASES; DISEASE RESISTANCE; AGRONOMIC CHARACTERS

Inheritance and heterosis studies of achene yield and related traits in sunflower. **Zia, U.Z., Sadaqat, H.A., Tahir, M.H.N., Sadia, B., Ahmad, S., Ali, I., Nazeer, W., Hussain, A., Bibi, A., Hussain, N., Iqbal, J.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 42-51(Apr 2016).*

This study was carried out to estimate the extent of heterosis and inheritance of different morphological traits in 32 sunflower hybrids developed at the Department of Plant Breeding and Genetics, University of Agriculture Faisalabad from 2010 to 2011. The crosses were developed using North Carolina Mating Design (NCD-1). The experiment was arranged using randomized complete block design (RCBD) in three replications. Plant height, head diameter, 100-achene weight, percent filled achenes and achene yield per plant were recorded in spring and autumn seasons. Non-additive type of gene action was important in the inheritance of plant height, head diameter, 100-achene weight and percent filled achenes while in case of achene yield per plant additive effects were more important. High magnitude of heterosis was observed for all the traits under study. None of the crosses were consistent in heterosis for all the traits. However, for achene yield, the cross combinations G40 x L31 (60.42) and A12 x HBRS-5 (48.02) showed significantly higher values of heterosis over Hysun-33 which is the highest yielding hybrid being used commercially in Pakistan. Majority of the hybrids displayed very low to negative heterosis (H sub t = -13.1 to 9.31 and H sub b = -19.8 to 3.55) for plant height during autumn. Larger heads with bolder seeds and minimum number of unfilled achenes were recorded for majority of hybrids during spring season compared with autumn season.

HELIANTHUS ANNUUS; HYBRIDS; HETEROSIS; SEASONS; YIELDS; AGRONOMIC CHARACTERS; GENETIC INHERITANCE;

Introducing Tiffany, the yellow-fleshed watermelon. **Ancheta, A.V.** *Agriculture (Philippines) v. 23 (07) p. 14; 16 (Jul 2019).*

CITRULLUS LANATUS; WATERMELONS; VARIETIES; AGRONOMIC CHARACTERS; PLANTING; CROP MANAGEMENT; PLANT ESTABLISHMENT; FRUIT; QUALITY

In-vitro selection of pineapple cv. 'Queen' with resistance to culture filtrate of Phytophthora cinnnamomi Rands. **Valencia, L. DC., Pascual, C.B., Delfin E.F.** Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 58-66 (Apr 2014).

Laboratory and growth room studies were conducted to develop a tissue culture medium for pineapple callus induction and in-vitro selection of pineapple cv. 'Queen' with resistance to culture filtrate of Phytopthora cinnamomi Rands. Basal Murashiege and Skoog's (MS) medium supplemented with 10 mg/L 4-amino -3.5, 6-trichloro-2-pyridine carboxylic acid (picloram) was found to be the most effective for callus induction after 4wk of culturing the explant in the medium. High frequency of regeneration of calli into plantlets was observed in MS medium supplemented with 5 muM benzene amino purine (BAP) and 1muM gibberellic acid (GA3). The Phytophthora cinnamomi Rands isolate used in the study was isolated from Phtophthora heart rot infected pineapple from Calauan, Laguna, Philippines. Inoculation of pineapple calli with different concentrations of P. cinnamomi crude filtrate showed that the toxic effects of the crude filtrate on the treated calli decreased with the reduction in filtrate concentration. Calli resistant to P. cinnamomi crude filtrate were selected and regenerated into plantlets after 3 cycles of selection.

PHYTOPHTHORA CINNAMOMI; PINEAPPLES; CALLUS; IN VITRO SELECTION; MERISTEMS; PICLORAM; TISSUE CULTURE; CULTURE MEDIA

Malimama, the miracle of sugarcane observed. **Valdevieso, R.D.** *Agriculture (Philippines) v. 23 (3) p.48-49 (Mar 2019)*.

SACCHARUM OFFICINARUM; VARIETIES; AGRONOMIC CHARACTERS; MEDICINAL PROPERTIES; PROPAGATION MATERIALS

Marker-aided transfer of beta carotene biosynthetic genes (Golden Rice 1) into two Philippine rice varieties. **Alfonso, A.A., Espejo, E.O., Ermita, C.J.D., Ravelo, G.B., Garcia, N.S., Avellanoza, E.S., Somera, J.J.** *Philippine Journal of Crop Science (Philippines) v. 38 (3) p. 1-9 (Dec 2013)*.

'Golden Rice' (GR), a new type of rice that accumulate beta-carotene in the endosperm, could be an additional strategy to alleviate vitamin A deficiency (VAD) in the Philippines and other countries where VAD is prevalent. Through DNA marker-aided backcrossing using rice variety Cocodrie processing Golden Rice 1 Event 309 (GR309) as donor, several introgression lines (ILs) in the background of NSIC Rc128 and PSB Rc 82 were developed. Stable ILs were verified to contain the GR309 locus using an event-specific Polymerase Chain Reaction (PCR) - based marker. Recurrent parent genome (RPG) recovery was evaluated using 98 genome-wide Simple Sequence Repeat (SSR) markers for PSB Rc82 and 103 of such markers for NSIC Rc128. Marker analysis revealed that at least 80% of the genetic constitution of the selected ILs were similar to the recurrent after 2.- backcrosses. Majority of the ILs already resembled their recurrent parent based on 32 agro-morphological traits. Among the ILs, the highest total carotenoid concentration was ar 1.80 mug/g, higher than the 1.62 mug/g observed in the GR donor. Ultimately, nine uniform ILs (4 from PSB Rc82 and 5 from NSIC Rc128 backgrounds) that produce beta-carotene and with high phenotypic acceptability scores were selected. Results are consistent with earlier reports that the combined use of morphological and DNA markers could enhance selection efficiency due to reduction in time, cost and resources in producing the desired breeding lines. This strategy is due to reduction in time, cost and resources in producing the desired breeding lines. This strategy is now being employed in developing lines with higher level of beta-carotene using Golden Rice 2 event R (GR2-R).

ORYZA SATIVA; RICE; VARIETIES; GENOMES; GENETIC MARKERS; RETINOL; VITAMIN DEFICIENCIES; CAROTENOIDS; BACKCROSSING; HYBRIDIZATION; PHILIPPINES

Marker-assisted breeding of abaca (Musa textilis Nee) for the development of high fiber quality and virus resistant cultivars. **Lalusin, A.G., Mendoza, M.R.R., Dizon, T.O., Parducho, M.A.L., Boguero, A.P.B.** *2017 TR-1808*.

Abaca (M. textilis Nee) is one of the strongest natural fibers used worldwide as a raw material in textiles, cordage, and specialty paper industries. Being endemic in the Philippines, abaca provided the country a new international market generating approximately $80 million annually. With the effort to increase the genetic pool of abaca indispensable for breeding, samples were collected from Luzon down to Mindanao totaling 86 accessions. This was 51.7% increase from the 56 accessions in the field. These accessions were evaluated using agronomic and molecular characterization. Comparing the results of the actual tensile strength data, tensile-associated markers and on-site field disease evaluation, AbuabLabo, Natural Tobacco, Lausigon Red and Inilabo have the greatest potential as parents for the hybrids. Since the collected abaca varieties did not mature at the same time only the data on molecular characterization and some agronomic data were gathered. Ditawani No. 2, Tagakan and Lagrada's Farm Wild 1, due to their potentially good characters as exhibited by molecular information, may be promising parents for future abaca breeding programs. As of today, there are 51 hybrids in the field. They were planted last July 2, 2016, during the rainy season. Field planting was delayed due to the lack of rainfall/irrigation and high temperature reaching 35 deg C. The abaca plants would take approximately 19.8 months from planting to maturity, thus agronomic valuation will be done on the first quarter of 2018. However, the hybrids were able to show promise in the molecular analysis. In fact, comparing the results from both the resistance gene specific and tensile associated markers hybrids A1, A5, F1, H1, J (except J2), Q4, Q5, Q10, O2, S and R already showed positive results. The remaining component of the project is the evaluation of the hybrids' tensile strength and resistance to abaca diseases in the field and screen house conditions, which will be done after we have selected the hybrids with good agronomic yield and resistance to abaca bunchy top virus under field condition which is schedules on the first quarter of 2018.

MUSA TEXTILIS; ABACA; VARIETIES; FIBRES; QUALITY; TEXTILES; PULP AND PAPER INDUSTRY; DISEASE RESISTANCE; GENETIC MARKERS; BREEDING METHODS

Molecular characterization and infectivity of the cotton leaf curl virus isolated from gumamela (Hibiscus rosa-sinensis) in the Philippines. **Dolores, L.M., Gonzales, M.C.** *2012 TR-1773*.

Hibiscus rosa-sinensis or gumamela at the Institute of Plant Breeding (IPB) were observed showing typical symptoms of the leaf curl disease like cupping or curling of the leaves, vein enation and clearing, mottling and stunting. Transmission tests were done using indicator hosts to isolate and determine the host range of the putative virus. Leaf cupping, veinenation, mottling and mosaic were observed in Gossypium hirsutum (cotton) and Vigna unguiculata (cowpea) 1 month after inoculation using whiteflies. Thirty four out of the 40 collected gumamela samples showed the expected band of approx 1.5kb after PCR amplification using degenerate primers, thereby confirming the presence of a begomovirus. The isolates were further characterized by sequencing, multiple sequence alignment and phylogenetic analysis. Multiple sequence alignment of the obtained DNA-A fragments revealed 97.0-99.0% similarities among isolates. Furthermore, sequence analysis using other leaf curl virus sequences in the GenBank showed that the begomovirus infecting gumamela in the Philippines was highly identical to the Cotton leaf curl Multan virus with 98% nucleotide similarities. Phylogenetic analysis showed that CLCuV isolates in the Philippines clustered with the CLCuV isolates from the other countries which were also isolated from Hibiscus plants as well as cotton and okra. Furthermore, DNA

betha is detected in CLCuV-infected gumamela plants as well as other genetic components which may be essential factors in disease complexes.

HIBISCUS ROSA SINENSIS; LEAVES; LEAF CURLS; COTTON; PLANT DISEASES; PLANT VIRUSES; PCR; DNA

Molecular markers associated to downy mildew [Peronosclerospora phillippinensis (W. Weston) C.G. Shaw] resistance in sugarcane (Saccharum offcinarum L.) hybrids (CP 57-604 X PHIL 84-77). **Baer, O.T, Lalusin, A.G.** *Philippine Journal of Crop Science (Philippines) v 38 (3) p.37-45 (Dec 2013)*

Downy mildew is one of the major diseases of sugarcane that reduces cane yield. The disease is caused by Peronosclerospora phillippinensis (Weston) C.G. Shaw which is commonly found in the Philippines. This study was conducted to identify molecular (SSR) markers that are linked with downy mildew resistance in a selected population of sugarcane. Hybridization between CP 57-604, a susceptible but high yielding variety and PHIL 84.77 a resistant and moderately high yielding was done. The field experiment was conducted mainly to screen the parents and the 100 progenies for the reaction to downy mildew, and to measure other important morphological characters of sugarcane. The experiment was laid out in a simple lattice design with two replications. The disease responses of the parents, as well as its progenies, were scored based on the rating scale given by International Society of Sugarcane Technologist (ISSCT). Considerable degree of resistance were found in progenies 1,2,4,10, 11, 13, 16, 30, 35, 36, 40, 44, 49, 51, 65, 66, 67, 68, 70, 71, 70, 81, 83 and 95, whereas progenies 53 and 78 were found susceptible. The entries identified as resistant had the highest correlation coefficient of 0.86 between severity and disease response at weeks 5 and 6. The disease reactions of the population were used in marker analysis using 5 SSR sugarcane markers that were previously identified to be associated to downy mildew resistance. Phenotype data and SSR banding profiles of the population were subjected to UPGMA using Nei (1978) unbiased genetic identity to determine the clustering of the disease resistant and susceptible traits. PHIL84-77 and the resistant progenies were clustered in group 1, while CP 57-604 and the susceptible progenies were clustered at group 2. Of the 5 markers for sugarcane and 48 rice microsatellites evaluated, 4 markers for sugarcane and 2 rice microsatellites were polymorphic across the screened genotypes. Sugarcane marker mSSCIR12 generated 5 alleles and found to be highly informative with PIC value of 0.82. Since mSSCIR12 can generate polymorphic bands, this marker can be utilized in mapping sugarcane genotypes for downy mildew resistance. It is also possible to map sugarcane genotypes and germplasm for other traits of interest. Haplotype analysis of 100 progenies of sugarcane developed from the cross between CP 57-604 and PHIL 84-77 was conducted. Genotypes 35 and 51 were found to be resistant to downy mildew based on phenotypic evaluation and haplotype analysis.

SUGARCANE; SACCHARUM OFFICINARUM; GENETIC MARKERS; HYBRIDS; HYBRIDIZATION; PERONOSCLEROSPORA; MILDEWS; DEFENCE MECHANISMS; DISEASE RESISTANCE

Mt. Data [Philippines] radish: P1-M gross from half hectare. **Sarian, Z.B**. *Agriculture (Philippines) v. 23 (3) p.10; 12 (Mar 2019)*.

RAPHANUS SATIVUS; VARIETIES; PLANTING; FARMYARD MANURE; PROFIT; INCOME

Multilocation performance evaluation of a new banana bunchy top virus (BBTV)-resistant lakatan cultivar. **Damasco, O.P., Dela Cueva, F.M., Dolojan, F.M., Gueco, L.S., Descalsota, J.C., Nuñez, J.P.P., Baldo, S.A., Vida, E.D. A.** *2016 TR-1795*.

Banana bunchy top virus (BBTV) is the most destructive virus disease of banana in the Philippines. Incorporation of resistance to BBTV by conventional breeding is not possible due to sterility of most commercial banana cultivars. Using gamma irradiation and in vitro-induced mutagenesis, promising 'Lakatan' mutant lines with intermediate resistance to BBTV and aphid vector (Pentalonia nigronervosa) were selected, evaluated and characterized, and the genetic stability of BBTV resistance confirmed in succeeding generations (PCAARRD-GIA project 1999-2005, 2007-2010). The project 'Multi-Location Performance Evaluation of A New Banana Bunchy Top Virus (BBTV) – Resistant 'Lakatan' Cultivar' (2013-2016) aimed to make 'Lakatan' banana production more profitable to small farmers by reducing losses due to banana bunchy top virus infection by 20% through adoption of disease resistant Lakatan. Prior to commercialization of the five selected improved 'Lakatan' mutant lines, the agronomic, yield, and economic performance, and the variability of host (mutant lines) reaction to BBTV isolates/strains were assessed in several locations across the country. The disease reaction o f 'single' mutant line and 'bulk' or composite of the five mutant lines were assessed to determine the best planning strategy for sustainable BBTV control and management. Promotion and dissemination of the 'Lakatan' mutant lines through farmers' demonstration trials, farmers' field days, trainings and seminars were conducted for increased awareness, wider acceptance and utilization of the improved 'Lakatan' mutant line varieties. The five selected BBTV resistant Lakatan mutant lines (ML 13-20-2, 28-30-2, 22-28-2,9-28-2, 9-28-3) were evaluated in replicated multilocation trials in five Lakatan growing areas in Region 4 (Laguna, Batangas, Cavite), Region 2 (Quirino) and Region 11 (Davao City). The mutant lines were likewise evaluated in several farmers' field using farmers' practices. Variations in agronomic characteristics and yield parameters of Lakatan mutant lines and control were observed across the different sites. Bunch yield of mutant lines across locations ranged from 9.2 to 16 k/bunch in Region 4, and 17.7 to 20.3 kg/bunch in Region 11. The control Lakatan had a mean yield 10.9 to 17.9 kg/bunch. In trial most sites, BBTV resistant improved Lakatan had higher mean bunch yield compared with the control Lakatan and the highest mean yield performance was observed in Davao City. Under farmers' field, bunch yield range from 10 to 18 kg/bunch. The BBTD incidence from planting up to the first harvest of mutant lines across locations ranged from 1.36% to 33.3% while control Lakatan had 17 to 50% incidence. In all trial sites mutant lines had lower disease incidence than Lakatan control. The highest BBTD incidence was observed in Cavite province which is a known hotspot for BBTV. The spread of BBTD was likewise slower in BBTV resistant mutant lines compared to the ordinary control Lakatan. To study the variability of disease, BBTV-infected plant samples were collected from nine provinces all over the country.

MUSA (BANANAS); VARIETIES; DNA; GENES; EVALUATION; AGRONOMIC CHARACTERS; YIELDS; NUCLEOTIDE SEQUENCE; GENOMES; BANANA BUNCHY TOP VIRUS; GENETIC STABILITY; DISEASE CONTROL; CROP PERFORMANCE; DISEASE RESISTANCE; MUTANTS; BREEDING METHODS; MORBIDITY

Mutant papaya has long fruit with small cavity, sweet and juicy. **Sarian, Z.B.** Agriculture *(Philippines) v. 23 (06) p. 60-61 (Jun 2019).*

CARICA PAPAYA; MUTANTS; TRANSGENIC PLANTS; FRUIT; QUALITY; SEEDS

National Scientists [Benito Vergara] named a camote after me [Zoc B. Sarian]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (4) p. 32 (Apr 2019)* .

IPOMOEA BATATAS; SWEET POTATOES; VARIETIES; LEAVES; SCIENTISTS; FOODS

Oldest Thai seed company is newest player in the Ph [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (07) p. 18-20 (Jul 2019).*

VEGETABLE CROPS; HYBRIDS; SEED; FIELD EXPERIMENTATION; CROP PERFORMANCE; CROPS; AGRONOMIC CHARACTERS

Phenotypic and molecular characterization of tungro resistant introgression lines derived from the cross Oryza sativa L. x Oryza rufipogon GRIFF. Bandillo**, N.B., Carpena, A.L., Ramos, J.M., Brar, D.S**. Philippine Journal of Crop Science (Philippines) v.39 (1) p.1-10 (Apr 2014).

Eight out of 20 alien introgression lines (AILS) including the Philippine National Seed Industry Council recommended rice variety Matatag 9, from crosses of rice variety IR64 with five accessions of Oryza rufipogon, were found resistant to tungro infection under field conditions. Subsequent enzyme-linked immunosorbent assay (ELISA) showed that two of these visually-observed resistant AILs were resistant. (up to 30% infection to both rice tungro spherical virus (RTSV) and rice tungro bacilliform virus (RTBV), causing the rice tungro disease. Introgressions in the AILs was analyzed using 142 simple sequence repeats (SSR) markets which showed 73-80 (51-56%) polymorphism between IR64 and five accessions of O. rufipogon. Introgressions from O. rufipogon based on these markers ranged 4-16%. IR84680-74-B-B-B observed to be resistant in the field and by ELISA showed 5% (4/79 markers) introgressions from O. rufipogon only on chromosome 3. Matatag 9 showed 9% (7/78 markers) introgressions from its O. rufipogon parent which were distributed on chromosomes 1, 3, 7 and 12. The markers identified in resistant lines may potentially tag novel quantitative trait loci (QTL) for resistance to rice tungro disease (RTD) which could be of great value for further elucidation of the molecular genetic control of traits investigated. These markers can be further validated in a mapping population and can be used for fine mapping QTLs, and eventually use in MAS to accelerate breeding tungro tolerant varieties.

ORYZA RUFIPOGON; ORYZA SATIVA; RICE; GENETIC MARKERS; VARIETIES; TUNGRO DISEASE; RICE TUNGRO VIRUS; DISEASE RESISTANCE; INTROGRESSION

Phenotypic variation of traditional rice (Oryza sativa L.) varieties in Bicol Region, Philippines. **Ferrer, M.C., Duldulao, M.D., Alfonso, D.O., Castro, J.R., Nombrere, J.M.Z., Niones, J.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 100-101 (Jul-2018)*.

Traditional cultivars are important for sustainable crop production and provide source of important traits in breeding rice varieties that are high yielding, good grain quality and resistant to biotic and abiotic stresses. In Bicol region, there is a need to protect and characterize these landraces to avoid its possible extinction especially in areas with high risk of volcanic activity. This endeavor ensures the availability of traditional cultivars and its agronomic profile to be used in continuous breeding efforts in future generations. In this study, 86 traditional cultivars collected from Bicol were characterized using 58 morphological traits following the standard descriptors list for cultivated rice. The overall phenotypic diversity based on Shannon-Weaver diversity indices showed a medium level of phenotypic variation among the germplasm. The rice collections that exhibited longest panicle (32 cm) are PINO and DOS OHOY. While collections MARAGADAW, PALAGADAN, SABLAY, AZUCENA, MILAGROSANG PUTI, and KALANAY produced the heaviest grain (30g) among the cultivars studied. Several traditional rice germplasm collections have desirable attributes and should be further explored for direct utilization of these germplasm for varietal improvement programs.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; GERMPLASM COLLECTIONS; GERMPLASM CONSERVATION; PHENOTYPES; PHILIPPINES

Plant variety protection-newly registered PhilRice [Philippine Rice Inst.] inbred rice genotypes for irrigated lowland. **Manigbas, N.L., Lambio, L.A.F., Barroga, W.V., Orcino, J.A., Padolina, T.F.** *Philippine Journal of Crop Science (Philippines) v 38 (3) p.31-36 (Dec 2013)*.

Five PhilRice-bred rice genotypes were approved by the Bureau of Plant Industry-Plant Variety Protection Office in December 2012. These genotypes were selected after it underwent DUS (distinct, uniform, stable) test in 2012 at the Philippine Rice Research Institute Central Experiment Station. PR32220 was derived from IR69800-5-3-1-1/LRJ-5-5 cross. It matures in 117 days, 106 cm in height and with an average of 11 tillers per plant. The yield was 8.2/ha in DS and 4.8 t/ha in WS. PR35766 was derived from PSB Rc14/PR31561-AR32-11-63-3 cross. It matures in 11 days, 103 cm in height and with an average of 14 tillers per plant. The yield was 7.4 t/ha in DS and 4.6 t/ha during WS. PR37273 was derived from PSB Rc96/ AR32-19-3-3 cross. It is semi-dwarf at 105 cm, with medium-tillering in 14 tillers per plant, and matures in 110 days. In 2012, the yield was 6.4 t/ha during DS and 5.0 t/ha in the WS. It has a premium total milled rice yield of 71.9% which is comparable to the check PSB Rc18. PR37598 was derived from C754WH-12-2-1/JASMINE cross. It matures in 112 days, has intermediate plant height of 113 cm, which medium-billering of 12 tillers per plant. The yield was 7.7 t/ha in the DS and 4.1 t/ha in WS. It has low amylose content of 18.0% making it generally soft and sticky when cooked. PR 39728 was derived from MX-B-27/NSIC Rc144 WT cross. It matures in 108 days, has intermediate height at 120 cm and with medium-tillering of 10 tillers per plant. The yield was 9.0 t ha-1 during DS and 4.4 t/ha in WS. It has very good brown rice yield which is significantly superior to the 2 check varieties with premium grade classification of 79.5%.

ORYZA SATIVA; RICE; VARIETIES; GENOTYPES; SELECTION; PLANT PROTECTION; IRRIGATED LAND; CROP YIELD

PR4662A - a newly developed female parent through CMS conversion for hybrid rice development. **Duran, P.L.H., Luciano, V.P., Ablaza, M.S.F., Gramaje, L.V., Caguiat, J.D.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 100 (Jul-2018)*.

Commercial exploitation of heterosis for hybrid rice technology would not be possible without sterility mechanism. In the Philippines, three-line system (CMS-based hybrids) is the most widely used by both public breeding institution and private companies because of its stability to varying environmental condition at the stage of F1 seed production. Male sterility in this study, the development of PR4662A, a newly-bred CMS line studied in detail for consideration in the hybrid rice breeding pool. The study was conducted at the experimental area of the Plant Breeding and Biotechnology Division of the Philippine Rice Research Institute. CMS conversion was started by selecting 35 elite maintainer (B) lines with trait of interest along with the four identified female parents (A). Hill to hill crossing was conducted to obtain the F1 seeds and series of backcrosses were followed up to six backcross generations (BC1F1 - BC6F1). Selection criteria for every backcross generation was based on the target trait from the recurrent parent, complete sterility, stability (microscope and phenotypic evaluation) and uniformity following the schematic conventional backcrossing, F! has 50% of its genome from male and 50% of unrelated genome from the female parent. BC1F1 generation has 75% recovery genome from male or recurrent parent (RP), BC2F1 has 87.5% from RP, 93.75% recovery genome for both BC3F1 and BC4F1 while 98.44% on BC5F1. Complete recovery of the recurrent parent is achieved of BC6F1. By thorough evaluation and initial testcrosses results, PR46622A can be nominated to be one of the upcoming female parents to develop superior hybrid.

ORYZA SATIVA; HYBRIDS; HETEROSIS; CYTOPLASMIC MALE STERILITY; SELECTION; BACKCROSSING

Production and characterization of gamma ray-induced rice mutants with broad-spectrum resistance to the bacterial blight pathogen Xanthomonas oryzae pv. oryzae. **Alfonso, A.A., Avellanoza, E.S., Miranda, R.T., Espejo, E.O., Garcia, N.S**.

An initial bulk M sub 2 population produced through gamma irradiation of mature seeds of rice variety NSIC Rc144 was subjected to a series of induced mass screening for potentially novel resistance to bacterial blight, one of the most serious diseases of rice. Lines initially found to be highly resistant to race 3 of the pathogen Xanthomonas oryzae pv. Oryzae (Xoo) were further evaluated in the same manner using other Xoo races. Selection and generation advance ultimately led to identification of two highly resistant M sub 7 lines. DNA fingerprinting using 63 genome-wide SSR markers revealed 100% similar banding patterns in the two mutant lines, indicating that these are sister lines whose origin can be traced to a single M sub 2 plant. DNA fingerprinting also revealed 98% similarity of the mutant lines with NSIC Rc144 indicating that the resistance is due to mutation and not due to genetic admixture or seed impurity. These lines were advanced and further evaluated using 14 isolates representing the 10 races of Xoo found in the Philippines. Two seasons of induced screening revealed an identical reaction pattern in these lines across a wide range of Xoo races. Such pattern is unique compared to known patterns elicited by four other Xoo-resistant isolines, suggesting possible novel resistance. F sub 2 segregation data on reaction to bacterial blight suggest a single-gene recessive mutation in these lines (p=0.4 for 3:1 test of fitness). These mutants are now being used as resistance donors in the breeding program while further molecular characterization is being pursued.

ORYZA SATIVA; VARIETIES; XANTHOMONAS ORYZAE; GAMMA IRRADIATION; BLIGHT; PATHOGENS; PEST RESISTANCE; INDUCED MUTATION; MUTANTS BREEDING METHODS

Quadro ALas rice hybrid can be planted 3 times a year. **Anon.** *Agriculture (Philippines) v. 23 (1) p.42 (Mar 2019)*.

ORYZA SATIVA; HYBRIDS; PLANTING; AGRONOMIC CHARACTERS; DISEASE RESISTANCE

Red Dragon onion yields high in Sariaya, Quezon [Philippines]. **Anon**. *Agriculture (Philippines) v. 23 (06) p. 37 (Jun 2019)*.

ALLIUM CEPA; ONIONS; HIGH YIELDING VARIETIES; CROP MANAGEMENT; BULBS; QUALITY; STORAGE; PHILIPPINES

Region-specific rice varieties: next-gen releases. **Padolina, T.F., Canilang, P.A.C., Manangkil, O.F., Braceros, R.C., Pamplona, A.M., Argayoso, M.A.C., Cappleman, L.D.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 110 (Jul-2018)*.

The participatory varietal selection (PVS) is conducted across the country with the 16 RFOs in both DS and WS to test newly-released varieties, fine-tune new technologies, and determine the variety suited for a specific region. Simultaneously, PVS-RM (research managed) trial sites conduct field days with varietal selection (preference analysis) and sensory evaluation of PVS entries. Yield stability, pest and disease resistance, and grain quality were the main criteria used for varietal competitiveness. Through the PVS, NextGen

recommended varieties according to the results of the National Cooperative Tests for rice (NCT), farmers' preference (from regional coordinators' reports), value chain analysis project, and the rice seed system workshop output. The most adapted irrigated inbred varieties across regions are: PSB Rc10, Rc18, Rc82, NSIC Rc158, Rc218, Rc224, Rc226, Rc298, Rc302, Rc308, Rc352, Rc354, Rc356, Rc358, Rc360, Rc394, Rc400 and Rc402 with an average yield range of 5.0-6.2 tha-1 for transplanted and 5.1-5.5 t/ha for transplanted and 8.0-14.0 t/ha when direct seeded. Registered seeds of the 3-5 most preferred and adapted varieties in the PVS are provided to accredited seeds produced are supervised by the Bureau of Plant Industry's National Seed Quality Control Services (NSQCS), and are available for the farmers.

ORYZA SATIVA; RICE; VARIETIES; SELECTION; TESTING; SEED PRODUCTION; DIFFUSION OF INFORMATION

Rehabilitation of abaca plantations through adoption of high yielding and virus resistant abaca hybrids. **Lalusin, A.G., Dizon, T.O., del Rosario, E.E., Pateña, L.F., Aspuria, E., Cedo, Ma.L.O., Quilloy, R.B., Lee, R.G., Rama, R.A.B., Tulin, E.E., Gapasin, R.M., Sales, E.K., Estrella, M.N., Santos, N., Parac, E.P., Salang, E.D., Fernandez, A.M.** *2015 TR-1735*.

ABACA; HIGH YIELDING BREEDS; PLANTATIONS; DISEASE RESISTANCE; CULTURE TECHNIQUES; PESTICIDE RESISTANCE

Role of morphological traits and biochemical contents in imparting resistance against Cucumber mosaic virus and Zucchini yellow mosaic virus in cucumber genotypes. Mozamil Mozamil, Muhammad Azam Khan, Muhammad Ashfaq, Mali Al Saba Shah. Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 75-81 (Mar 2019).

Cucumber, a popular vegetable of the Cucurbitaceae family, is cultivated on a large scale all over the world including Pakistan. In the present study, the role of morphological traits and biochemical factors of six cucumber genotypes (Shaheen, Beit Apha, Songroo, Best Pick, All Season and Alpha Prime) were investigated in imparting resistance and susceptibility against Cucumber mosaic virus (CVM) and Zucchini yellow mosaic virus (ZYMV). Different vegetative parameters showed different trends among the diseased and healthy plants for resistant and susceptible varieties. Total number of leaves, flowers and shoots per plant, leaf area (cm2), stem diameter (mm), total chlorophyll contents and total soluble phenols were reduced in inoculated plants of both susceptible and resistant genotypes. In resistant varieties, however, this decrease was less compared with the decrease in the inoculated plants of the susceptible varieties. The results suggest that breeders should prefer the use of a resistant variety (Beit Alpha) in the development of new resistant cucumber varieties that can perform better against CMV and ZYMV infections.

CUCUMBERS; CUCUMBER MOSAIC CUCUMOVIRUS; ZUCCHINI YELLOW MOSAIC POTYVIRUS; PHENOLIC COMPOUNDS; CHLOROPHYLLS; NUCLEIC ACIDS; DISEASE CONTROL; DISEASE RESISTANCE; GENOTYPES; AGRONOMIC CHARACTERS

Selection of cassava (Manihot esculenta Crantz) parental lines for the development of varieties with high yield and resistant to major diseases. **Lalusin, A.G., Boguero, A.P.B., Abustan, M.A.M., Mendoza, M.R.R., Mendoza, M.R.R.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 81-93 (Aug 2018).*

Cassava (Manihot esculenta Crantz) is a top crop commodity in developing countries. It ranks 3rd as the most important food crop next to rice and corn. There is wide diversity and distinctiveness among the heterozygous plants that can contribute to the upgrading of genetic resources for cassava varietal improvement programs. A

total of 276 cassava accessions were collected from different provinces in the Philippines. These collected accessions were evaluated and characterized using morphological characters and molecular markers. An average of 0.76 Shannon-Weaver index obtained from the morphological data showed that the accessions are highly diverse. Molecular markers, on the other hand were used to screen the diversity of the collected accessions. At 0.48 similarity index, a total of 7 clusters were generated using the binary data from the SSR primers. Accessions that grouped in cluster 6 showed the highest average yield of 22.2 t/ha. Some of these markers can also be applied directly in the cassava breeding program since they are gene-specific markers for interesting traits. Gene-specific primers were also used to screen for CMV resistance, early bulking and cyanogenic potential. Based on the markers and yield parameters, 45 promising accessions were selected and 39 out the 45 showed resistance to CMD. These accessions also did not exhibit any symptoms, unlike the accessions planted in the border. Using the early bulking markers, 34 accessions showed positive results. However, only 5 accessions were able to exhibit positive results on the markers for a cyanogenic potential, which means that majority of the accessions are edible or with low cyanide. Unfortunately, markers for CaWB were not able to identify potentially resistant members of the collection. After determining the yield of the accessions, a total of 45 elite accessions were selected with high yield, high starch content, as well as CMV resistance, and early bulking traits. The selected superior lines would undergo hybridization to produce promising lines that can be released in the future as a commercial variety.

MANIHOT ESCULENTA; HIGH YIELDING VARIETIES; GENETIC MARKERS; DISEASE RESISTANCE; GENES; AGRONOMIC CHARACTERS; SELECTION

Seminal root elongation response of Philippine rice cultivars to different NH4+ concentrations. **Banting, M.D.M., Estrada, S.B., Castillo, M.P.B., Manangkil, J.M., Obara, M., Niones, J.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 108 (Jul-2018)*.

Plant roots are important organs for water and nutrient uptake from the surrounding soil. Crop breeders consider that an active root systems contributes to enhanced nutrient uptake and an important breeding target for producing higher yields. Thus, this study aimed to determine potential donor parents of root system development traits by measuring seminal root length of genotypes grown in hydroponic culture as an indicator of genetic variation. Eighty eight Philippine released and 1,247 traditional rice varieties were established and Ammonium (NH4+) served as a single source of nitrogen, with 5 muM NH4+ as stress, while 500 muM NH4+ as non-stress condition. Significant differences in the mean values of seminal root length were observed for both released and traditional varieties across NH4+ concentrations. Under stress condition, forty-seven genotypes were determined as elongating roots with seminal root length that were 2% to 42% longer than of the check-Kasalath. These genotypes may be utilized and further evaluated for root traits discovery and breeding efforts for the development of new varieties.

ORYZA SATIVA; VARIETIES; ROOT SYSTEMS; HYDROPONICS; ROOTS; LENGTH; ROOTING; NUTRIENT UPTAKE

Sequence analysis of nuclear inclusion b gene of Papaya ringspot virus isolates from Luzon, Philippines. **Belen, G.B., Sta. Cruz, F.C., Diaz, M.G.Q.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 1-11 (Apr 2016)*.

The sequences of the nuclear inclusion b (Nlb) gene of Papaya ringspot virus (PRSV) isolates from six provinces in Luzon, Philippines, were analyzed to determine the size and cleavage sites of the gene, and the sequence

similarity of the virus isolates and their phylogenetic relationship. Nucleotide and deduced amino acid sequences of the Nlb gene were compared among the PRSV isolates from Albay, Bulacan, Cavite, Marinduque, Isabela and Laguna; and with those published PRSV sequences from the National Center for Biotechnology Information (NCBI) GenBank. Amino acid residues of the Nlb gene of PRSV isolates from Albay, Bulacan, Cavite and Marinduque were cleaved at specific sites following the V(Q-S) rule at the NIa/Nlb junction, and a new V(E-L) motif was observed at NIb/CP junction, giving a predicted size of 1551 nucleotides with coding capacity of 517 amino acid residues. Correspondingly, the PRSV Isabela and PRSV Laguna had 1526 and 1527 bases, which represent the partial size of Nlb gene of these isolates. The known consensus sequences YCDADGS, GNNSGQPSTVVDNT(S)LMV, and NGDDL-X34-K which are implicated for the putative RNA polymerase function of potyviruses were conserved in the Nlb gene sequences of all PRSV isolates. Nucleotide sequence identities of the full-length Nlb gene of PRSV isolates from Albay, Bulacan, Cavite and Marinduque ranging 95.5-96.6% were very close to isolates from Vietnam (94-95%) but relatively differed with those of PRSV from China, Taiwan, Mexico, India and Thailand (82-89%). Likewise, the full-length Nlb gene of Philippine PRSV isolates had amino acid sequence identities of 97.3-98.5%. Phylogenetic analysis of PRSV utilizing the Nlb gene showed that all six PRSV Philippine isolates were clearly separated from isolates in South and Southeast Asia except those from Vietnam.

CARICA PAPAYA; PAPAYAS; PLANT VIRUSES; GENES; PHYLOGENY; DISEASE CONTROL; NUCLEOTIDE SEQUENCE; PHILIPPINES

Sequential path analysis for determination of relationships between yield-related characters and yield and amylase content in rice. **Sharifi, P**. *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 73-79 (Dec 2018)*.

The present study was conducted to determine the cause and effect of grain yield and yield components in 65 rice genotypes. The rice genotypes included four local landraces (Hashemi, Tarom, Alikazemi and San gjo), four released cultivars with high yield (Khazar, Fajr, HP and Sephidrod) and their 57 derived mutant lines (M5). The genotypes were grown during the spring of 2013-2014 growing season at the experimental farm of Rice Research Institute of Iran (RRII) in Rasht. Grain yield (GY) was positively correlated with plant height (PH), number of panicle per plant (NPP), panicle length (PL), number of spikelet per panicle (SNP), number of filled grains per panicle (FG), 100-grain weight (HGW), amylose content (AC) and gelatinization temperature (GT). The positive and significant correlation coefficients were obtained between amylose content and GY, PW, SNP and GL. Sequential path analysis showed that NPP and PW as the first-order variables accounted 23% of GY variation. The path analysis indicated that there is no common causal factor that directly influences both grain yield and amylose content. The direct effect of spikelets number per panicle was positive on amylose content. Predictor variables containing NPP and PW (as the first-order variables), FG, SNP and PH (as the second-order variables) and GL (as the third-order variables) had positive effects on grain yield and enhanced this predictor variable. Consequently, improvement of these traits can increase potential grain yield. The negative effect of plant height (as the third-order variables) was observed on grain yield. The use of dwarf and semi-dwarf varieties can increase total grain yield.

ORYZA SATIVA; RICE; GENOTYPES; YIELDS; YIELD COMPONENTS; AMYLOSE; MUTATION

Stability of selected rice genotypes under high temperature condition in Cagayan [Philippines]. **Madrid, L.B., Manigbas, N.L., Tapic, R.T.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings;

Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine *Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 107 (Jul-2018)*.

Cagayan [Philippines] is one of the highest rice producers and also one of the hottest areas in the Philippines. Existing rice varieties have no known tolerance to heat stress, but still being planted by farmers in Cagayan due to their good performance. To determine the stability and adaptability under high temperature condition, these varieties together with two new heat-tolerant elite lines were planted in four municipalities of Cagayan. Based on AMMI analysis, variance due to genotype, environment and GEI were significant (P0.05). Environment contributed the greatest proportion which was 43.1% of the total variance, while genotype contributed 35.5%, and GEI 21.5%. Results also showed that the highest yielding genotype across environment was PR40330-42-7-12-1. Highest genotype for each location varied. In Iguig, the highest was PR40330-42-7-12-1, in Peñablanca and Solana, NSIC Rc218, and in Tuguegarao, NSIC Rc240. The highest yielding environment was Peñablanca. In terms of stability, NSIC Rc152 was the most stable followed by PR42026-34-1-33.2. Yield stability index was also computed and revealed NSIC Rc152 as the most desirable genotype followed by PR40330-42-7-12-1. Panicle and canopy temperature varied significantly across genotypes which range from 4.9-10.8 deg C. The significant differences between genotypes could be attributed to ability of genotypes to transpire and cool the canopy in response to high air temperature. This could be their way to adapt to high temperature condition.

ORYZA SATIVA; GENOTYPES; ADAPTABILITY; TEMPERATURE; HEAT TOLERANCE; PHILIPPINES

Tale of a red jackfruit that turned out dark orange. **Anon**. Agriculture *(Philippines). v. 23 (07) p. 36-37 (Jul 2019)*.

ARTOCARPUS HETEROPHYLLUS; VARIETIES; FRUIT; SEED; SEEDLINGS; COLOUR

Tanglaw' and 'Tanyag' - new NSIC - approved UPLB [University of the Philippines Los Baños Laguna] eggplant (Solanum melongena L.) hybrids for commercial cultivation in Luzon [Philippines]. **Hautea, D.M., Quilloy, R.B., Taylo, L.D., Narciso, J.O., Mostoles, M.D.J., Navasero, M.V., Hautea, R.A**. Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 58-66 (Apr 2014).

Two new eggplant F1 hybrid varieties named 'Tanglaw' (NSIC 2013 Eg03H) and 'Tanyag' (NSIC 2013 Eg02H) developed by Crop Science Cluster - Institute of Plant Breeding, University of the Philippines, Los Baños were approved for commercial cultivation in Luzon by the National Seed Industry Council (NSIC) on October 18, 2013. These eggplant F. hybrids were evaluated under the national Cooperative Testing for Vegetable during CY 2012-2013. 'Tanglaw' and 'Tanyag' equalled and surpassed during the WS and DS, respectively, the marketable yield potential of the commercial hybrid check, Morena. The two new hybrids possess purple, elongated and medium-length fruits (19 cm.), flower 2-3 days earlier and have more fruits per kg than the check. The field reactions against sucking arthropod pests were resistant to moderately resistant. The availability of comparable eggplant F1 hybrids from hybrids from the public sector could provide eggplant farmers in Luzon a wide selection of good seeds at more affordable prices.

SOLANUM MELONGENA; AUBERGINES; EVALUATION; HYBRIDS; CULTIVATION; PEST RESISTANCE

Ten years of genetically modified crop regulation in the Philippines. **Halos, S.C., Soriano, T.** *Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 41-51 (Apr 2014).*

The Philippines established the final phases of a regulatory system for genetically modified (GM) crops in 2002 that provided access by small corn farmers to the GM crop technology. This paper describes the system, management and processes of Philippine GM crop regulation in relation to features of transparency, predictability, science-based decision, manageability and adaptability. It presents the problems encountered and solutions adopted. Information and data were gathered from the Bureau of Plant Industry (BPI), the Office of Policy and Planning, Department of Agriculture (DA), Biotechnology Coalition of the Philippines (BCP), and relevant websites. In 10 years, there were 2 changes in national leadership, 4 Philippines Congresses, 5 changes of department leadership, 5 changes in leadership at the BPI and various changes in local government leaderships with local elections occurring every year. Demands to ban genetically modified organisms (GMOs) and field trials or reverse decisions are made now and then. and two court cases have also been brought against the system. Nevertheless, with minimum resources, the GM crop regulatory system has stabilized due to clear implementable policies brought about by a close working relationship between policy making and implementation, support from affected sectors, the continuity in office of key individuals in the system, science-based decisions and manageability. The policies and practices ensure transparency and predictability. policy making is responsible to issues that arise during implementation and to trade issues. In policy and in practice, the system is participatory and socio-culturally sound. Compared with the additional income earned by Filipino GM corn farmers, government investments in establishing and maintaining the regulatory system is minimal and worth the investment.

CROPS; ZEA MAYS; GENETICALLY MODIFIED FOODS; REGULATIONS; POLICIES; GOVERNMENT; PHILIPPINES

Three happy sweet corn farmers. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (06) p. 36-37 (Jun 2019)*.

ZEA MAYS; MAIZE; VARIETIES; CROP YIELD; AGRONOMIC CHARACTERS; FARMERS; INCOME; PROFIT

Transient expression of red fluorescent protein gene from Discosoma sp. in calli and immature embryos of different maize (Zea mays L.) genotypes. **Opiasa, R.D., Damasco, O.P., Laude, T.P., Laurena, A.C., Laude, R.P**. Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 10-20 (Dec 2018)

To demonstrate the feasibility of the transformation and expression of a foreign gene, transient expression of red fluorescent protein (RFP) gene, DsRed2, was investigated in maize embryogenic calli and 5-d old pre-cultured maize embryos using Particle Inflow Gun technology. The study involved two phases - (1) looking into the response of maize genotypes to culture media and subculture cycles and (2) determination of the optimal bombardment parameters affecting the efficiency of the transient expression of RFP gene. Ten maize genotypes were used to test for their response to induction of callus using two kinds of media, NC6 Dicamba (NC6DIC), a synthetic auxin and silver nitrate. Embryogenic calli were seen in cultures grown in NC6DIC with silver nitrate and best observed in the third subculture cycle. Out of 10 genotypes used, five responded favorably to NC6DIC with silver nitrate, namely; IPB Pi17, CML 161, IPB Var 4, CML 482 and IPB P51. Using nested RCBD, results showed that the production of calli is dependent on genotypes, media and/or subculture cycles. Previously incubated embryogenic calli and pre-cultured embryos were subjected to bombardment. The bombardment phase followed the 4-hr and 16-hr post-bombardment incubation in an osmoticum containing NC6 medium supplemented with 0.2 M mannitol and 0.2 M sorbitol and the gene construct coated with 0.7mum tungsten microparticles. The percent RFP transient expression (%TE) in both bombarded pre-cultured embryos and calli observed after 24 hr was highest in genotype IPB P51 at 400kPA. At acceleration pressure of 800kPA, %TE in IPB 51 was relatively lower than that of IPB Var 4 which exhibited the highest %TE

of 70%. The number of fluorescent loci was not significantly different in embryos and maize calli bombarded at 400 and 800 kPA at 10 cm and at 25' Hg vacuum pressure. The results of the study are of potential use in stable transformation in the future.

ZEA MAYS; MAIZE; GENES; GENOTYPES; CALLUS; PROTEINS; EMBRYO CULTURE; GENE EXPRESSION; GENETIC TRANSFORMATION; CULTURE MEDIA

Understanding lodging resistant traits from diverse sugarcane lines. **Jongrungklang, N., Maneerattanarungroj, P., Jogloy , S., Songsri, P., Jaisil, P**. Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 71-80 (Aug 2018).

Lodging decreases sugarcane productivity due to a reduction in biomass production and cane quality. One strategy to overcome this problem is to breed for lodging resistant lines. This implies that the lodging resistant traits in sugarcane are first identified. Therefore, the objective of this study was to identify lodging resistant traits in diverse sugarcane lines and their relationship with lodging. Eight diverse sugarcane lines were planted from January 2012 to January 2013 at the experimental farm of Mitr Phuwiang Sugar Mill, Thailand. The plants were arranged in randomized complete block design with four replications. After 12 months, canes in each plot were measured for lodging, stalk height, stalk diameter, leaf and stalk weight, root length density (RLD), root length density percentage (% RLD), and root anatomy. High stalk dry weight is a key factor that induces lodging in cane. Lodging resistant cultivars showed low stalk heights (248.2-263.7 cm) and stalk dry weights (4,884.6-5,482.8 g -sqm) as well as a good partition of the root in the upper soil layer, providing a strong root structure. The appropriate balance between shoot and root part is possibly contributing to low lodging incidences and maintains high yield. Therefore, breeding programs should focus on the selection of cultivars with large root systems in the upper soil layer to provide strong support to the aerial part.

SUGARCANE; VARIETIES; BREEDING METHODS; QUALITY; LENGTH; ROOTS; BIOMASS; LODGING RESISTANCE; AGRONOMIC CHARACTERS

Utilization of simple sequence repeats markers in the genetic characterization of Philippine rubber, Hevea brasiliensis (Wild. ex A. Juss) Muell. Arg., germplasm. **Cantila, A.Y., Espino, R.R.C., Sales, E.K.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 33-39 (Dec 2015)*.

Simple Sequence Repeats (SSRs) were utilized to genetically characterize rubber genotypes among 86 clones of rubber germplasm in the Philippines. Twenty-two out of 40 screened SSR primers were found to be informative with a mean of 99.09% polymorphic rate. These primers generated 119 brands with a mean of 5.41 bands per primer in a corresponding range of 100 to 491 base pairs (bp). From 119 alleles, 118 were polymorphic and 76.4 were effective. The resolving power of molecular markers measured as Polymorphism Information Content (PIC) had a mean value of 0.65. SSRs had detected a broad genetic base of 0.30 in Unweighted Pair Group Method with Arithmetic Mean (UPGMA) indicated by Jaccard's similarity coefficient. On the other hand, five ideal groups were computed by Ad hoc statistics for Bayesian grouping as determined using the Structure 2.3.4 program with high replications and iterations of Markov Chain Monte Carlo (MCMC) and admixture model/correlated allele frequencies, respectively. SSRs have provided efficient, reliable and useful derivation of allelic variations, polymorphism information and genetic similarities. The derived ideal groups showed potential use in the decision-making process as to what clones are to be bred.

HEVEA BRASILIENSIS; RUBBER; SPECIES; CLONING; POLYMORPHISM; GENETIC MARKERS; GERMPLASM; GENOTYPES; PHILIPPINES

Yield evaluation of IPB Var 6 half-sib families towards improvement for water stress tolerance. **Ocampo, E.T.M., Sanchez, Ma.A.B., Heredia, M.C.C., Adorada, P.J.R., Beltran, A.K.M**. 8. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 99 (Jul-2018).*

IPB Var 6 is a white quality maize protein open-pollinated variety that can be processed to corn grits that are highly acceptable for food. However, this variety is low yielding under water stress conditions thus population improvement through recurrent selection can be done to improve this variety. Eighty half-sib families from improved IPB Var 6 (Cycle 2) for double stress tolerance were generated and evaluated for yield and other agronomic traits during dry season of 2017. This is in continuance of the population improvement of this variety to withstand both abiotic stress conditions. Experiment was laid-out in a randomized complete block design with two replications in a single environment. After statistical analysis, 20% half-sibs were selected for recombination. Based on the analysis of variance, the coefficient of variation for yield is 19.37% and while there is no significant variation among the half-sib evaluated, the mean yield is 1.06 tons/ha. The 16 half-sib families selected had a grain yield of 1.16 to 1.46 ton/ha while the tolerant check had an average yield of 1.21 tons/ha. Further activities include recombination of the half-sib families to constitute an improved variety and extensive field testing to increase favorable alleles for double stress tolerance of IPB Var 6.

ZEA MAYS; VARIETIES; CROP YIELD; EVALUATION; SELECTION; GENES; AGRONOMIC CHARACTERS; DROUGHT STRESS

Varietal characteristics and yield performance of hybrid rice NSIC Rc368H (Mestiso 55). **Caguiat, J.D., Gramaje, L.V., Luciano, V.P., Ablaza, M.S.F., Tabanao, D.A.A., Manangkil, O.E., Argayoso, M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 102 (Jul-2018)*.

The use of hybrid rice with its 15-20% yield advantage over inbred is one of the strategies to help achieve rice self-sufficiency. The Philippine government supports this program by setting a goal of 1 million hectares planted with 25% contributed by public rice hybrids. This study aimed to evaluate the yield performance, pest and disease reaction and grain quality and to characterize morphoagronomic traits of Mestiso 55. Data indicated that it has an average yield of 6.2 t/ha during the DS, maximum yield of 10 t/ha and yield advantage of 15.6% over the check variety, PSB Rc82. Based on grain quality standard, it has intermediate amylase content with long and slender grain, with premium milling recovery and grade 1 headrice recovery. It has high percentage acceptability both in cooked and raw forms as compared to IR64, the eating quality check and PSB Rc82, the check variety. It exhibited intermediate reaction to blast in all test sites, intermediate reaction to bacterial lead blight and sheath blight in PhilRice Midsayap, UPLB and WESVIARC, and resistant to moderately resistant to whiteheads (YSB) in BIARC and PhilRice Isabela. Mestiso 55 recorded an average yield of 5319.6 t/ha in 30 PVS sites across 14 regions in the country, with highest yield of 10448 t/ha against the check variety NSIC Rc222 with 8076 t/ha yield (Ilocos Sur) during 2017DS. During 2015WS, Mestiso 55 recorded an average yield of 5531.3 t/ha across 17 sites with highest recorded yield of 9689.9 t/ha in Lanao del Norte. This hybrid

was recommended for dry season planting in irrigated lowland areas and transplanting culture and was released by the National Seed Industry Council with the registry number NSIC Rc368H.

ORYZA SATIVA; HYBRIDS; AGRONOMIC CHARACTERS; CROP YIELD; CROP PERFORMANCE; DISEASE RESISTANCE; BLIGHT

F50 Plant structure

Floristic composition and structure of Philippine took forest in the Satoyama-Satami landscape of Batangas Province, Verde Island Passage, Philippines. **Caringal, A.M., Buot, I.E.Jr.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) : FORESPI, 2018. p. 14*.

Ongoing resort establishment along the coast of Verde Island Passage Marine Corridor in Batangas Province [Philippines] threatens the natural population of Tectona philippinensis - an endemic species. Specifically, the study aimed to determine the general floristic composition and structural attributes of woody vegetation associated with T. philippinensis and evaluate the zonation patterns and environmental factors affecting the distribution of species in the Philippine teak forest landscape. Vegetation data were collected between October 2016 - February 2017 from 24: 20m x 20m (=0.96ha) quadrats randomly established along the 56km island-mainland agro-ecosystem continuum. Vegetation parameters such as abundance, diameter and height of woody species were recorded for the manual estimates of basal area, relative frequency, relative dominance, and importance value. Shannon-Wiener (H') and Evenness (J) values for all species were generated by PAleontological STatistics (PAST) Software Package Version 3.15. The floristic survey enumerated a total of 128 species under 111 genera in 48 families. The average H' was 1.95 which ranged from 0.8675 to 2.681 per 400 sqm while the mean Peilou's J or Evenness was 0.3149 varying from 0.0985 to 0.5631/400sqm. The H' Index in the present study was within the Very Low range (1.99) to Moderate (2.5-2.99). In terms of structure, large number of trees belongs to the lower dbh and height classes which indicate regeneration under considerable disturbances. Despite abundance of human-disturbance indicator flora, T.philippinensis was the most frequent (100%) and most important dominant (IV: 65.3%) along this satoyama-satouimi landscape where co-dominance are also shared by coastal floral such as Xylocarpus, Thespesia, and Terminalia. Generally, the floristic elements and vegetation structure of Philippine teak forest still indicated a healthy reproductive forest associated with an 'open-area phenomena' if not outright anthropogenic disturbances.

TECTONA; FORESTS; INDIGENOUS ORGANISMS; BOTANICAL COMPOSITION; FLORA; TREES; SPATIAL DISTRIBUTION; PHILIPPINES

God's crown (Phaleria macrocarpa (Scheff.) Boerl: Thymelaceae): an introduced fruit with pharmaceutical potential in the Philippines. **Magdalita, P.M., San Pascual, A.O., Coronel, R.E.** (Dec 2018)

The God's crown (Phaleria macrocarpa (Scheff.) Boerl) tree also known as Makhota Dewa is a member of the Thymelaceae family. It was introduced from Indonesia by the late Dr. Roberto E. Coronel in 2009. The tree fruited for the first time in 2014. Morphological characterization of the tree, leaf, fruit, seed and seedlings was conducted for 2 yr. A fruiting God's crown tree is 165.5 +- 6.37 cm high with a canopy spread of 156.5 +- 9.19 cm. It produces fruit all year round, but the peak of harvest season occurs in February. The trunk has a

diameter of 20.25 ± 0.21 mm. The mature leaves are green, narrow ovate, glabrous with very short petioles. Fruits are globose to heart shape, small sized (21.16 +- 12.04 g), with red (RHCC 46C) and thin peel, white flesh (RHCCN155B) that is dry with mild aroma. It has high flesh portion of 79.56 +- 5.45% and with 1 to 2 small, brown (RHCC 200B) seeds.

THYMELAEACEAE; SPECIES; DRUG PLANTS; MEDICINAL PROPERTIES; CHEMICAL COMPOSITION; FRUITING; FRUITS;

F60 Plant physiology and biochemistry

Chemical composition of Bambusa vulgaris shoots as influenced by harvesting time and height. **Jara, A.A., Razal, R.A., Migo, V.P., Acda, M.N., Calderon, M.M., Florece, L.M.** Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 1-9 (Dec 2018)

The chemical composition of Bambusa vulgaris Schrad. Ex Wendl. Shoots was investigated as an alternative feedstock and substrate for different bioconversion processes. Shoots having heights of 30, 60 and 90 cm were harvested at the onset and towards the end of the rainy season in Los Banos, Laguna, Philippines. Chemical analyses using standard procedures showed ranges in composition of 36.7-49.9% for holocellulose, 14.2-29.6% for 𝝰-cellulose, 11.6-20.3% for lignin, 5.3-9.2% for cyclohexane-ethanol extractives, 24.4-34.9% for hot water extractives, and 9.1%-11.6% for ash. Shoots harvested at the onset of the rainy season had higher hot water extractives and lignin content compared to those harvested at the end of the rainy season, by 9.2% and 4.8%, respectively. On the other hand, shoots harvested at the end of the rainy season had higher ash, holocellulose and alpha-cellulose content, by 0.8%, 11.6% and 11.9%, respectively. With shoot height, lignin content increased by as much as 6.0% while ash content decreased by 1.8%. The study suggests that harvesting time and shoot height could influence chemical composition of the shoots; as such, they should be taken into consideration for the more efficient utilization of the resource.

BAMBUSA VULGARIS; BAMBOOS; BAMBOO SHOOTS; HEIGHT; HARVESTING DATE; CHEMICAL COMPOSITION; BAMBUSA VULGARIS

Cytotoxicity of Peperomia pellucid (L.) HBK extracts on cancer cell lines and their effects on cfos and cjun genes. **Buhian, S.P.C., Oyong, G.G., Cabrera, E.C.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 24-32 (Mar 2019).*

The cytotoxicity of methanolic and ethanolic extracts from the plant locally known as 'Pansit-pansitan' [Peperomia pellucid (L.) HBK] on human cancer and normal cell lines was determined. Extracts were obtained by macerating fresh aerial of the plant with methanol and ethanol, followed by rotary evaporation. Extracts were dissolved in dimethylsulfoxide (DMSO) and filter-sterilized. Cytotoxicity was tested on human colorectal adenocarcinoma cells (HT-29), human monocytic leukemia cells (THP-1), and normal human fibroblast and liver cells (HDFn and THELE-3, respectively) using PrestoBlue R resazurin assay. Zeocin was used as positive control. Absolute quantification of transcript levels for the early apoptotic cfos and cjun marker genes was conducted using quantitative real time polymerase chain reaction (qRT-PCR). Cytotoxicity tests showed that based on the guidelines of the US National Cancer Institute, both extracts were highly cytotoxic to the cancer cell lines, as evidenced by their half maximal cytotoxic concentration (IC 50) values below 20 mug/mL. These ranged from 7.374 to 12.112 mug/mL. On the other hand the extracts were found to be nontoxic to the two normal cell lines HDFn and THLE-3, with (IC50) of 55.629 mug/mL, respectively, for the methanolic extract; and

52.188 mug/mL, and 63.483 mug/mL, respectively, for the ethanolic extract. Expression of the early apoptotic genes cjun and cfos was found to be upregulated in both HT-29 and THP-1 treated with (IC50) of the plant extracts. The results showed that the extracts have promising anti cancer therapeutic potential, as suggested by the upregulation of the expression of the early apoptotic genes cjun and cfos in cancer cells, without being cytotoxic to normal cells.

PEPEROMIA; SPECIES; PLANT EXTRACTS; DRUG PLANTS; NEOPLASMS; TOXICITY; METHANOL; ETHANOL; APOPTOSIS

Development of probiotic nutraceuticals using indigenous plants and lactic acid bacteria. **Saguibo, J.D., Mercado, M.A.** 2016 TR-1742.

Leaf extracts of moringa, bitter gourd, avocado, aratiles and piper betle were used for selection of anti-diarrheal plant. Based on the clarity of zones of inhibitions, piper beetle leaf extract exhibited the highest antimicrobial activity against diarrhea-causing pathogens like Salmonella typhimurium, Eschirichia coli and E. coli 0157:H7. Among the sixty lactic acid bacteria isolated from Phiippine plants, ten isolates that survived better against 30% pure piper betle extract were selected for further tests. Par5, NN39 and Lk13 showed the highest antimicrobial properties against E.coli, B. cereus and S. aureus. All the ten selected LAB showed susceptibility to ampicillin concentration higher than 0.125uh/mL. But only Par5, NN39, SP5 and SP6 were resistant at 128 ug/mL streptomycin concentration. Although exposure on artificial gastric juice (pH2) after 3h resulted to very low survival, they showed good survival on simulated intestinal fluid with LK 13 having the highest tolerance for both acid and bile tests. Sequencing of 16s rRNA using primers FC27 sense and RC1492 antisense revealed that PAR5 (99%), NN39 (96%) and LK13 (99%) are homologous to Pediococcus pentosaceous ATCC 25745. LK13 exhibited the highest Betha-galactosidase activity (5.15x10-6 UoNPG/mg biomass). The developed anti-diarrheal product with freeze-dried ikmo extract and Par5 (10 sup 9 cfu/mL) were non-infected with common food pathogens and able to inhibit these pathogens in vitro, even after 8 weeks of storage whether at refrigerated o r freezing temperatures. Test for acute oral toxicity of the product showed LD50 at 27.97g/kg. Anti-diarrheal test using laboratory animals is recommended to confirm functionality.

MOMORDICA CHARANTIA; LEAVES; PLANT EXTRACTS; PIPER BETLE; INDIGENOUS ORGANISMS; PROBIOTICS; LACTIC ACID BACTERIA; ANTIMICROBIAL PROPERTIES; DRUG PLANTS; HERBACEOUS PLANTS; MEDICINAL PROPERTIES

Financial crises was a blessing in disguise. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (5) p. 54-55 (May 2019)*.

PLANTS; FLOWERS; FARMS; PLANT EXTRACTS; ESSENTIAL OILS; ENTERPRISES

Influence of nitrogen level and water scarcity during seed filling period on seed yield and fatty acid compositions of corn. **Koca, Y.O., Canavar, O., Yorulmaz, A., Erekul, O.** Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 90-97 (Dec 2015).

The study investigated the effect of different nitrogen and irrigation levels during seed filling on per cob yield, grain quality and fatty acid composition of corn oil using two corn hybrids (31G98 and Kermes cv.). The experiment was conducted in Turkey in 2011 and 2012, and was arranged following the split-plot design in RCBD with water levels (W) as main plot and nitrogen (N) levels as subplot. The four water levels were 300 mm (W1), 400 mm (W2), 500 mm (W3) and 600 mm (W4), while the five nitrogen levels were 0 (N1), 80 (N2),

160 (N3), 240 (N4) and 320 (N5) kg/ha. The results indicated that different N levels and water scarcity (W) affected cob yield, protein, oil yield and fatty acid compositions of both corn cultivars. Per cob yield, protein and oil yield increased with N levels until N4 in both years. The highest cob, protein and oil yield were recorded from N4 and W3 in both corn cultivars. N x W interaction also affected all fatty acid components such as palmitic, stearic, oleic, linoleic and arachidic fatty acids in corn oil. However changing climate such as extreme temperatures and rain during the growth period also caused irregular changes in fatty acid compositions of corn oil. Additionally, Oleic and Linoleic were found to be the dominant fatty acids of the corn oil in all treatments. The results of this study suggest that the combination of N4 and W3 level is the most viable option for optimum cob yield, protein and oil yield.

ZEA MAYS; MAIZE; HYBRIDS; FATTY ACIDS; NITROGEN FERTILIZERS; IRRIGATION; DROUGHT STRESS; QUALITY; SEED; CHEMICAL COMPOSITION; WATER LEVELS; YIELDS; MAIZE OIL; SEED FILLING

Nutritional properties of Philippine farmer-bred maize varieties. **Purification, M.V., Pentecostes, K.Z., Beltran, A.K.M., Sanchez, M.A.B., Laude, T.P.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 35-46 (Dec 2018)*.

Seed samples from 46 Philippine farmer-bred maize varieties collected from Luzon, Visayas and Mindanao, Philippines, with different kernel color, were evaluated for nutritional composition. At alpha=0.05, the 46 farmer-bred maize varieties showed variability in their nutritional composition except for ash content. The crude protein content of the varieties ranged 6.12%-17.87% while the lysine and tryptophan contents ranged 0.10%-0.50% and 0.023%-0.095%, respectively. The crude fat, crude fiber and total carbohydrates content ranged 3.66%-7.29%, 0.93%-5.18% and 69.07%-83.84%, respectively. The average ash content of the maize varieties was 1.60% varying 1.23%-3.13%. The starch content ranged 48.68%-87.85% while the amylose and amylopectin contents ranged 5.94%-28.64% and 26.26%-71.73%, respectively. Mineral contents of the maize varieties were also determined. Potassium content ranged 160.23 mg/100 g-387.82 mg/100 g while magnesium ranged 96.81 mg/100 g-204.13 mg/100 g. The calcium content of the maize varieties ranged 14.08 mg/100 g-130.10 mg/100 g while iron and zinc content ranged from 1.38 mg/100 g-8.28 mg/100 g and 0.85 mg/100 g-4.99 mg/100 g, respectively. The maize varieties also showed good variability in terms of their antioxidant potential. Phytochemicals such as total phenols content (TCC), total flavonoids content (TFC) and total carotenoids content (TCC), and percent scavenging activity were determined. The scavenging activity ranged 14.69%-84.53% while TPC, TFC and TCC ranged 3.18%-7.5%, 2.54 mg/CE 100 g-7.11 mg/CE 100 g-7.11 mg CE/100g and 0.20 mg/100 g-2.19 mg/100 g, respectively. The variability observed revealed that the germplasm used are very promising toward genetic improvement of grain quality traits. Moreover, this study presents baseline information on the nutritional composition of selected Philippine maize farmer-bred varieties for maize varietal improvement.

ZEA MAYS; MAIZE; VARIETIES; GERMPLASM; SEED; FARMERS; NUTRITIVE VALUE; MINERALS; PROXIMATE COMPOSITION; PHILIPPINES

Response of ajowan (Carum copticum L.) to abscisic acid and salicylic acid applications under varying water deficit conditions. **Ghassemi, S., Ghassemi-Golezani, K., Zehtab-Salmasi, S.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 80-85 (Dec 2018)*.

Grain yield and yield components of ajowan (Carum copticum L.) were evaluated under field condition in response to salicylic acid (SA) (0 and 1 mM/L) and abscisic acid (ABA) (0 and 50 muM/L) applications when

irrigated after 70, 100, 130 and 160 mm evaporation from class A pan. Umbels per plant, grains per plant, 1000-grain weight, plant biomass, grain yield per unit area, and harvest index decreased with increasing water stress. Application of ABA and SA increased yield and yield components of ajowan, but did not affect harvest index. Generally foliar application of SA and ABA improved the field performance of ajowan under favorable and unfavorable water regimes.

CARUM; SPECIES; ABA; SALICYLIC ACIDS; INFLORESCENCES; DROUGHT STRESS; BIOMASS; FOLIAR APPLICATION; APPLICATION RATES; CROP YIELD; IRRIGATION

Seminal root elongation response of Philippine rice cultivars to different NH4+ concentrations. **Banting, M.D.M., Estrada, S.B., Castillo, M.P.B., Manangkil, J.M., Obara, M., Niones, J.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 108 (Jul-2018)*.

Plant roots are important organs for water and nutrient uptake from the surrounding soil. Crop breeders consider that an active root systems contributes to enhanced nutrient uptake and an important breeding target for producing higher yields. Thus, this study aimed to determine potential donor parents of root system development traits by measuring seminal root length of genotypes grown in hydroponic culture as an indicator of genetic variation. Eighty eight Philippine released and 1,247 traditional rice varieties were established and Ammonium (NH4+) served as a single source of nitrogen, with 5 muM NH4+ as stress, while 500 muM NH4+ as non-stress condition. Significant differences in the mean values of seminal root length were observed for both released and traditional varieties across NH4+ concentrations. Under stress condition, forty-seven genotypes were determined as elongating roots with seminal root length that were 2% to 42% longer than of the check-Kasalath. These genotypes may be utilized and further evaluated for root traits discovery and breeding efforts for the development of new varieties.

ORYZA SATIVA; VARIETIES; ROOT SYSTEMS; HYDROPONICS; ROOTS; LENGTH; ROOTING; NUTRIENT UPTAKE

F61 Plant physiology - Nutrition

Comparative assessment of biological nitrogen fixation in Pongamia pinnata, a biofuel legume tree. **Calica, P.N., Gresshoff, P.M.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 14-23 (Mar 2019)*.

Pongamia pinnata has been established as a biofuel legume tree. Different methods such as acetylene reduction assay, ureide analysis, isotopic techniques, nitrogen difference method and isotope techniques (15 N natural abundance and 15 N enrichment technique) were employed to analyze, assess and estimate symbiotic nitrogen fixation in 16-wk-old pongamia seedlings. In the acetylene reduction assay, the uninoculated control had negligible ethylene produced while inoculated plants were shown to have increasing ethylene production from 0-min to 60-min incubation with a range of 0.03 to 2.76 mL. Pongamia was found to produce 1.19 x 10-6 mole per plant with a Rhizobum (PR-UQ-95) inoculation. Ureide analysis was also done, not only to estimate fixed nitrogen, but also to determine the presence of allantoin in the xylem of pongamia. The result showed that allantoin was present in pongamia at low levels of 143-150 nmole, which means pongamia utilizes uriedes in the form of allantoin to transport its fixed nitrogen to other plant parts to support growth and reproduction. The nitrogen difference method and isotope techniques quantified the fixed nitrogen of pongamia inoculated with PR-UQ-05 which was estimated to be 100 mg/plant (based on the

difference of total N yield between the nodulated and non-nodulated pongamia seedlings) and from 20.4 mg/plant (natural abundance) to 47.4 mg/plant (enriched). The different methods used in this study showed different results based on the amount of fixed nitrogen calculated for each method. However, all of the methods employed in this study demonstrated that Pongamia inoculated with PR-UQ-05 fixed more nitrogen than the uninoculated control. The symbiotic nitrogen fixation of Pongamia demonstrated in this study is very relevant to the biofuel industries.

PONGAMIA PINNATA; LEGUMES; NITROGEN FIXATION; BIOFUELS; ISOTOPES; ETHYLENE PRODUCTION; INOCULATION

Marker-aided transfer of beta carotene biosynthetic genes (Golden Rice 1) into two Philippine rice varieties. **Alfonso, A.A., Espejo, E.O., Ermita, C.J.D., Ravelo, G.B., Garcia, N.S., Avellanoza, E.S., Somera, J.J.** *Philippine Journal of Crop Science (Philippines) v. 38 (3) p. 1-9 (Dec 2013)*.

'Golden Rice' (GR), a new type of rice that accumulate beta-carotene in the endosperm, could be an additional strategy to alleviate vitamin A deficiency (VAD) in the Philippines and other countries where VAD is prevalent. Through DNA marker-aided backcrossing using rice variety Cocodrie processing Golden Rice 1 Event 309 (GR309) as donor, several introgression lines (ILs) in the background of NSIC Rc128 and PSB Rc 82 were developed. Stable ILs were verified to contain the GR309 locus using an event-specific Polymerase Chain Reaction (PCR) - based marker. Recurrent parent genome (RPG) recovery was evaluated using 98 genome-wide Simple Sequence Repeat (SSR) markers for PSB Rc82 and 103 of such markers for NSIC Rc128. Marker analysis revealed that at least 80% of the genetic constitution of the selected ILs were similar to the recurrent after 2.- backcrosses. Majority of the ILs already resembled their recurrent parent based on 32 agro-morphological traits. Among the ILs, the highest total carotenoid concentration was ar 1.80 mug/g, higher than the 1.62 mug/g observed in the GR donor. Ultimately, nine uniform ILs (4 from PSB Rc82 and 5 from NSIC Rc128 backgrounds) that produce beta-carotene and with high phenotypic acceptability scores were selected. Results are consistent with earlier reports that the combined use of morphological and DNA markers could enhance selection efficiency due to reduction in time, cost and resources in producing the desired breeding lines. This strategy is due to reduction in time, cost and resources in producing the desired breeding lines. This strategy is now being employed in developing lines with higher level of beta-carotene using Golden Rice 2 event R (GR2-R).

ORYZA SATIVA; RICE; VARIETIES; GENOMES; GENETIC MARKERS; RETINOL; VITAMIN DEFICIENCIES; CAROTENOIDS; BACKCROSSING; HYBRIDIZATION; PHILIPPINES

Relationship between chlorophyll meter readings and leaf nitrogen concentration in papaya (Carica papaya L.). **Cavalcante, I.H.L., Da Silva, G.B., Santos, E.M., Lima, A.M.N**. *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 75-79 (Apr 2016).*

Papaya or pawpaw is native to Central and South America distributed throughout the tropical areas of the worlds, but poorly studied for plant physiology. The portable chlorophyll meter has been used to predict nitrogen (N) requirements to improve N fertilizer management in some fruit crops such as custard apple and passion fruit. Thus, an experiment was carried out to evaluate the relationship between the readings provided by the chlorophyll index and the leaf nitrogen 9N0 concentration in papaya (pawpaw) applied with different N rates (0, 320, 400 and 560 g N per plant). Positive and highly correlations were found between the leaf chlorophyll reading and N content in pawpaw. The satisfactory validation of the linear relationship indicate the

potential use of chlorophyll meter to estimate leaf N status of papaya, showing that plants which contained from 36.00 to 36.56 (leaf chlorophyll a), 11.6-11.96 (leaf chlorophyll b) and 47.65-48-52 (total leaf chlorophyll) are supplied with N adequately.

CARICA PAPAYA; PAPAYAS; CHLOROPHYLLS; LEAVES; NITROGEN FERTILIZERS; PLANT NUTRITION; FERTILIZER APPLICATION; PLANT PHYSIOLOGY; APPLICATION RATES

Response of MYKOVAM sup R treated lakatan banana plantlets to water deficit. **Elleva, L.I.F., Garcia, G.R., Divina, F.A., II, Fabro, D.M.A., Aguilar, E.A., Aggangan, N.S.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 56-62 (Aug 2018)*.

Lakatan banana (AA) is an economically important fruit crop in the Philippines and is one of the few fruits available year-round. Lakatan cv, compared with other local varieties has smaller root system and is known to be highly susceptible to water stress and most banana diseases. Previous studies have shown that MYKOVAM sup R (containing Arbuscular Mycorrhizal Fungi) inoculation of tissue-cultured banana at potting out and at 3-4 leaf stage enhanced root-VAM association. This pot experiment determined the shoot and root responses of banana with and without MYKOVAM sup R inoculation under water deficit condition. The treatments were: Well-watered with MYKOVAM sup R (T1), Well-watered (T2), Water deficit with MYKOVAM sup R (T3), and Water deficit (T4). Starting at field capacity, water was withheld until tensiometer reading reached 80 KPa. Water deficit was imposed for 14 d followed by a recovery period. Water deficit, regardless of MYKOVAM sup R treatment, significantly reduced the shoot (number of green leaves and pseudostem girth) and root growth (root volume, root length and number of root tips) and the relative water content of the youngest green leaf. In water deficit treatment, MYKOVAM sup R inoculated plantlets, upon watering after the imposition of water deficit, exhibited faster recovery and showed a significantly better growth (shoot and root) and higher relative water content compared to uninoculated plantlets. This study validated that MYKOVAM sup R inoculation improved the tolerance of the Lakatan banana plantlets to water deficit. Field studies are recommended to confirm the findings.

MUSA (BANANAS); VARIETIES; SEEDLINGS; MYCORRHIZAE; BIOFERTILIZERS; WATER DEPLETION; DROUGHT STRESS; INOCULATION

F62 Plant physiology - Growth and development

Allelopathic influence of sorghum aqueous extract on growth, physiology and photosynthetic activity of maize (Zea mays L.) seedling. **Kamran, M., Cheema, Z.A., Farooq, M., Ali, Q., Muhammad Zohaib Anjum, Raza, A.** Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 33-41 (Mar 2019).

The allelopathic of sorghum (Sorghum bicolor l. Moench) was evaluated on maize (Zea mays L.) seedlings as allelopathic influence may be inhibitory or promotive, depending upon concentration and dose. Seeds of hybrid maize (DK-919) were sown in pots containing acid-washed sand. The pots were moistened exogenously with different concentrations of sorghum leachate, viz. 100%, 50%, 25%, 10%, 5% and 3%, with and without adjuvant (Emulan @ 5%) after 7 d of seedling emergence. The seedlings were harvested 30 d after sowing. Based on the results, application of sorghum allelopathic extract (SWE) at the lowest doses (5% and 3%) without adjuvant was the most beneficial for improvement of maize seedling growth. Addition of adjuvant in sorghum allelopathic extract showed inhibitory influence on the seedling growth of maize. Maximum increase in chlorophyll, carotenoids, proteins and sugar content was observed at lower (5% and 3%) sorghum water

extract concentrations. The activities of catalase, superoxide dismutase, and peroxidase were decreased at higher concentrations of sorghum allelopathic extract. Application of sorghum allelopathic extract at lower concentrations (5% and 3%) offers a pragmatic and eco-friendly option to improve the growth of maize crop.

ZEA MAYS; MAIZE; SEEDLINGS; SORGHUM BICOLOR; PLANT GROWTH SUBSTANCES; PLANT PRODUCTION; ALLELOCHEMICALS; ALLELOPATHY; PHOTOSYNTHESIS; ENZYME ACTIVITY

Genetic analysis for heat tolerance and early morning flowering traits at flowering stage in rice (Oryza sativa L.). **Baliuag, N.N.A., Redoña, E.D., Hernandez, J.E., Sta. Cruz, P.C., Ye, C.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 62-72 (Dec 2015).*

Genetic factors for heat tolerance and early morning flowering (EMF) in rice were evaluated as part of rice genetic improvement under heat stress condition. Qualitative trait loci (QTL) linked to heat tolerance and early morning flowering (EMF) were analyzed by selective genotyping of phenotypic extremes in 235 BC1F1 plants derived from the cross PSB-Rc82/PSB-Rc82/WAB56-125 under controlled high temperature and 684 BC1F2 plants under glasshouse conditions using single marker analysis (SMA). For heat tolerance, data of pollen fertility and spikelet fertility of BC1F1 plants under high temperature were gathered and analyzed. For EMF, four parameters of flower opening to closing were determined, namely: time when flowers start to open (FOT), time of peak flowering (PFT), time when most of the flowers are closed (FMCT), and time when all of the flowers are closed (FCT). SMA revealed three markers on chromosomes 2, 3, and 8 are possibly linked to pollen fertility, while two markers on chromosomes 7 and 8 are possibly linked to spikelet fertility under high temperature. SMA for EMF revealed three markers on chromosomes 5, 7, and 9 are possibly linked to FOT, while six markers on chromosomes 5, 7, 8, 9, and 11 are possibly linked to PFT, FMCT and FCT. In general, markers on chromosomes 7 and 8 could be linked to QTLs controlling both heat tolerance and EMF at flowering stage in rice. The results could be useful for further fine mapping and marker-aided selection for heat-tolerant and heat escape in rice genotypes in the future.

ORYZA SATIVA; GENETIC MARKERS; GENETIC MAPS; BREEDING METHODS; FLOWERING; HEAT TOLERANCE; HEAT STRESS

F70 Plant taxonomy and geography

Floristic composition and structure of Philippine took forest in the Satoyama-Satami landscape of Batangas Province, Verde Island Passage, Philippines. **Caringal, A.M., Buot, I.E.Jr.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) : FORESPI, 2018. p. 14*.

Ongoing resort establishment along the coast of Verde Island Passage Marine Corridor in Batangas Province [Philippines] threatens the natural population of Tectona philippinensis - an endemic species. Specifically, the study aimed to determine the general floristic composition and structural attributes of woody vegetation associated with T. philippinensis and evaluate the zonation patterns and environmental factors affecting the distribution of species in the Philippine teak forest landscape. Vegetation data were collected between October 2016 - February 2017 from 24: 20m x 20m (=0.96ha) quadrats randomly established along the 56km island-mainland agro-ecosystem continuum. Vegetation parameters such as abundance, diameter and height of woody species were recorded for the manual estimates of basal area, relative frequency, relative

dominance, and importance value. Shannon-Wiener (H') and Evenness (J) values for all species were generated by PAleontological STatistics (PAST) Software Package Version 3.15. The floristic survey enumerated a total of 128 species under 111 genera in 48 families. The average H' was 1.95 which ranged from 0.8675 to 2.681 per 400 sqm while the mean Peilou's J or Evenness was 0.3149 varying from 0.0985 to 0.5631/400sqm. The H' Index in the present study was within the Very Low range (1.99) to Moderate (2.5-2.99). In terms of structure, large number of trees belongs to the lower dbh and height classes which indicate regeneration under considerable disturbances. Despite abundance of human-disturbance indicator flora, T.philippinensis was the most frequent (100%) and most important dominant (IV: 65.3%) along this satoyama-satouimi landscape where co-dominance are also shared by coastal floral such as Xylocarpus, Thespesia, and Terminalia. Generally, the floristic elements and vegetation structure of Philippine teak forest still indicated a healthy reproductive forest associated with an 'open-area phenomena' if not outright anthropogenic disturbances.

TECTONA; FORESTS; INDIGENOUS ORGANISMS; BOTANICAL COMPOSITION; FLORA; TREES; SPATIAL DISTRIBUTION; PHILIPPINES

Elimination of the Asian subterranean termite Coptotermes gestroi (Blattodea : Rhinotermitidae) using above-ground chlorfluazuron baits. **Rojo, M.J.A., Acda, M.N.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 90-93 (Mar 2019).*

Termite baits containing 0.10% chlorfluazon mixed in alpha cellulose powder was evaluated against the Asian subterranean termite, Coptotermes gestroi Wasmann (formerly Coptotermes vastator light) (Blattodea: Rhinotermitidae) in wood structures exclusively using above-ground bait (AG) stations. Wood structures from all test sites were successfully eliminated after 8-12 wk of baiting. All sites were further monitored for the next three consecutive months and no sign of either termite recovery of re-infestation of a different colony was detected. Successful elimination of C. gestroi infestation in structures using only AG stations indicated that in-ground bait stations (IGs) may not be necessary for successful termite baiting in the Philippines. Changes in termite baiting protocols in tropical countries are proposed to reduce the cost of baiting in the Philippines and other Southeast Asian countries.

COPTOTERMES; ISOPTERA; SPECIES; CHLORFLUAZURON; ATTRACTANTS; PEST CONTROL EQUIPMENT; INSECT CONTROL; INFESTATION

Bayer's dual trait Arize AZ 8433 DT hybrid rice combats insect pests as well as diseases. **Anon**. *Agriculture (Philippines) v. 23 (5) p. 8-10 (May 2019)*.

ORYZA SATIVA; HYBRIDS; INFESTATION; CROP YIELD; NILAPARVATA LUGENS; PEST RESISTANCE

Native entomopathogenic fungi isolated from Duzce, Turkey and their virulence on the mealworm beetle [Tenebrio molitor L. (Coleoptera: Tenebrionidae)]. **Karaborklu, S., Altin, N., Keskin, Y.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 82-89 (Mar 2019).*

Native entomopathogenic fungi were isolated from Duzce province of Turkey and their virulence was tested against Tenebrio molitor larvae using direct spraying and grain spraying methods. Forty-five isolates were obtained. Beauveria bassiana was obtained from 24.07 % of the soil samples and metarhizium anisopliae from 11.11 % of the soil samples. The level of insecticidal activity of the isolates fluctuated between 20% and 100%, when directly sprayed on the larvae. In the direct spray application, the most effective isolates were B.

bassiana YK11, TK16, M. anisopliae YK43, YK44 and YK45. These isolates caused 100% mortality on the larvae of T. molitor at 168 h. In 12 isolates, there was 100% mortality at 240 h under laboratory condition. Lethal time (LT50) of B. bassiana and M. anisopliae isolates varied from 10.48 to 127.40 h. Virulence of the fungal isolates in 3% (w/v) aqueous suspension was lower than that in the 10% aqueous (w/v) suspension in the grain spray application. Virulence of fungal isolates was significant in 10% aqueous (w/v) suspension and 93.33% and 100% mortality were observed in B. bassiana YK23 and YK26, respectively, at 240 h. B. bassiana and M. anisopliae isolates showed promising effectiveness for the control of insect pests.

TENEBRIO MOLITOR; COLEOPTERA; SPECIES; TENEBRIONIDAE; ENTOMOGENOUS FUNGI; BEAUVERIA BASSIANA; METARHIZIUM ANISOPLIAE; INSECT CONTROL; BIOLOGICAL CONTROL; PATHOGENICITY; PEST CONTROL; PEST RESISTANCE

WV [Western Visayas, Philippines] farmers urged to report crop pest incidents immediately. **Toreno, S.M.H.** *Agriculture (Philippines) v. 23 (5) p. 48-49 (May 2019)*.

ORYZA SATIVA; PEST INSECTS; INFESTATION; BIOLOGICAL CONTROL; CULTURAL METHODS; METARHIZIUM ANISOPLIAE; PHILIPPINES

H- PLANT PROTECTION

H10 Pests and plants

Development of molecular diagnostic tools for armored scale insects (Hemiptera: Diaspididae) and their natural enemies on coconut and associated crops. **Caoili, B.L., Bautista, Ma.A.M., Sapin, G.D., Guerrero, M.S., Laquinta, J.F., Rubico, E.C., Palisoc, R.V.** *2016 TR-1807*.

In support for the efficient and accurate identification of armored scale insects and their natural enemies, a molecular-based diagnostic protocol was developed. Armored scale insects and their associated natural enemies were collected from 16 provinces in the country. A diagnostic protocol was optimized using the 28S ribosomal DNA as molecular barcode to identify the armored scale insects collection. Fourteen scale insect species belonging to the family Diaspididae, the armored scale insects, and 6 non-diaspidid scale insects species under the families Coccidae and Eriococcidae were identified. Comparison with the BLAST database revealed significant hits for armored scale insects namely, Abgrallaspis cyanophylli (99%) from coconut, Aonidiella citrina (98%) from banana, Aspidiotus cryptomeriae (100%) from ornamental anahaw, As. Destructor (99 to 100%) from cconut and banana, As. Excises (99%) from squash and coconut, As. Rigidus (99 to 100%) from coconut, mangosteen, palmera, Manila palm, red palm squash, and nipa, Chrysomphalus aonidium (99%) from coconut, Hemiberlesia palmae (99%) from coconut, Pinnapis aspidistrae from gabi San Fernando (99%), and Pseudaulacaspis pentagona (98%) from coconut. On the other hand, armored scale insect with no significant BLAST hit since they shared less than 98% nucleotide identity were found to be closely related to Chinonaspis wisteriae (94 to 95%) and Ps. cockerelli (93%), both collected from coconut. Those diaspidids collected from lanzones were closely related to Unaspis environmental (95%) and U. euonymi (95%). On the other hand, non-diaspidid species collected from cocon ut under the family Coccidae were positively identified as Coccus formicarii (10 0%), C. hesperidum (99%), Paralecanium expansum (98%). Other coccids positively identified as Parasaissetia nigra (99%), Pulvinaria psidii (99%) were collected from coffee and banana, respectively. In addition, the only eriococcid from coconut only had 87% nucleotide identity with Eriococcus spurious. Three marker genes, namely 28S, ITS2 and COI genes were used to optimize a molecular-

based diagnostic protocol for the accurate identification of the natural enemies of the armored scale insects in the study. Among the marker genes tested, the 28S gave the best results, however due to the absence of significant nucleotide sequence hits in the GenBank database, the natural enemies were only identified up to the genus level. A Comperiella sp., with only 83% to 87% nucleotide identity with Compe riella bifasciata, was found to be associated with As. rigidus infesting coconut and banana in Laguna, coconut and nipa in Basilan suggested that the Comperiella sp. from these sites might be distinct from each other. Marietta sp. was also detected in As. rigidus from Basilan. A Coccophaginae species was found to be associated with As. destructor infesting coconut from Zamboanga (89 to 91%) and Ca marines Norte, while those from Quezon was associated with Encarsia sp. (92%). Another parasitoid identified closely related to Pteropterix sp. (89%) was found to be associated with Ps. Cockerel infesting coconut in Zamboanga. As. excisus reared on squash fruit in Basilan was found to be parasitized with Encarsia sp. that is closely related to E. heratyi (91%). Meanwhile the predators identified closely related to Telsimia sp. (89 to 90%) was identified feeding on As. destructor from Albay, Agusan del Sur, Camarines Norte and Camarines Sur. Chilocorus sp. closely related to C. cacti (92%) was also preying on As. destructor from Agus an del Sur. Pseudoscymnus sp. (91%) and Nothocolus sp. (84%) was also associated with As. destructor from Camarines del Norte. With the absence of significance hit in the Genbank database for species identification of some scale insects and natural enemies collected in this study, careful examination of these samples b y the alpha taxonomists should be done for accurate identification up to species level. Only then that the barcodes for these insects will be assigned for the specific species.

COCONUTS; DNA; DIAGNOSIS; GENE BANKS; COCCOIDEA; NATURAL ENEMIES; PREDATORS

Development of sensitive prototype sensor for monitoring insecticide residues in fruits and vegetables to address current MRLS [maximum residue limits]. **Calumpang, S.M.F., Tapia, A.K.G., Manalo, A.P.A., Torrizo, L.F.B., Lacsamana, M.S.** 2017 TR-1791.

The study focused on the design and fabrication of photodiode based transducer for a diffraction based biosensor for pesticide residue detection. The transducer device features a microcontroller-based data logging unit for measuring, recording and transmitting data while the sensors of this transducer features an array of photodiode for measuring multiple diffraction spots simultaneously. The aim of the transducer is for the measurement of the intensity of diffracted light spots, varied by the change in the refractive index of the acetylcholinesterase enzyme stamped fluid cell when profenofos or malathion insecticide was introduced. In order to simulate the reaction of the biological elements, a variable intensity laser driver was used for testing the device. Based on test results, at significance level of 5% it was found out that the fabricated transducer had no significant difference in response as compared to the laboratory photodetector. In general, the study succeeded on the design and fabrication of the transducer device as the device was able to record the reaction of actual samples. For further development, additional processing for immediate diffraction spot detection and percent intensity change calculation is recommended. Using acetylcholinesterase isolated from the pig brain as binding element, the diffraction based sensor was tested for profenofos and malathion. A linear calibration curve was made and the sensor has a limit of detection of 0.092 ppm for malathion and 0.079 ppm for profenofos. The commodities were also spiked with its maximum residue limit (MRL) concentration in order to generate the percent intensity range that will indicate compliance. The percent recoveries of the extract was within the matrix spiked percent recovery range which is between 75 to 125 percent recovery. Using the data, a pass or fail mechanism can be used since further analysis is needed to validate the method that will quantify the pesticide content of the commodities.

FRUITS; VEGETABLES; INSECTICIDES; RESIDUES; SENSORS; MAXIMUM RESIDUE LIMITS; BIOSENSORS; DESIGN; TECHNOLOGY; TECHNOLOGY TRANSFER

Development of sustainable technologies and approaches for adaptive rice-based agricultural systems (DSTAR): influence of organic/bio-organic fertilizers on populations of arthropods (pests/natural enemies) and major diseases in irrigated/rainfed rice. **Sinohin, A.M., Gonzales, P.G.** *2014 TR- 1704*.

Field experiments were conducted at CES [Central Experimentation Station]-UPLB [University of the Philippines Los Baños] and farmer's rainfed rice field in Barangay [village] San Jose, San Antonio, Quezon [Philippines] to compare the effect of bio-organic fertilizer and biocon agents on rice sheath blight severity, arthropods count (pests/natural enemies), agronomic character and grain yield. During the dry season 2014, generally, more natural enemies were counted on Biocon and Bio N treated plants. Under CES-UPLB condition, the dry and wet season trial showed that grain yield of Biocon and Bio N treatments were comparable with inorganic fertilizer treatment. Sheath blight severity Biocon and Bio N treatments were comparable with inorganic fertilizer but significantly low compared with the untreated control. Generally, the profitability with bio-organic fertilizer and biocon agent usage can still be realized. Only 50% of the required inorganic fertilizer was applied with Bio N and Biocon treatments with grain yield comparable with inorganic fertilizer alone. However, the possible net return and return on investment does not include the external, off-farm costs of environmental damage caused by chemical fertilizer.

ORYZA SATIVA; RICE; ORGANIC FERTILIZERS; ARTHROPODA; NATURAL ENEMIES; PESTS OF PLANTS; DRY SEASON; WET SEASON; AGRONOMIC CHARACTERS

H20 Plants diseases

Assessment of Musa genetic resources for their host reaction to Fusarium oxysporum f.sp. cubense tropical race 4 (Foc TR4), towards understanding the genetic base of host-pathogen interactions. **Dela Cueva, F.M., Gueco, L.S., Silva, F.F.M.A.** *2016 TR-1776.*

MUSA (BANANAS); GENETIC RESOURCES; HOST PATHOGEN RELATIONS; FUSARIUM OXYSPORUM; GENETIC RESISTANCE; GENOMES; FUSARIUM; WILTS

Development of PRSV-P resistant papaya genotypes by introgression of genes from wild Carica species. **Guevarra, M.L.D., Sison, M.L.J., Siar, S.V.** *2016 TR-1779*.

Papaya is an important fruit commodity in the country. However, production is continuously hampered by Papaya ringspot virus (PRSV), a serious disease which resulted to low fruit quality. This project aims to further evaluate the putative PRSV-P resistant BC3 lines, BC4 lines, and F1 reconstituted 'Sinta' (new hybrid) produced from concluded ACIAR project. Field evaluation for PRSV-P resistance/susceptibility was conducted in 10 BC3 and sib-cross lines, 10 BC4 and sib-cross lines and susceptible check, Davao Solo. In general, there was variation in the rate of symptom development of BC3, sib-cross 3, BC4 and sib-cross 4 from the Davao Solo. The development of the symptoms in the backcross generations was slower than that of the Davao Solo which produced severe symptoms. There were also plants (sib-cross 3 and BC4) that remained symptom free from viral infection even after 11 months of exposure in the field. Furthermore, backcross plants had the ability to recover from infection and produced good and marketable fruits; in contrast to Davao Solo with few, small and unmarketable fruits. Yield trial of 17 backcross lines was also done at IPB Experimental station in Brgy. [village] Tranca, Bay, Laguna [Philippines]. A total of 108 bearing plants generated number of 2,035 fruits for

six months and yielded a total of 1,036 kg. Multi-location planting of new hybrid papaya (2 lines) in three papaya growing areas (Cavite, Laguna and Institute of Plant Breeding) [Philippines] had similar response of the backcross to PRSV-P infection. Three pants of new hybrid papaya planted at IPB on 2010 remained visually symptomless after 11 months of exposure to natural infection. New hybrid plants also exhibited high tolerance against PRSV-P; wherein mild to moderately infected plant have the ability to recover from infection and bear good quality fruits. Fruit qualities of new hybrid papaya were presented. Fruits were generally sweet. The observed sweetness of the fruit could be attributed to V. querciflia since it is known for its high sugar levels. TSS ranged from values 11.3 to 12.30B. The fruit weight ranged from 1,412-1,628 grams and the fruits have firm yellow orange flesh with mild papaya aroma. On-station planting of 2 IPB inbred lines, 10 commercial papaya hybrids, and 4 collected germplasm was also done for extensive hybridization. Continuous selection and crossing/selfing for seed maintenance of selected backcross lines and inbred lines, population development towards red-fleshed and solo-type papaya with PRSV-P resistance/tolerance, and generation advancement of new germplasm and commercial papaya hybrids resulted to a total of 85,547 seeds. Production of new hybrid seeds was also done.

CARICA PAPAYA; PAPAYAS; HYBRIDS; GENES; INTROGRESSION; GENOTYPES; DISEASE CONTROL; PLANT DISEASES; DISEASE RESISTANCE; BREEDING METHODS; SYMPTOMS; INFECTION

Development of sensitive and reliable detection of Banana bunchy top virus in abaca (Musa textilis Nee) by polymerase chain reaction. **Piamonte, R.T. Sta. Cruz, F.C.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 12-19 (Aug 2018)*.

In the current abaca rehabilitation and virus resistance breeding programs, it is crucial that sensitive and reliable diagnostics is established for virus indexing of abaca planting materials and for virus resistance screening. This study was conducted to develop a sensitive and reliable detection of Banana bunchy top virus (BBTV) by polymerase chain reaction (PCR) in abaca plant. The conditions for virus detection by PCR were optimized in template DNA extracted by Dellaporta, Sarkosyl and CTAB methods and in varying amounts (undiluted, 1000, 100, 10, 1, 0.1, 0.01 and 0.001 ng) using different primers. Detection of BBTV was most sensitive using template DNA extracted by Dellaporta compared with Sarkosyl and CTAB methods. The detectable at various concentrations up to 0.001 ng. Dellaporta extracted DNA but can be efficiently (100%) detected from 0.1 to 100 ng. The virus was also detectable at 0.001 ng but efficiency was lower with Sarkosyl (0.1 to 10 ng) and CTAB (1 to 100 ng) extracted DNA. The presence of inhibitors prevented the amplification of BBTV in the highly concentrated (undiluted and 1000 ng) Sarkosyl and CTAB but not Dellaporta extracted DNA. Dilution of the template DNA increased the sensitivity of detection. The Musa sequence was amplified in more concentrated DNA (undiluted and 1000 ng) extracted by Dellaporta but not Sarkosyl and CTAB methods, suggesting that Dellaporta extracted contained lesser amount of inhibitors. Detection of BBTV was most consistent using the BBT1/BBT2 primer pair which amplifies the DNA-R component (replicase) of the viral genome. Amplification of an internal control DNA using the Musa tagged microsatellite primers AGMI025 and AGMI026 confirmed the reliability of BBTV detection by PCR.

MUSA TEXTILIS; ABACA; BANANA BUNCHY TOP VIRUS; PCR; DIAGNOSIS; SENSORS; DNA; GENES; GENETIC MARKERS

Development of sustainable technologies and approaches for adaptive rice-based agricultural systems (DSTAR): influence of organic/bio-organic fertilizers on populations of arthropods (pests/natural enemies) and major diseases in irrigated/rainfed rice. **Sinohin, A.M., Gonzales, P.G.** *2014 TR- 1704*.

Field experiments were conducted at CES [Central Experimentation Station]-UPLB [University of the Philippines Los Baños] and farmer's rainfed rice field in Barangay [village] San Jose, San Antonio, Quezon [Philippines] to compare the effect of bio-organic fertilizer and biocon agents on rice sheath blight severity, arthropods count (pests/natural enemies), agronomic character and grain yield. During the dry season 2014, generally, more natural enemies were counted on Biocon and Bio N treated plants. Under CES-UPLB condition, the dry and wet season trial showed that grain yield of Biocon and Bio N treatments were comparable with inorganic fertilizer treatment. Sheath blight severity Biocon and Bio N treatments were comparable with inorganic fertilizer but significantly low compared with the untreated control. Generally, the profitability with bio-organic fertilizer and biocon agent usage can still be realized. Only 50% of the required inorganic fertilizer was applied with Bio N and Biocon treatments with grain yield comparable with inorganic fertilizer alone. However, the possible net return and return on investment does not include the external, off-farm costs of environmental damage caused by chemical fertilizer.

ORYZA SATIVA; RICE; ORGANIC FERTILIZERS; ARTHROPODA; NATURAL ENEMIES; PESTS OF PLANTS; DRY SEASON; WET SEASON; AGRONOMIC CHARACTERS

Disease incidence, growth, and physiological characterization of rice cultivars with different susceptibility to bakanae disease. **Sang-Yeol Kim, Dong-Soo Park, In-Jung Lee, Yeon-Gyeong Park, Jong-Ho Seo, Hyun-Kyung Bae, Chung-Dong Hwang, Jong-Min Ko**. *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 38-46 (Aug 2018)*.

Bakanae disease is a serious problem in many rice-producing countries because it causes significant yield loss. Disease incidence, seedling growth, and physiological traits, such as leaf chlorophyll content, endogenous gibberellin (GA), and abscisic acid (ABA) production, were investigated in two moderately tolerant cultivars (Milyang 313 and Saenuri) and one susceptible cultivar (Daebo) after seeds were inoculated with bakanae disease. We evaluated their susceptibility to the disease during two seeding times (April 30 and May 10, 2016) in a nursery bed. The results showed that, 30 days after seeding, the degree of bakanae disease incidence, seedling emergence, seedling elongation, dry weight per plant, leaf chlorophyll content, and endogenous GA production corresponded to the degree of varietal tolerance. Bakanae disease incidence was lower in the tolerant cultivars, Milyang 313 and Saenuri, thus, seedling emergence rate and leaf chlorophyll content were higher than in the susceptible cultivar, Daebo. Meanwhile, seedling elongation and dry weight per plant were greater in the susceptible cultivar 30 dayscultivar, Daebo. Meanwhile, seedling elongation and dry weight per plant were greater in the susceptible cultivar 30 days after seeding. Content of endogenous GA (GA3 GA1 GA8) markedly increased in all three cultivars and at the later seeding time. GA levels were markedly affected by degree of susceptibility, disease incidence, and seedling elongation. In contrast, GA20 did not show any consistent trend. The endogenous ABA level of the infected cultivars was markedly increased, compared with the control, but this hormone did not show any consistent tendency between the susceptible cultivar and the tolerant cultivars across seeding times. These results demonstrate that Milyang 313 and Saenuri are tolerant, whereas Daebo is susceptible to bakanae disease, thus, these tolerant cultivars should be utilized in breeding programs to produce more bakanae-disease-tolerant cultivars.

ORYZA SATIVA; RICE; VARIETIES; FUNGAL DISEASES; GIBBERELLA FUJIKUROI; MORBIDITY; ABA; GIBBERELLIC ACID; DISEASE RESISTANCE

Fine mapping of bacterial stalk rot resistance loci in tropical white maize. **Canama, A.O., de Vera, M.L., Frankie, R.B**. *2015 TR-1745*.

The research project aimed to address the limitation of the existing QTL map for maize bacterial stalk rot resistance (BSRR). Although a major QTL for BSRR was identified in chromosome 2 of the maize genome, the flanking markers are not yet tightly linked (5 cM) to be useful for MAS. The general objective of the project was to fine-map the bacterial stalk rot resistance (BSRR) quantitative trait loci (QTL) regions with DNA markers. Specifically, the research project aimed to 1)screen new polymorphic simple sequence repeat (SSR) and resistance gene analog (RGA) markers by bulk segregant analysis (BSA); b)saturate the QTL for BSRR in P8 x YIF62 cross with SSR and RGA markers and 3)re-map/analyze the QTLs using the saturated linkage/QTL map. The research have significant accomplishments/findings. In DNA marker polymorphism survey, a total of 99 SSR and RGA primer pairs were screened for polymorphism between P8 and YIF62 parental genotypes and BSR resistant and susceptible DNA bulks and 8(23%) SSR markers were polymorphic between the parental inbred lines. No SSR markers were identified to be polymorphic between the DNA bulks. A total of 57 RGA primers were screened for polymorphism between the parental lines and 12 were polymorphic between the BSR tail DNA bulks. In DNA marker segregation and linkage analysis, of the 23 (2 SSR and 21 RGA) polymorphic markers, 17 (74%) followed the expected Mendelian segregation ratios. The remaining six markers 26% showed distorted segregation at 0.01P0.05. A total of 23 (2 SSR and 21 RGA) markers were added to the previous 77 marker loci analyzed wherein 14 linkage groups were established. Eleven of these linkage groups were assigned to each corresponding chromosome number of the maize genome. In the mapping of BSRR-QTL regions, single marker analysis detected putative QTLs for BSRR in chromosome 2. Sux of (2 SSR and 4 RGA) the eight markers were significantly associated with BSRR. Based on composite interval mapping (CIM), at a very high LOD of approx 9, two putative QTLs were identified in chromosomes 2. The flanking markers detected in chromosome 2 are not yet tightly linked (5 cM) to be useful as starting points to clone and characterized the underlying resistance genes.

ZEA MAYS; MAIZE; VARIETIES; DISEASE RESISTANCE; GENOMES; QUANTITATIVE TRAIT LOCI; DNA; GENETIC MAPS; GENETIC MARKERS; GENETIC POLYMORPHISM

Fumonisin-producing Fusarium species causing ear rot of corn in the Philippines. **Pascual, C.B., Barcos, A.K.S., Mandap, J.A.L., Ocampo, E.T.M**. *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 12-21 (Apr 2016)*.

A wide occurrence of corn ear rot caused by Fusarium species has been observed in the last few years in many corn-growing areas in the Philippines. The disease caused by Fusarium species produces fumonisins, a family of mycotoxins causing fatal diseases in animals and human. No local studies on Fusarium ear rot of corn contaminated with fumonisins have been done. Hence, this study was conducted to identify Fusarium infecting corn in different corn-growing regions by conventional and molecular methods and to determine accurately the Fusarium isolates producing fumonisins using specific primers by polymerase chain reaction (PCR) assay and by enzyme-linked immunosorbent assay (ELISA) test. Three hundred isolates of Fusarium were extracted into pure culture from the collections in various corn-growing regions in the Philippines. The isolates were characterized based on morphological traits, ELISA test and PCR assay. F. verticillioides was the predominant Fusarium species that produced fumonisin observed in the corn-growing areas of the Philippines.

Also observed were one F. proliferatum isolate and three F. graminearum isolates. Twenty out of the 254 F. verticillioides isolates collected were non-producers of fumonisins. These findings are very important to come up for a more stable resistance to Fusarium ear rot in corn breeding in the Philippines. Information generated from this study can be used to manage the risk of fumonisin contamination on corn grains after harvest.

ZEA MAYS; MAIZE; FUSARIUM; SPECIES; FUMONISINS; PLANT DISEASES; FUNGAL MORPHOLOGY; PCR; PHILIPPINES

Improving the bacterial blight resistance of Mestiso hybrid rice through gene pyramiding. **Tabanao, D.A., Unay, J.J., Waing, F.P., Domingo, J.M., Rico, E.P.Jr., Garcia, N.S., Espejo, E.O., Borines L.M**. *Philippine Journal of Crop Science (Philippines) v 38 (3) p.10-17 (Dec 2013)*.

The success of hybrid rice in increasing grain yield is hampered by its susceptibility to bacterial blight, which causes significant reduction in grain yield. This study aimed to determine the presence of introgressed resistance gene in improved maintainer and restorer parent lines: assess the genetic similarity of the improved parent lines to the original Mestizo 1 and Mestiso 2 parent lines; and evaluate disease resistance, grain quality and agronomic performance of the improved hybrids. With target gene selection 21 backcross lines were confirmed to have 2-3 Xa genes, exhibiting high levels of resistance. Most of these improved maintainer and restorer lines had recovered at least 80% of the recurrent parent genome based on-wide marker assay using simple sequence repeats. Cytoplasmic male-sterile lines were improved through repeated backcrossing to maintainer lines, with target gene selection and pollen sterility evaluation at each cycle. On-station and on-farm yield trials showed that the improved hybrids were disease resistant and comparable to the original hybrids with respect to morpho-agronomic traits and grain physico-chemical properties. The agreement between genotype and phenotype data indicated that resistance genes were successfully incorporated and the genetic background of recurrent parents were sufficiently recovered.

ORYZA SATIVA; RICE; HYBRIDS; GENES; BREEDING METHODS; BLIGHT; PLANT DISEASES; DISEASE RESISTANCE; AGRONOMIC CHARACTERS

Molecular characterization and infectivity of the cotton leaf curl virus isolated from gumamela (Hibiscus rosa-sinensis) in the Philippines. **Dolores, L.M., Gonzales, M.C.** *2012 TR-1773*.

Hibiscus rosa-sinensis or gumamela at the Institute of Plant Breeding (IPB) were observed showing typical symptoms of the leaf curl disease like cupping or curling of the leaves, vein enation and clearing, mottling and stunting. Transmission tests were done using indicator hosts to isolate and determine the host range of the putative virus. Leaf cupping, veinenation, mottling and mosaic were observed in Gossypium hirsutum (cotton) and Vigna unguiculata (cowpea) 1 month after inoculation using whiteflies. Thirty four out of the 40 collected gumamela samples showed the expected band of approx 1.5kb after PCR amplification using degenerate primers, thereby confirming the presence of a begomovirus. The isolates were further characterized by sequencing, multiple sequence alignment and phylogenetic analysis. Multiple sequence alignment of the obtained DNA-A fragments revealed 97.0-99.0% similarities among isolates. Furthermore, sequence analysis using other leaf curl virus sequences in the GenBank showed that the begomovirus infecting gumamela in the Philippines was highly identical to the Cotton leaf curl Multan virus with 98% nucleotide similarities. Phylogenetic analysis showed that CLCuV isolates in the Philippines clustered with the CLCuV isolates from the other countries which were also isolated from Hibiscus plants as well as cotton and okra. Furthermore, DNA

betha is detected in CLCuV-infected gumamela plants as well as other genetic components which may be essential factors in disease complexes.

HIBISCUS ROSA SINENSIS; LEAVES; LEAF CURLS; COTTON; PLANT DISEASES; PLANT VIRUSES; PCR; DNA

Molecular markers associated to downy mildew [Peronosclerospora phillippinensis (W. Weston) C.G. Shaw] resistance in sugarcane (Saccharum offcinarum L.) hybrids (CP 57-604 X PHIL 84-77). **Baer, O.T, Lalusin, A.G.** *Philippine Journal of Crop Science (Philippines) v 38 (3) p.37-45 (Dec 2013)*

Downy mildew is one of the major diseases of sugarcane that reduces cane yield. The disease is caused by Peronosclerospora phillippinensis (Weston) C.G. Shaw which is commonly found in the Philippines. This study was conducted to identify molecular (SSR) markers that are linked with downy mildew resistance in a selected population of sugarcane. Hybridization between CP 57-604, a susceptible but high yielding variety and PHIL 84.77 a resistant and moderately high yielding was done. The field experiment was conducted mainly to screen the parents and the 100 progenies for the reaction to downy mildew, and to measure other important morphological characters of sugarcane. The experiment was laid out in a simple lattice design with two replications. The disease responses of the parents, as well as its progenies, were scored based on the rating scale given by International Society of Sugarcane Technologist (ISSCT). Considerable degree of resistance were found in progenies 1,2,4,10, 11, 13, 16, 30, 35, 36, 40, 44, 49, 51, 65, 66, 67, 68, 70, 71, 70, 81, 83 and 95, whereas progenies 53 and 78 were found susceptible. The entries identified as resistant had the highest correlation coefficient of 0.86 between severity and disease response at weeks 5 and 6. The disease reactions of the population were used in marker analysis using 5 SSR sugarcane markers that were previously identified to be associated to downy mildew resistance. Phenotype data and SSR banding profiles of the population were subjected to UPGMA using Nei (1978) unbiased genetic identity to determine the clustering of the disease resistant and susceptible traits. PHIL84-77 and the resistant progenies were clustered in group 1, while CP 57-604 and the susceptible progenies were clustered at group 2. Of the 5 markers for sugarcane and 48 rice microsatellites evaluated, 4 markers for sugarcane and 2 rice microsatellites were polymorphic across the screened genotypes. Sugarcane marker mSSCIR12 generated 5 alleles and found to be highly informative with PIC value of 0.82. Since mSSCIR12 can generate polymorphic bands, this marker can be utilized in mapping sugarcane genotypes for downy mildew resistance. It is also possible to map sugarcane genotypes and germplasm for other traits of interest. Haplotype analysis of 100 progenies of sugarcane developed from the cross between CP 57-604 and PHIL 84-77 was conducted. Genotypes 35 and 51 were found to be resistant to downy mildew based on phenotypic evaluation and haplotype analysis.

SUGARCANE; SACCHARUM OFFICINARUM; GENETIC MARKERS; HYBRIDS; HYBRIDIZATION; PERONOSCLEROSPORA; MILDEWS; DEFENCE MECHANISMS; DISEASE RESISTANCE

Multilocation performance evaluation of a new banana bunchy top virus (BBTV)-resistant lakatan cultivar. **Damasco, O.P., Dela Cueva, F.M., Dolojan, F.M., Gueco, L.S., Descalsota, J.C., Nuñez, J.P.P., Baldo, S.A., Vida, E.D. A.** *2016 TR-1795.*

Banana bunchy top virus (BBTV) is the most destructive virus disease of banana in the Philippines. Incorporation of resistance to BBTV by conventional breeding is not possible due to sterility of most commercial banana cultivars. Using gamma irradiation and in vitro-induced mutagenesis, promising 'Lakatan' mutant lines with intermediate resistance to BBTV and aphid vector (Pentalonia nigronervosa) were selected, evaluated and characterized, and the genetic stability of BBTV resistance confirmed in succeeding generations

(PCAARRD-GIA project 1999-2005, 2007-2010). The project 'Multi-Location Performance Evaluation of A New Banana Bunchy Top Virus (BBTV) – Resistant 'Lakatan' Cultivar' (2013-2016) aimed to make 'Lakatan' banana production more profitable to small farmers by reducing losses due to banana bunchy top virus infection by 20% through adoption of disease resistant Lakatan. Prior to commercialization of the five selected improved 'Lakatan' mutant lines, the agronomic, yield, and economic performance, and the variability of host (mutant lines) reaction to BBTV isolates/strains were assessed in several locations across the country. The disease reaction o f 'single' mutant line and 'bulk' or composite of the five mutant lines were assessed to determine the best planning strategy for sustainable BBTV control and management. Promotion and dissemination of the 'Lakatan' mutant lines through farmers' demonstration trials, farmers' field days, trainings and seminars were conducted for increased awareness, wider acceptance and utilization of the improved 'Lakatan' mutant line varieties. The five selected BBTV resistant Lakatan mutant lines (ML 13-20-2, 28-30-2, 22-28-2,9-28-2, 9-28-3) were evaluated in replicated multilocation trials in five Lakatan growing areas in Region 4 (Laguna, Batangas, Cavite), Region 2 (Quirino) and Region 11 (Davao City). The mutant lines were likewise evaluated in several farmers' field using farmers' practices. Variations in agronomic characteristics and yield parameters of Lakatan mutant lines and control were observed across the different sites. Bunch yield of mutant lines across locations ranged from 9.2 to 16 k/bunch in Region 4, and 17.7 to 20.3 kg/bunch in Region 11. The control Lakatan had a mean yield 10.9 to 17.9 kg/bunch. In trial most sites, BBTV resistant improved Lakatan had higher mean bunch yield compared with the control Lakatan and the highest mean yield performance was observed in Davao City. Under farmers' field, bunch yield range from 10 to 18 kg/bunch. The BBTD incidence from planting up to the first harvest of mutant lines across locations ranged from 1.36% to 33.3% while control Lakatan had 17 to 50% incidence. In all trial sites mutant lines had lower disease incidence than Lakatan control. The highest BBTD incidence was observed in Cavite province which is a known hotspot for BBTV. The spread of BBTD was likewise slower in BBTV resistant mutant lines compared to the ordinary control Lakatan. To study the variability of disease, BBTV-infected plant samples were collected from nine provinces all over the country.

MUSA (BANANAS); VARIETIES; DNA; GENES; EVALUATION; AGRONOMIC CHARACTERS; YIELDS; NUCLEOTIDE SEQUENCE; GENOMES; BANANA BUNCHY TOP VIRUS; GENETIC STABILITY; DISEASE CONTROL; CROP PERFORMANCE; DISEASE RESISTANCE; MUTANTS; BREEDING METHODS; MORBIDITY

Phenotypic and molecular characterization of tungro resistant introgression lines derived from the cross Oryza sativa L. x Oryza rufipogon GRIFF. Bandillo**, N.B., Carpena, A.L., Ramos, J.M., Brar, D.S**. Philippine Journal of Crop Science (Philippines) v.39 (1) p.1-10 (Apr 2014).

Eight out of 20 alien introgression lines (AILS) including the Philippine National Seed Industry Council recommended rice variety Matatag 9, from crosses of rice variety IR64 with five accessions of Oryza rufipogon, were found resistant to tungro infection under field conditions. Subsequent enzyme-linked immunosorbent assay (ELISA) showed that two of these visually-observed resistant AILs were resistant. (up to 30% infection to both rice tungro spherical virus (RTSV) and rice tungro bacilliform virus (RTBV), causing the rice tungro disease. Introgressions in the AILs was analyzed using 142 simple sequence repeats (SSR) markets which showed 73-80 (51-56%) polymorphism between IR64 and five accessions of O. rufipogon. Introgressions from O. rufipogon based on these markers ranged 4-16%. IR84680-74-B-B-B observed to be resistant in the field and by ELISA showed 5% (4/79 markers) introgressions from O. rufipogon only on chromosome 3. Matatag 9 showed 9% (7/78 markers) introgressions from its O. rufipogon parent which were distributed on chromosomes 1, 3, 7 and 12. The markers identified in resistant lines may potentially tag novel quantitative trait loci (QTL) for

resistance to rice tungro disease (RTD) which could be of great value for further elucidation of the molecular genetic control of traits investigated. These markers can be further validated in a mapping population and can be used for fine mapping QTLs, and eventually use in MAS to accelerate breeding tungro tolerant varieties.

ORYZA RUFIPOGON; ORYZA SATIVA; RICE; GENETIC MARKERS; VARIETIES; TUNGRO DISEASE; RICE TUNGRO VIRUS; DISEASE RESISTANCE; INTROGRESSION

Production and characterization of gamma ray-induced rice mutants with broad-spectrum resistance to the bacterial blight pathogen Xanthomonas oryzae pv. oryzae. **Alfonso, A.A., Avellanoza, E.S., Miranda, R.T., Espejo, E.O., Garcia, N.S**.

An initial bulk M sub 2 population produced through gamma irradiation of mature seeds of rice variety NSIC Rc144 was subjected to a series of induced mass screening for potentially novel resistance to bacterial blight, one of the most serious diseases of rice. Lines initially found to be highly resistant to race 3 of the pathogen Xanthomonas oryzae pv. Oryzae (Xoo) were further evaluated in the same manner using other Xoo races. Selection and generation advance ultimately led to identification of two highly resistant M sub 7 lines. DNA fingerprinting using 63 genome-wide SSR markers revealed 100% similar banding patterns in the two mutant lines, indicating that these are sister lines whose origin can be traced to a single M sub 2 plant. DNA fingerprinting also revealed 98% similarity of the mutant lines with NSIC Rc144 indicating that the resistance is due to mutation and not due to genetic admixture or seed impurity. These lines were advanced and further evaluated using 14 isolates representing the 10 races of Xoo found in the Philippines. Two seasons of induced screening revealed an identical reaction pattern in these lines across a wide range of Xoo races. Such pattern is unique compared to known patterns elicited by four other Xoo-resistant isolines, suggesting possible novel resistance. F sub 2 segregation data on reaction to bacterial blight suggest a single-gene recessive mutation in these lines (p=0.4 for 3:1 test of fitness). These mutants are now being used as resistance donors in the breeding program while further molecular characterization is being pursued.

ORYZA SATIVA; VARIETIES; XANTHOMONAS ORYZAE; GAMMA IRRADIATION; BLIGHT; PATHOGENS; PEST RESISTANCE; INDUCED MUTATION; MUTANTS BREEDING METHODS

Protecting onion and garlic from infestation through smart ICT [information and communication technology] application. **Domingo, O.F.** *Agriculture (Philippines) v. 23 (06) p. 38-39 (Jun 2019*).

ALLIUM CEPA; ALLIUM SATIVUM; PEST INSECTS; INFESTATION; PLANT DISEASES; MONITORING; REMOTE SENSING; SATELLITES; IMAGERY; DIFFUSION OF INFORMATION

Rehabilitation of abaca plantations through adoption of high yielding and virus resistant abaca hybrids. **Lalusin, A.G., Dizon, T.O., del Rosario, E.E., Pateña, L.F., Aspuria, E., Cedo, Ma.L.O., Quilloy, R.B., Lee, R.G., Rama, R.A.B., Tulin, E.E., Gapasin, R.M., Sales, E.K., Estrella, M.N., Santos, N., Parac, E.P., Salang, E.D., Fernandez, A.M.** *2015 TR-1735*.

ABACA; HIGH YIELDING BREEDS; PLANTATIONS; DISEASE RESISTANCE; CULTURE TECHNIQUES; PESTICIDE RESISTANCE

Role of morphological traits and biochemical contents in imparting resistance against Cucumber mosaic virus and Zucchini yellow mosaic virus in cucumber genotypes. Mozamil Mozamil, Muhammad Azam Khan,

Muhammad Ashfaq, Mali Al Saba Shah. Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 75-81 (Mar 2019).

Cucumber, a popular vegetable of the Cucurbitaceae family, is cultivated on a large scale all over the world including Pakistan. In the present study, the role of morphological traits and biochemical factors of six cucumber genotypes (Shaheen, Beit Apha, Songroo, Best Pick, All Season and Alpha Prime) were investigated in imparting resistance and susceptibility against Cucumber mosaic virus (CVM) and Zucchini yellow mosaic virus (ZYMV). Different vegetative parameters showed different trends among the diseased and healthy plants for resistant and susceptible varieties. Total number of leaves, flowers and shoots per plant, leaf area (cm2), stem diameter (mm), total chlorophyll contents and total soluble phenols were reduced in inoculated plants of both susceptible and resistant genotypes. In resistant varieties, however, this decrease was less compared with the decrease in the inoculated plants of the susceptible varieties. The results suggest that breeders should prefer the use of a resistant variety (Beit Alpha) in the development of new resistant cucumber varieties that can perform better against CMV and ZYMV infections.

CUCUMBERS; CUCUMBER MOSAIC CUCUMOVIRUS; ZUCCHINI YELLOW MOSAIC POTYVIRUS; PHENOLIC COMPOUNDS; CHLOROPHYLLS; NUCLEIC ACIDS; DISEASE CONTROL; DISEASE RESISTANCE; GENOTYPES; AGRONOMIC CHARACTERS

Sequence analysis of nuclear inclusion b gene of Papaya ringspot virus isolates from Luzon, Philippines. **Belen, G.B., Sta. Cruz, F.C., Diaz, M.G.Q.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 1-11 (Apr 2016)*.

The sequences of the nuclear inclusion b (Nlb) gene of Papaya ringspot virus (PRSV) isolates from six provinces in Luzon, Philippines, were analyzed to determine the size and cleavage sites of the gene, and the sequence similarity of the virus isolates and their phylogenetic relationship. Nucleotide and deduced amino acid sequences of the Nlb gene were compared among the PRSV isolates from Albay, Bulacan, Cavite, Marinduque, Isabela and Laguna; and with those published PRSV sequences from the National Center for Biotechnology Information (NCBI) GenBank. Amino acid residues of the Nlb gene of PRSV isolates from Albay, Bulacan, Cavite and Marinduque were cleaved at specific sites following the V(Q-S) rule at the NIa/Nlb junction, and a new V(E-L) motif was observed at NIb/CP junction, giving a predicted size of 1551 nucleotides with coding capacity of 517 amino acid residues. Correspondingly, the PRSV Isabela and PRSV Laguna had 1526 and 1527 bases, which represent the partial size of Nlb gene of these isolates. The known consensus sequences YCDADGS, GNNSGQPSTVVDNT(S)LMV, and NGDDL-X34-K which are implicated for the putative RNA polymerase function of potyviruses were conserved in the Nlb gene sequences of all PRSV isolates. Nucleotide sequence identities of the full-length Nlb gene of PRSV isolates from Albay, Bulacan, Cavite and Marinduque ranging 95.5-96.6% were very close to isolates from Vietnam (94-95%) but relatively differed with those of PRSV from China, Taiwan, Mexico, India and Thailand (82-89%). Likewise, the full-length Nlb gene of Philippine PRSV isolates had amino acid sequence identities of 97.3-98.5%. Phylogenetic analysis of PRSV utilizing the Nlb gene showed that all six PRSV Philippine isolates were clearly separated from isolates in South and Southeast Asia except those from Vietnam.

CARICA PAPAYA; PAPAYAS; PLANT VIRUSES; GENES; PHYLOGENY; DISEASE CONTROL; NUCLEOTIDE SEQUENCE; PHILIPPINES

Bunch grass (Cenchrus ciliaris L.): a potential forage crop for saline environment. **Mahmood, S., Irshad, A., Ishtiaq, S.** *Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 52-57 (Apr 2014)*.

The growth and biochemical responses of Cenchrus ciliaris L. (Bunch grass) were investigated under varying levels of salinity under controlled growth conditions. C. ciliaris rhizomes were planted in pots acclimatized for 21 days, then subjected to 0 (control), 50, 100, 150, 200 ml mol/L NaCI in full strength Hoagland solution for 60d. Elevated level (200 m mol/L) of salinity induced a significant (P0.05) reduction in fresh and dry biomass of plants. Macronutrient (Na+, Ca2+, Mg2+, K+) of the roots and shoots were also influenced by salt stress, but more drastic change (P0.05) was observed in the shoots. A steaky K+ uptake by the schools was observed with increasing salt levels. Both Fe and Zn content of the shoot progressively declined, which was much profound at 200m mol/L NaCI. An appreciable increase of (up to 3 fold was observed) in the amount of proteins and total soluble sugars were noticed after exposure to different salinity levels. C. ciliaris appeared to cope with salt stress through an integrated mechanism of salt tolerance, which includes greater K+ uptake, capacity to maintain Na+/Ca2+ ratios and enhanced biosynthesis of protein and sugars. The study has shown the salt tolerance potential of C. ciliaris, and has potential to be grown as a substitute for traditional forage crops under saline condition.

CENCHRUS; GRASSES; VARIETIES; FEED CROPS; SALT TOLERANCE; SALINITY CONTROL; GROWTH

Development of molecular markers for the assessment of moisture stress tolerance in eggplant (Phase 2). **Delfin, E.F.** *2016 TR-1809*.

Greenhouse and filed verification trials were conducted to identify drought tolerant eggplant variety/accessions. The greenhouse verification trials identified promising accessions; PHL 12232, PHL 1519 and PHL 4841 which were evaluated under field condition along with other selected eggplant accessions and reference varieties, Mara and Mistisa. Tolerant and intolerant accessions were identifies in the field trial. Drought tolerant entries were PHL 5764, PHL 4841, PHL 2778 while PHL 1602 was identified drought intolerant entry. For the field trial, drought treatment was imposed at 5 weeks after transplanting by withholding irrigation for 2 weeks. Drought treatment was terminated early due to heavy rainfall occurrence at 3 weeks after drought imposition. PHL 2789 produced the highest fruit yield for both the control and drought conditions followed by PHL 2778. The yield of these two entries were significantly higher than the reference varieties, Mistisa, DLP and Mara for both growing conditions. This observation was further observed during the recovery period with PHL 2789 producing significantly higher than the 3 checks while PHL 2778 produce higher yield than Mistisa and DLP. Each genotype showed reductions in yield in both drought and recovery period, with genotypes showing different magnitudes of reduction. In terms of relative yield, 2 entries PHL 5764 and PHL 484 showed consistently low yield reduction (less than 20%) during drought and recovery period. Further verification of fruit yield of promising accessions showed the adverse effect of drought on fruit field with reductions ranging from 11% to 59%. The trial was also affected by bacterial wilt infection such that yield loss could have been also influenced by the disease occurrence. The promising entries previously selected in terms of yield such as accessions PHL 2789 and PHL 2778 had yield reductions of 25 and 11% respectively. On the other hand, accession PHL 1602 which also had high yield reduction in the previous trial, had yield reduction of 46%. The four selected entries were also subjected to antioxidant activity assay using 2, 2-Diphenyl-1-picryhydrazyl (DPPH). The promising drought tolerant entries showed in increasing trend in

terms of percent scavenging activity until the 10th day after drought deposition (DAI) whereas PHL 1602, the drought intolerant accession was observed to have reduced activity at 10 DAI. Polymorphic markers were identified for the initial selection of PHL 4841 and PHL 2789 and Mara and Mistisa (Female parent). Six polymorphic markers (EM141, EME05B09, EM133, emh11O01, emf21I02 and EM117) were identified for the cross Mistisa x PHL 4841 and four markers (CSM20, eme09E09, EM13 1 and EE063)for the cross Mara x PHL 2789. These 10 primer pairs were used in the hybridity testing of the progenies of the two crosses. The low percentage of SSR marker polymorphism was attribute to the self-pollinating nature of eggplant. Low percent polymorphism was also observed from the selected accessions in the field. The percent polymorphism are as follows; 12.4% for the cross PHL x PH5764, 6.8% for PHL 1602 x PHL 4841 and 10.80% for PHL 1602 x PHL 2778. SSR marker screening for PHL 1602 x PHL 2789 cross is not completed yet with only 59 markers screened the low percent polymorphism observed indicate the relatively low genetic diversity among the parental crosses used. The identified SSR polymorphic markers successfully used in hybridity testing of F1 progenies derived from selected eggplant genotypes. For F1s derived from M9stisa x PHL 4841 cross, only markers EM117, emh11O01, emf21I02 and EM141 were able to distinguish hybrids out of the six markers used in this cross. Thus, the efficiency of the marker in terms of identifying hybrids ranged from 36.67%-96.67%. for the cross between Mara PHL 27 89, markers CSM20 and EM131 all 30 progenies exhibited the presence of bands fr om both parents. Moreover, the six SSR polymorphic markers used in the hybridity testing of progenies from the cross PHL 1602 x PHL 2778 showed 42.86-100% efficiency while percent hybridiy among the 35 progenies tested ranged from 71.43-100 %. The identified polymorphic SS markers were also used to assess the genetic diversity among selected eggplant accessions which exhibited different drought responses. Twenty eggplant accessions from Turkey, China, India Laos, Taiwan, Africa and difference provinces of the Philippines were analyzed for genetic diversity.

SOLANUM MELONGENA; AUBERGINES; VARIETIES; GENETIC MARKERS; MOISTURE CONTENT; DROUGHT RESISTANCE; DROUGHT STRESS; TOLERANCE; GENETIC POLYMORPHISM; DNA; EXPERIMENTATION

Prediction of maize (Zea mays L.) yield under moderately waterlogged condition using agronomic traits measured prior to harvesting. **Paril, J.F., Sanchez, M.A.B., Salazar, A.M.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 82-89 (Dec 2015).*

Maize production in the Philippines is facing constraints brought about by more intense and frequent rainfall resulting to excess soil moisture stress or waterlogging. Identification and assessment of agronomic traits related to waterlogging are keys to the development of tolerant cultivars. S1 families from high yielding open-pollinated maize cultivars, IPB VAR6 (high lysine and tryptophan contents, also known as quality protein maize cultivar) and IPB VAR13 (hybrid maize alternative of poor Filipino farmers), were evaluated under normal field soil moisture and moderate waterlogging conditions. Yield was used as the indicator of stress tolerance. For each cultivar, 20 S sub 1 families were selected based on best linear unbiased yield predictors, estimated from models accounting for treatment, S sub 1 family, and interaction effects. Correlation analysis indicated that anthesis-silking interval and adventitious root growth were not significantly correlated with yield. Yield prediction models utilizing 10 agronomic traits measured prior to harvesting as explanatory variables, were used to complement the correlation analysis. The models showed 69.1% and 73.1% adjusted R sup 2 under normal field soil moisture and moderate waterlogging conditions, respectively. These models have potential applications in early yield prediction and in predicting yield when empirical yield data for some entries are lost due to inclement weather, pests, diseases and data mishandling.

ZEA MAYS; MAIZE; HIGH YIELDING VARIETIES; WATERLOGGING; AGRONOMIC CHARACTERS; SOIL WATER CONTENT; HARVESTING

Response of ajowan (Carum copticum L.) to abscisic acid and salicylic acid applications under varying water deficit conditions. **Ghassemi, S., Ghassemi-Golezani, K., Zehtab-Salmasi, S.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 80-85 (Dec 2018)*.

Grain yield and yield components of ajowan (Carum copticum L.) were evaluated under field condition in response to salicylic acid (SA) (0 and 1 mM/L) and abscisic acid (ABA) (0 and 50 muM/L) applications when irrigated after 70, 100, 130 and 160 mm evaporation from class A pan. Umbels per plant, grains per plant, 1000-grain weight, plant biomass, grain yield per unit area, and harvest index decreased with increasing water stress. Application of ABA and SA increased yield and yield components of ajowan, but did not affect harvest index. Generally foliar application of SA and ABA improved the field performance of ajowan under favorable and unfavorable water regimes.

CARUM; SPECIES; ABA; SALICYLIC ACIDS; INFLORESCENCES; DROUGHT STRESS; BIOMASS; FOLIAR APPLICATION; APPLICATION RATES; CROP YIELD; IRRIGATION

Response of MYKOVAM sup R treated lakatan banana plantlets to water deficit. **Elleva, L.I.F., Garcia, G.R., Divina, F.A., II, Fabro, D.M.A., Aguilar, E.A., Aggangan, N.S.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 56-62 (Aug 2018)*.

Lakatan banana (AA) is an economically important fruit crop in the Philippines and is one of the few fruits available year-round. Lakatan cv, compared with other local varieties has smaller root system and is known to be highly susceptible to water stress and most banana diseases. Previous studies have shown that MYKOVAM sup R (containing Arbuscular Mycorrhizal Fungi) inoculation of tissue-cultured banana at potting out and at 3-4 leaf stage enhanced root-VAM association. This pot experiment determined the shoot and root responses of banana with and without MYKOVAM sup R inoculation under water deficit condition. The treatments were: Well-watered with MYKOVAM sup R (T1), Well-watered (T2), Water deficit with MYKOVAM sup R (T3), and Water deficit (T4). Starting at field capacity, water was withheld until tensiometer reading reached 80 KPa. Water deficit was imposed for 14 d followed by a recovery period. Water deficit, regardless of MYKOVAM sup R treatment, significantly reduced the shoot (number of green leaves and pseudostem girth) and root growth (root volume, root length and number of root tips) and the relative water content of the youngest green leaf. In water deficit treatment, MYKOVAM sup R inoculated plantlets, upon watering after the imposition of water deficit, exhibited faster recovery and showed a significantly better growth (shoot and root) and higher relative water content compared to uninoculated plantlets. This study validated that MYKOVAM sup R inoculation improved the tolerance of the Lakatan banana plantlets to water deficit. Field studies are recommended to confirm the findings.

MUSA (BANANAS); VARIETIES; SEEDLINGS; MYCORRHIZAE; BIOFERTILIZERS; WATER DEPLETION; DROUGHT STRESS; INOCULATION

Stability of selected rice genotypes under high temperature condition in Cagayan [Philippines]. **Madrid, L.B., Manigbas, N.L., Tapic, R.T.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine *Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 107 (Jul-2018)*.

Cagayan [Philippines] is one of the highest rice producers and also one of the hottest areas in the Philippines. Existing rice varieties have no known tolerance to heat stress, but still being planted by farmers in Cagayan due to their good performance. To determine the stability and adaptability under high temperature condition, these varieties together with two new heat-tolerant elite lines were planted in four municipalities of Cagayan. Based on AMMI analysis, variance due to genotype, environment and GEI were significant (P0.05). Environment contributed the greatest proportion which was 43.1% of the total variance, while genotype contributed 35.5%, and GEI 21.5%. Results also showed that the highest yielding genotype across environment was PR40330-42-7-12-1. Highest genotype for each location varied. In Iguig, the highest was PR40330-42-7-12-1, in Peñablanca and Solana, NSIC Rc218, and in Tuguegarao, NSIC Rc240. The highest yielding environment was Peñablanca. In terms of stability, NSIC Rc152 was the most stable followed by PR42026-34-1-33.2. Yield stability index was also computed and revealed NSIC Rc152 as the most desirable genotype followed by PR40330-42-7-12-1. Panicle and canopy temperature varied significantly across genotypes which range from 4.9-10.8 deg C. The significant differences between genotypes could be attributed to ability of genotypes to transpire and cool the canopy in response to high air temperature. This could be their way to adapt to high temperature condition.

ORYZA SATIVA; GENOTYPES; ADAPTABILITY; TEMPERATURE; HEAT TOLERANCE; PHILIPPINES

Understanding lodging resistant traits from diverse sugarcane lines. **Jongrungklang, N., Maneerattanarungroj, P., Jogloy , S., Songsri, P., Jaisil, P**. Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 71-80 (Aug 2018).

Lodging decreases sugarcane productivity due to a reduction in biomass production and cane quality. One strategy to overcome this problem is to breed for lodging resistant lines. This implies that the lodging resistant traits in sugarcane are first identified. Therefore, the objective of this study was to identify lodging resistant traits in diverse sugarcane lines and their relationship with lodging. Eight diverse sugarcane lines were planted from January 2012 to January 2013 at the experimental farm of Mitr Phuwiang Sugar Mill, Thailand. The plants were arranged in randomized complete block design with four replications. After 12 months, canes in each plot were measured for lodging, stalk height, stalk diameter, leaf and stalk weight, root length density (RLD), root length density percentage (% RLD), and root anatomy. High stalk dry weight is a key factor that induces lodging in cane. Lodging resistant cultivars showed low stalk heights (248.2-263.7 cm) and stalk dry weights (4,884.6-5,482.8 g -sqm) as well as a good partition of the root in the upper soil layer, providing a strong root structure. The appropriate balance between shoot and root part is possibly contributing to low lodging incidences and maintains high yield. Therefore, breeding programs should focus on the selection of cultivars with large root systems in the upper soil layer to provide strong support to the aerial part.

SUGARCANE; VARIETIES; BREEDING METHODS; QUALITY; LENGTH; ROOTS; BIOMASS; LODGING RESISTANCE; AGRONOMIC CHARACTERS

Yield evaluation of IPB Var 6 half-sib families towards improvement for water stress tolerance. **Ocampo, E.T.M., Sanchez, Ma.A.B., Heredia, M.C.C., Adorada, P.J.R., Beltran, A.K.M**. 8. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 99 (Jul-2018).*

IPB Var 6 is a white quality maize protein open-pollinated variety that can be processed to corn grits that are highly acceptable for food. However, this variety is low yielding under water stress conditions thus population improvement through recurrent selection can be done to improve this variety. Eighty half-sib families from improved IPB Var 6 (Cycle 2) for double stress tolerance were generated and evaluated for yield and other agronomic traits during dry season of 2017. This is in continuance of the population improvement of this variety to withstand both abiotic stress conditions. Experiment was laid-out in a randomized complete block design with two replications in a single environment. After statistical analysis, 20% half-sibs were selected for recombination. Based on the analysis of variance, the coefficient of variation for yield is 19.37% and while there is no significant variation among the half-sib evaluated, the mean yield is 1.06 tons/ha. The 16 half-sib families selected had a grain yield of 1.16 to 1.46 ton/ha while the tolerant check had an average yield of 1.21 tons/ha. Further activities include recombination of the half-sib families to constitute an improved variety and extensive field testing to increase favorable alleles for double stress tolerance of IPB Var 6.

ZEA MAYS; VARIETIES; CROP YIELD; EVALUATION; SELECTION; GENES; AGRONOMIC CHARACTERS; DROUGHT STRESS

H60 Weeds and weed control

Acetolactate synthase activity and growth of rice (Oryza sativa L.) and weed species treated with the herbicide propyrisulfuron. **Salamanez, K.C., Baltazar, A.M., Rodriguez, E.B., Lacsamana, M.S., Ismail, A.M., Johnson, D.E.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 23-32 (Dec 2015)*.

Propyrisulfuron, a recently developed sulfonylurea herbicide, has shown high activity against broadleaf weeds, sedges, and grasses, unlike older sulfonylureas which are active only against broadleaf weeds and sedges. Greenhouse and laboratory studies were conducted to determine if the differential response of three rice cultivars (Azucena, N22 and IR64) and five weed species (Ludwigia hyssopifolia, Cyperus iria, Echinochloa colona, Echinochloa crus-galli, and Leptochloa chinensis) to propyrisulfuron is a function of its acetolactate synthase (ALS) activity. Growth and ALS activity were measured from test plants grown in sterilized soil under greenhouse conditions. Proprisulfuron inhibited in vivo ALS activity of the five weed species resulting in reduced shoot fresh weight, growth inhibition and eventual death. Ludwigia hyssopifolia and Cyperus iria were most susceptible, followed by Echinochloa colona, Echinochloa crus-galli, and Leptochloa chinensis. In weeds, inhibition of ALS activity increased progressively with time, with lowest in vivo ALS activity and greatest injury at 6 days after herbicide spraying. In contrast, minimal inhibition of in vivo ALS activity was observed in the three rice cultivars, where Azucena (japonica) showed lesser tolerance than N22 (aus) and IR64 (indica). Greater seedling injury and in vivo ALS inhibition occurred in plants treated at the two-leaf stage than in plants treated at the five-leaf stage. The I sub 50 values of in vitro ALS activity were similar in rice and weeds indicating that response to propyrisulfuron cannot be attributed to differences in ALS sensitivity at the target site. The study showed that propyrisulfuron is active not only against L. hyssopifolia and C. iria but also against E. colona, E. crus-galli and L. chinensis, with high selectivity to rice. The ability of propyrisulfuron to control grasses is a characteristic not found in older sulfonylureas. Hence, propyrisulfuron can be used as an alternative herbicide that can control grasses, broadleaf weeds and sedges in rice.

ORYZA SATIVA; VARIETIES; LUDWIGIA; CYPERUS; ECHINOCHLOA COLONA; ECHINOCHLOA CRUS GALLI; LEPTOCHLOA; WEEDS; HERBICIDES; WEED CONTROL

Influence of tillage and weed control practices on growth and yield of wheat. **Khaliq, A., Shakeel, M., Matloob, A., Hussain, S., Tanveer, A., Murtaza, G**. *Philippine Journal of Crop Science (Philippines) v. 38 (3) p.54-62 (Dec 2013)*.

Tillage systems in conjunction with weed control strategies can be manipulated as an integrated weed management approach. Influence of different weed control treatments on wheat and its associated weeds was evaluated under conventional, reduced and zero tillage systems. Mature sorghum (Sorghum bicolor L. Moench) aqueous extract (sorgaab) was used either alone or tank-mixed with 50% of the label dose of iodo+mesosulfuron. Label dose of this herbicide and a weedy check were maintained for comparison. Zero tillage reduced weed density and dry biomass and resulted more grain yield even in weedy control relative to the rest of tillage practices. Recommended iodo+mesosulfuran dosage and its 50% reduced dose tank-mixed with sorgaab had greater weed suppression in zero tillage in terms of weed density and dry biomass. These treatments, also improved wheat leaf area index and crop growth rate. Highest grain yield (4.52 t/ha) was obtained with label herbicide dose followed by its 50% reduced dose tank mixed with sorgaab (4.28 t/ha) under zero tillage system. Highest net benefits (Rx 163951/ha) were associated with the use of label herbicide dose in all tillage practices. Sorgaab application in zero tillage produced higher marginal rate of return (MRR) 37.23%, while all other tillage practices had lower MRR due to costs involved. Sowing of wheat is recommended in zero tillage with use of tank mixture of sorgaab with 50% of the label herbicide dose to manage weeds.

WHEATS; SORGHUM BICOLOR; ZERO TILLAGE; WEEDS; WEED CONTROL; HERBICIDES; CROP YIELD

Practical ways to control cogon (Memoirs of an Agro Journalist). **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (08) p. 59 (Aug 2019)*.

CENTROSEMA; WEED CONTROL; SHADING; FOREST TREES; BAMBOOS; SWEET POTATOES; VARIETIES

Potential allelopathic compounds from the leaves of Talinum paniculatum (Jacq.) Gaetrn and Sphaneticola trilobata (L.): isolation, characterization and bioherbicide application. **Salamanez, K.C.** *2017 TR-1786*.

Bioactive extracts were isolated from the leaves of Talinum paniculatum (Jacq.) Gaetrn and Sphaneticola trilobata (L.) by a combination of solvent extraction and chromatographic techniques Phytochemical screening, UV-Vis and IR spectra analyses, melting point determination and chromatographic mobility showed that most active extracts in Talinum could be Betha-sitosterol while in Wedelia could be caffeic acid. The dose-response whole pot assays revealed that dichoromethane extract of Talinum and both acid-hydrolyzed and ethanolic extracts of Wedelia exhibited bioherbicidal potential.

PORTULACACEAE; SPECIES; HERBACEOUS PLANTS; LEAVES; HERBICIDES; EXTRACTS; PESTICIDAL PROPERTIES

J- Postharvest Technology

J10 Handling, transport, storage and protection of agricultural products

Pre-extraction treatment of Buri (Corypha utan Lamk.) petioles and its effects on buntal fibers. **Mendoza, R.C., Ulac, A.P., Daracan, V.C., Abasolo, W.P.** *Philippine Journal of Crop Science (Philippines) v. 43 (3) p. 21-25 (Dec 2018).*

Buri petioles were subjected to different pre-extraction treatments to determine an easier method of buntal fiber extraction, which can be an alternative to manual pulling. The treatments were control or no treatment, 2 hr soaking in 20:20:60 acetic acid-hydrogen peroxide-water solution heated in a hot water bath, 2 hr boiling in tap water, 2 hr steaming and 15 d water retting. The effect of the different pre-extraction treatments on color, tensile strength and percent elongation of the fibers were determined. Easiness of pulling out the fibers, economic preference of farmers and non-farmers and the quality of extracted buntal fibers from each pre-extraction treatment were also ranked. Fiber color was affected by pre-extraction treatments, where the change in color of the fibers was greatly seen in boiling in tap water and steaming of petioles. Tensile strength did not differ significantly, while percent elongation of all treated fibers were significantly smaller compared to untreated fibers. Values obtained in this study were comparable with what the Philippine Fiber Industry and Development Authority (PhilFIDA) reported for buntal fibers being used in the industry. Farmers and non-farmers both prefer hot water bath in acetic acid-hydrogen peroxide-water solution and water retting as pre-treatment since fibers are easiest to extract. But considering the easiness of extraction and buntal fiber quality, they prefer using water-retted petioles. Farmers still preferred to extract buntal fibers from untreated petioles while non-farmers chose the water-retted petioles as pre-treatment.

PALMAE; SPECIES; FIBRES; FARMERS; PETIOLES; EXTRACTION; COLOUR; POSTHARVEST TECHNOLOGY

J11 Handling, transport, storage and protection of plant products

Advancing the Philippine mango industry: production of export-quality mangoes: Science and Technology based postharvest quality management adoption for mango in Regions 1 [Ilocos. Region], 2 [Cagayan Valley], 3 [Central Luzon], 4 [Southern Tagalog], 6 [Western Visayas] and 12 [Central Mindanao] [Philippines]. **Esguerra, E.B., Amatorio, E.Q., Del Carmen, D.R., Hilario, D.C.R., Absulio, A.L.** *2016 TR-1790*.

The gains from the previous DOST-PCAARRD [Department of Science and Technology-Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development]funded projects on mango were promoted on wider coverage to expand the supply base of quality mangoes for the domestic and export markets through grower-clustering strategy involving a total of 17 clusters with 136 farmer members in Regions Regions 1 [Ilocos. Region], 2 [Cagayan Valley], 3 [Central Luzon], 4 [Southern Tagalog], 6 [Western Visayas] and 12 [Central Mindanao] [Philippines]. Competencies of the clusters were enhanced through trainings, seminars, field days and technology-demonstrations (total of 13) on Integrated Crop Management (ICM), Postharvest Quality Management (PQM) and Good Agricultural Practices (GAP). From the baseline data of 30% average recovery of export-grade mangoes, there was a slight increase in all regions in 2014 except in Region 12:SKSU. Highest recovery of 60-67% was obtained in Regions 1:PSU and 3:CLSU. The rest of the regions had 42-56% highest recovery. However, in 2015 (Year 3), there was decrease in the recovery of export-grade mangoes with most of the harvests categorized as local- or process-grade. The lowest recovery of export-grade mangoes was obtained in Region 12. Mangoes produced in the clusters in Regions 1:DMMSU [Don Mariano Marcos Memorial State University] and 4:UPLB [University of the Philippines Los Baños] were supplied to a Japan exporter because other than meeting the quality requirement, the mangoes also passed the maximum residue level imposed by the buyers. The causes of downgrading and rejection of mangoes are insect damage (thrips and cecid fly), and to preharvest disease caused by scab. Because mangoes were harvested at mature stage, a total soluble solids content at the ripe stage ranged from 16-18 deg Brix. Titratable acidity and pH did not vary among mangoes harvested in the different project sites. Storage temperature (ambient, 25 deg C or 13 deg C) likewise did not affect the physic-chemical composition of the

fruits. The mangoes were acceptable to the sensory panelists regardless of the treatment and source. The wide variation in growing conditions in different regions particularly the occurrence of rain during fruit development and maturation rendered the mangoes susceptible to decay. Thus, even with appropriate preharvest fungicide sprays, decay still occurred after harvest. The conventional HWT 52-55 deg C for 10 minutes is recommended as a supplementary postharvest treatment. The rapid HWT of 59 deg C for one minute is suitable only when mangoes are produced during the dry, hot months where level of infection is low.

MANGOES; VARIETIES; KEEPING QUALITY; POSTHARVEST CONTROL; QUALITY CONTROLS; PREHARVEST TREATMENT; PRODUCTION INCREASE; MARKETING CHANNELS; SUPPLY BALANCE; STANDARDS; EXPORT CONTROL; PHILIPPINES

Cavite [Philippines] coffee farmers enco uraged to 'pick red cherries' for fine robusta. **Tan, Y.** *Agriculture (Philippines) v. 23 (6) p. 20; 22 (Jun 2019)*.

COFFEA CANEPHORA; COFFEE BEANS; FRUITS; HARVESTING; QUALITY; PHILIPPINES

Cooling efficiency and effectiveness of single-crate evaporative cooler for selected fresh produce. **Lualhati, R.A.O., Del Carmen, D.R.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 47-55 (Aug 2018).*

High temperature and low relative humidity (RH) promotes weight loss in fresh produce resulting in wilting, shrivelling, and browning. Refrigeration is the best way to prevent this but small farmers cannot afford it. An alternative is evaporative cooling. However, most evaporative coolers were not designed to be portable. This study used a simple evaporative cooler (EC) crate for packaging and transport of selected fresh fruits and vegetables from farm to market. The cooling efficiency of the EC using plastic crate with dimensions of 54 x 36 x 30 cm wrapped with duck cloth was 70-74%. The EC was effective in extending the shelf life of lettuce, rambutan, and bitter gourd up to 2 d. Shelf life of eggplant was extended up to 6 d. Weight loss was reduced by 66-86% for lettuce, 80% for rambutan, 68-73% for eggplant. Effect of weight loss on indices of quality deterioration (wilting, shrivelling, and browning) was established through regression and revealed shriveling of eggplant have high while wilting of lettuce have low sensitivity to weight loss. Increase in the indices of quality deterioration results to 1.50 to 1.75 decline in VQR. The critical weight loss at limit of marketability (VQR=3) for lettuce, rambutan, bitter gourd, and eggplant was 19.1, 6.2, 7.4, and 7.0%, respectively, based from the derived exponential decay of VQR with respect to weight loss.

LETTUCES; RAMBUTANS; MOMORDICA CHARANTIA; AUBERGINES; COOLING; EVAPORATION; KEEPING QUALITY; RELATIVE HUMIDITY; REFRIGERATION

Development and promotion of news and enhanced biofertilizers, biostimulants and biopesticides for increased crop productivity: yeast application for biocontrol of postharvest pathogens of fruits and vegetables. **Exconde, S.B., Batin, C.J.G.** *2015 TR-1706*.

Postharvest decays of fruits and vegetables account for significant levels of postharvest losses. It is estimated that about 20-25% of the harvested fruits and vegetables are decayed by pathogens during postharvest handling. In recent years intensive efforts have been made to develop new control methods to manage the postharvest diseases. The use of biological control agents offers an alternative or supplemental way of reducing the use of chemicals in nature. The research objective is to study the potency of yeasts in controlling post harvest diseases. Antagonistic yeasts are recommended potential microbial agents for controlling the

postharvest diseases of fruits and vegetables. Epiphytic yeasts were isolated from fruit sources such as grape, apple, banana, orange, mango and carrot. Total yeast isolates used for screening were 47, 7 from collection of the PNCM and 40 isolated from fruit sources. Twenty two of the 40 yeast isolates from fruit sources exhibited antagonistic activity against 11 fungal (Aspergillus flavus, Bipolaris maydis, Botryodiplodia sp., Colleotrichum gloeosporioides, C. musae, Curvularia inaequalis, Fusarium oxysporum, Penicillium digitatum, P. vexans, Rhizopus oligosporus and Rhizoctonia solani) and 6 bacterial (Bacillus cereus, Erwinia carotovora, Micrococcus luteus, Ralstonia solanacearum, Serratia marcescens and Xanthomonas oryzae) pathogens in in vitro tests. The yeast antagonists from fruit sources were identified as Pichia kluyveri, Hypopichia burtonii, Meyerozyma guilliermondii, and Pichia kudriavzevii. Known yeast species obtained from the PNCM collection were identified as Candida albicans, Bebaryo myces hansenii, Pichia anomala, Rhodotorula glutiinis, Saccharomyces cerevisiae, Kluyveromyces marxianus and Torulopsis candida. These isolates were assayed and showed antagonistic activity against 9 fungal (Bipolaris maydis, Botryodiplodia sp., Colletotrichum gloeosporioides, Colletotrichum musae, Fusarium oxysporum, Penicillium digitatum, Phomposis vexans, Rhizoctonia solani, Rhizopus oligosporus and 4 bacterial (Erwinia carotovora, Micrococcus luteus, Ralstonia solanacearum and Xanthomonas oryzae) pathogens in in vitro tests. Yeast biomass production was scaled up using sugar cane molasses medium. Formulation of the biocon agents was developed using talc as carrier and carboxymethyl cellulose and sodium alginate as adhesion promoters. Stability tests showed that the suitable storage condition for the yeast agents was at 11 +- 1 deg C (refrigerated temperature). Toxicity tests done using mice showed no disease, deformations or ill effects in the test animals indicating safetiness of the product. In vivo assays conducted showed that yeast isolates were effective as control agent against pathogens in a wide range of crops. P. kudriavzevii was effective in controlling C. musae in banana, R. solanacearum in tomato, P. digitatum in calamansi and A. flavus in garlic. S. cerevisiae gave significant result in the control of C. gloeosporioides in mango, P. digitatum in calamansi and A. flavus in nuts. D. hansenii was also a promising isolate in combating C. musae in banana, A. flavus in garlic, and in nuts. T. candida was effective against C. gloeosporioides in mango, A. flavus in garlic and nuts. K. ohmeri was a potent agent against C. gloeosporioides in mango, P. digitatum in calamansi, A. flavus in garlic and in onion. No isolate was able to control E. carotovora in tomato and in eggplant.

MUSA (BANANAS); GARLIC; CALAMONDINS; NUTS; MANGOES; ONIONS; AUBERGINES; YEASTS; BIOLOGICAL CONTROL; PATHOGENS; POSTHARVEST TECHNOLOGY; POSTHARVEST DECAY; EPIPHYTES; MICROBIAL PESTICIDES; POSTHARVEST LOSSES

Leyte [Philippines] rice processing center is most advanced in the region. **Tan, Y.** *Agriculture (Philippines) v. 23 (08) p. 56-58 (Aug 2019).*

RICE; DRYING; POSTHARVEST TECHNOLOGY; FARMERS; PLANTING; FARM INPUTS; CROP YIELD; PHILIPPINES

Malunggay [Moringa oliefera] helps in healthy nation building. **Urlanda, R.V.** *Agriculture (Philippines) v. 23 (6) p. 32-34 (Jun 2019).*

MORINGA OLEIFERA; LEAVES; DRYING; FOOD TECHNOLOGY; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; BREAST FEEDING

Not just your ordinary rice: genetic purity testing on breeder seeds affected by post-harvest handlings through grow-out testing. **Ferriol, A.G.S., Brena, S.R.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay

(Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 114-115 (Jul-2018).*

Poor seed quality: slow germination, weak seedlings, and mixed or genetically contaminated lots cannot lead to a uniform crop production and therefore lead to farmers' lower income. Experiment was conducted under irrigated condition during WS of 2017 in a RCBD with three replications at PhilRice CES to evaluate the effect of postharvest practices to purity and quality of the variety. Samples were collected each after threshing, drying and cleaning and examined in laboratory for varietal purity testing then tested through Grow-out Testing to further confirm the test results in the lab. Field inspection was conducted 20 days after transplanting; maximum tillering; on-set of flowering; and two weeks before harvest. Genetic purity through visual evaluation was scored based on base colors, plant heights, days to heading and rain shape. Commonly recorded off-types are purple-based plant, with long awn, taller plants, early heading and late maturity. Off-types observed may be caused by improper post-harvest handling. Inadequately performed threshing, drying and cleaning operations contribute to increased losses and low seed quality. It is recommended therefore that post-harvest deserves special attention, machines and equipment are maintained clean with responsible people in operation.

ORYZA SATIVA; RICE; SEEDS; QUALITY; POSTHARVEST TECHNOLOGY; TESTING; WET SEASON

Portaso: drying palay safely and effectively. **Urlanda, R.V**. *Agriculture (Philippines) v. 23 (3) p.60-61 (Mar 2019)*.

RICE; NATURAL DRYING; DRYERS; POSTHARVEST TECHNOLOGY

Postharvest system improvement–best practices in fresh and dried chili in Southeast Asia: quality and safety aspect. **Esguerra, E.B., Absulio, W.L.** *2016 TR-1716*.

Chili (Capsicum frustescens), popularly known as bird's eye chili or 'siling labuyo' in the Philippines, is one of the most popular spices grown in the country. Chilies are commonly used during meals as condiment to add flavor and spice to local viands. Chilies are produced across the country mostly for domestic consumption but some are also exported. Fortunately, the chili industry has no rejection notifications and has great potential to expand. To develop GAP on fresh chili and GMP on dried chili aiming for high value domestic and export markets and to develop supply chain management in postharvest, available data and information on chili were gathered. Likewise, interview of chili growers and processors and production site visits were conducted. Different supply chains were drawn from the interviews wherein the growers/processor, buyer/trader/assembler, wholesaler, retailer, and consumers are the main players. Quality and safety issues along the value chain were identified and the main concerns were on the non-compliance to GAP, lack of knowledge on the specific chili variety planted, fluctuating market price, and marketing. Along with these, best practices and other suggestions were given to improve the current state of the chili value chain. Compliance and implementation of national GAP and other standards will greatly enhance production and postharvest practices to reduce problems on quality and safety of produce. Compliance will also be enhanced if 'price premiums' are given to complying farmers. For the processing aspects, compliance with GMP and standards will improve the operation and management of the processing plants and broaden their market potentials locally and internationally. Lastly, with government's intervention, a shorter supply chain can be developed by linking growers directly to specific trading centers and/or institutional buyers to address marketing issues, and to mediate in the relationship of farmer and buyers/traders to provide security and to avoid price distortions.

Government support are also needed to initiate research activities to provide reliable data and information to further support development of best practices for production, postharvest and processing of chili.

CHILLIES; CAPSICUM FRUTESCENS; VARIETIES; SAFETY; QUALITY; PRODUCTION; PROCESSING; POSTHARVEST TECHNOLOGY

Ultrasound-assisted electrodisinfection process for the inactivation of Escherichia coli Biotech 1640 in selected crops. **Sanchez, L.A.M.L., Lit, Ma.A.** *Philippine Journal of Crop Science (Philippines) v. 43 (2) p. 20-26 (Aug 2018)*.

The effectiveness of combined ultrasound and electrolyzed water treatment for the inactivation of E. coli in cherry tomato, lettuce, and cucumber was investigated and compared to its individual treatment to assess its practicality for industrial applications. 'Ultrasound only' treatment was conducted at a fixed frequency (56 kHz) while 'electrolyzed water only' treatment was conducted at varying TRO concentration (5 ppm, 10 ppm, 20 ppm). For 'ultrasound + electrolyzed water' treatment, 10 ppm TRO concentration was used with 56 kHz ultrasonification. Results show that ultrasound enhanced the effectiveness of electrolyzed water wherein the log reduction increased up to 118% (2.49 log to 5.45 log), 130% (2.27 log to 5.23 log), and 124% (2.28 log to 5.12 log) for cherry tomato, lettuce, and cucumber, respectively. Moreover, for all produce types, the rate constants were highest in the combined ultrasound and electrolyzed water treatment. Comparison among the disinfection treatments showed ultrasound-assisted electrodisinfection as the most efficient treatment, but electrodisinfection only may be practical for cost effective industrial application.

CHERRY TOMATOES; LETTUCES; CUCUMBERS; ESCHERICHIA COLI; ULTRASONICS; FOOD SAFETY; DISINFECTION; POSTHARVEST TECHNOLOGY

Verification trail on hermetic seed storage technology for mungbean certified and farm-saved seeds in Region 2 [Cagayan Valley]. **Calderon, V.J.F., Aquino, R.M.G., dela Cruz, C.G., Atalin, V.U., Tion, A.M.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 126-127 (Jul-2018)*.

This study aims to evaluate and determine the most effective and economical hermetic seed storage technology for certified and farm-saved mungbean seeds. Mungbean varieties evaluated: V1-UPL Mg 7 and V2-BPI Mg 9 were subjected to three seed treatments, namely, ST1- rice hull ash, ST2- wood ash, and ST3- gypsum. The seeds were stored in four different packaging materials S1- laminated sacks, S2-tin cans with polyethylene lining, S3- plastic drums with polyethylene lining and S4- laminated sacks with polyethylene lining (vacuum-packed) for 12 months. Based on the results of mungbean seed storage treatments, germination percentage of UPL Mg and BPI Mg 9 are statistically the same, but a highly significant differences was noted on the treatment means combination of seed treatments and different packaging materials. The combination of tin cans with polyethylene lining x wood ash and tin cans with polyethylene lining x rice hull ash gained a germination percentage of 82% and 84%, respectively. Likewise, the combination of plastic drums with polyethylene lining x wood ash and plastic drums with polyethylene lining x rice hull ash gained a germination percentage of 80% to 85%, respectively. In fact a reduction of 20-30% was observed on germination percentage when storage length reached 6 months in the laminated sacks. These developed technologies could be used as an option for farmers to save quality planting materials that is readily available during the planting time and besides these storage materials can be used three to five years depending on the handling.

MUNG BEANS; VARIETIES; SEEDS; GERMINATION; SEED STORAGE; TECHNOLOGY; SEED TREATMENT; PHILIPPINES

J12 Handling, transport, storage and protection of forest products

Ex ante evaluation of the industry strategic S and T [Science and Technology] plans (ISPs) of the forestry sector: Ex ante evaluation of the industry strategic S and T [Science and Technology] plans (ISPs) for bamboo. **Depositario, D.P.T., Reyes, G.U., Aquino, D.R.G.** *2016 TR-1768*.

This report covers three objectives. The first one is to validate the assumptions related to the indicators used in the proposed specific interventions of bamboo. Indicators for culm yield such as baselines and benchmarks indicators were found to be achievable given certain management practices, site quality and species. Additional yield indicators were also set to take into account local variations in yield while indicators for hectarage were set based on current area covered with bamboo. Further, achievable targets were set taking into consideration the current production and potential of the industry. The second objective is to trace and analyze the pathways by which the S and T interventions will, individually and collectively, result in the projected changes in the bamboo industry. Pathways of the respective projects and of the Bamboo ISP as a whole were mapped and analyzed and it was found out that interventions utilizing mature technologies generated returns whereas those project which developed and/or are still developing new technologies will require some time before their target benefits are realized. Moreover, projects in the technology generation stage will require technology transfer activities to facilitate the dissemination and eventual utilization of outputs of target-end users. The last objective of this research is to identify, quantify and estimate in monetary terms where possible, the likely benefits and costs of the interventions for bamboo.Using benefit-cost analysis, the values for benefits and costs were estimated the Bamboo and projected. The study found that the Bamboo ISP is worth investing in since it will yield positive net benefits in the future. It was also revealed that by taking into account environmental benefits in the analysis, prospective returns from an intervention increase significantly. Moreover, it was found that projects turn out to be more economically viable when a project's design is such that a production-oriented project is simultaneously conducted with a processing- and/or marketing-related projects. Further, it was analyzed that by focusing only on the potential returns from farmer-adoptors alone and not on the potential benefits to other players in the industry (e.g., processors) of an intervention, there could be an underestimation of the net economic benefits from the public investments.

BAMBOOS; PRODUCTION; COST BENEFIT ANALYSIS; ECONOMIC VALUE; POSTHARVEST CONTROL; QUALITY ASSURANCE; WOOD TECHNOLOGYJelfarm exports 13-15 tons of okra [Abelmoschus esculentus]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (06) p. 36-37 (Jun 2019)*.

ABELMOSCHUS ESCULENTUS; OKRAS; HARVESTING; WASHING; GRADING; PACKAGING; QUALITY CONTROLS; EXPORTS

Polishing Philippine gold; raising the value of Carabao mangoes. **Anon**. *(Philippines) v. 23 (5) p. 60-62 (May 2019).*

MANGIFERA INDICA; MANGOES; DRYERS; DRYING; KEEPING QUALITY; PROCESSED PLANT PRODUCTS

Enhancing the Philippine sea cucumber industry through the development of an appropriate processing technology. **Pangan, R.S., Yaptenco, K.F., Pardua, S.N., Duque, A.C**. Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology Yaptenco, K.F.Pangan, R.S. *2016 TR-1724. p.109-130.*

A hygienic and profitable way of processing sea cucumber was developed which is appropriate for village-level application. The developed processing technology involved the design and fabrication of a preparation table, a boiling apparatus, a cleaning/scraping machine and a dry er. Each of the developed machine/equipment were based from the results of the survey conducted regarding the existing processing activities in different areas of the country. The system was designed to process 100 kilos of fresh sea cucumber in a single batch. As compared to the traditional processing method, product produced is of better quality resulting to a much higher selling price for the farmers. Furthermore, the developed technology complies with the processing standards set by the Bureau of Agriculture and Fisheries Products Standards (BAFPS) wherein, use corals and steel brushes in cleaning were eliminated, smoke contamination was avoided and quality was maintained wherein no smoke odor, decay and scorch marks are present in the product. The increase in income of the farmers as well as the detailed cost-benefit analysis of using the developed technology is likewise shown in this paper. The developed technology is very simple to operate and the machines are very easy to fabricate even in small shops.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRYING; DRYERS; DRIED PRODUCTS; PROCESSED PRODUCTS; FOOD TECHNOLOGY; TECHNOLOGY TRANSFER; INNOVATION; COST BENEFIT ANALYSIS; PHILIPPINES

Mass balance analysis and product recovery of processing and drying of sandfish (Holothuria scabara). **Yaptenco, K.F., Pardua, S.N., Lapitan, E.L.O., Pangan, R.S.** Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology, Yaptenco, K.F.Pangan, R.S. *2016 TR-1724 p.49-70*.

The sandfish (Holothuria scabra) is processed and dried into a high-value product that is used as food ingredient, primarily for the Chinese market. Due to high demand and indiscriminate harvesting, undersized product in the Philippines is prevalent. Mass balance analysis of sandfish samples from Coron (Palawan province) and Bolinao (Pangasinan province [Philippines] was conducted to demonstrate the benefits observing size limits in harvesting. Individual weight of sandish from Coron and Bolinao had ranges of 557 - 1,237 g and 89 - 590 g, respectively. Based on degutted weight of each animal, the product recovery was significantly greater for larger animals (8.8%) versus smaller animals (6.2%). Since premium prices are also paid for large dried product, there are economic benefits to be gained from allowing sandish to grow above 500 g live weight. Estimated total value of dried Coron samples was more than seven times the value for Bolinao samples.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRIED PRODUCTS; PROCESSED PRODUCTS; INGREDIENTS

Moisture sorption isotherms of dried sandfish (Holothuria scabra) for shelf life prediction. **Yaptenco, K.F., Pardua, S.N., Duque, J.A.C., Pangan, R.S.** Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology, Yaptenco, K.F.Pangan, R.S. *2016 TR- 1724 p.95-108*.

Dried sandfish (Holothuria scabra) is often poorly dried by artisinal fishers in the Philippine, resulting in downgrading of the product, this study aimed to develop moisture content sorption isotherms (MSI) at 30, 45 and 60 deg C at ten levels of water activity (alpha w) using an isopiestic method based on saturated salt solutions. MSI data was fitted to six mathematical models by non-linear regression analysis. Water vapor transmission rate (WVTR) of low-density polyethelyne (PE) and polypropylene (OPP) film was measured at 30 and 35 deg C. A mass-balance model was used to predict shelf life and moisture content during storage based on MSI and WVTR data. MSI of H.scabra followed a type III curve, which was best fitted to a Peleg model. For a stable product, the recommended range for MC during storage was 0.12- 0.18 g/g dry matter to avoid over-or under-drying, this corresponded to alpha w of 04-0.6. Predicted shelf life for PE and OPP film packs at 30 deg C reached 11 4 and 372 d, respectively; at 35 deg C, predicted shelf life was 83 d and 141 d, respectively.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRIED PRODUCTS; PROCESSED PRODUCTS; MOISTURE CONTENT; KEEPING QUALITY; WATER ACTIVITY; DRYING

K- FORESTRY

K01 Forestry - General aspects

700,000 forest trees in Mt. Purro Nature Reserve [Talawis, Antipolo City, Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.38-39 (Mar 2019)*.

SWIETENIA; ACACIA MANGIUM; GMELINA; INDIGENOUS ORGANISMS; FOREST RESERVES; PROTECTED FORESTS; RURAL AREAS; TOURISM; FARM HOLIDAYS; PHILIPPINES

All about forest certification. **Tolentino, N.L., Capinpin, H.L.L.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 7-8 (Jan-Dec 2017).*

FORESTS; CERTIFICATION; FORESTRY POLICIES; FOREST MANAGEMENT; SUSTAINABILITY

Canopy dynamics of typhoon-disturbed mahogany stand in Mount Makiling Forest Reserve, Asean Heritage Park [Philippines]. **Agudilla, M.A.R., Alegre, A.C., Israel, K.P.R., Nicmic, J.C., Reyes, J.N.I., Soriano, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Food and Agriculture Organization of the United Nations, Rome (Italy).- College, Laguna (Philippines): FORESPI, 2018. *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018.- p. 13*.

The study was carried out to analyze the bio-invasiveness and co-existence of large leaf mahogany (Swietennia macrophylla) with the native species after typhoon disturbance in PFLA3 (Permanent Forest Laboratory Area) in Mount Makiling Forest Reserve. The study was conducted by strategically laying five 10 m x 10 m quadrats. Canopy gaps were measured using hemispherical photographs with different exposure settings and Normalized Difference Vegetation Index (NDVI) was employed as a prediction model to determine the silvicultural pathways. The 5 plots yielded a total of 293 individuals shared by 23 species of trees. These species represent 21 genera under 15 families. Mahogany is the most dominant (93.4) and the most ecologically important (171.95) species. Seven new species are observed to coexist with Mahogany plantation, namely, Narra (Pterocarpus indicus), Amamali (Leea aculeata), Pararubber (Hevea brasiliensis), Lanutan (Mirephora lanotan), Tambalau (Knema glomerata), Kapulusan (Nephelium rambutan-ake), and Magabuyo

(Celtis luzonica). Mahogany population structure shows a reverse J-shaped population curve which reveals that the future communities may be sustained. Hemispherical photographs revealed that light can still penetrate because the forest canopy is not totally closed such that understorey layers composed of seedlings and saplings may grow abundantly. Avenga pinnata serve as intermediate sub-canopy. NDVI findings showed a drop on vegetation cover in 2006 and 2014 which can be attributed to typhoons Milenyo and Glenda. Recovery of vegetation after the disturbance is attributed to natural recruitment and regeneration. The study provides scientific understanding of a natural canopy dynamics and silvicultural pathways which may help in forest management and conservation of the mahogany stand.

SWIETENIA; FOREST STANDS; CANOPY; SILVICULTURE; FOREST MANAGEMENT; RESOURCE CONSERVATION; FOREST RESERVES; PHILIPPINES

Capacity building, institutional and policy mechanisms for rainfed agricultural lands at the Mt. Makiling Forest [Philippines] reserve. **Calimag, C.A., Carandang, A.P., Dolom, P.C., Mariano, R.R.E., Alcasid, E.B., Nicmic, J.C., Miranda,M.C.** *2015 TR-1733*.

The project Capacity Building Institutional and Policy Mechanisms for Rainfed Agricultural Lands at the Makiling Forest Reserve is an action – research program aimed at improving the farmers' way of the life especially those who are dependent on rainfled agriculture and the same time assess existing policies and regulations concerning the sustainable management and maintenance of the watersheds. Results of several activities and research mechanisms used in data gathering will hopefully facilitate implements to develop and design mechanisms in coping up with climate change thru the formulation of policies in support to sustainable watershed management. The project consisted of two components – capacity building and policy research in support to sustainable watershed management concerning the development and management of water resources particularly in Mt. Makiling Forest Reserve. For capacity building, activities included groundworking to establish contact with local officials and members of the community within the barangays [villages] situated around Mt. Makiling. Field and cross visits were also done to be able to gain knowledge and experience on the management practices of watershed areas in country. Assessment of the capabilities of farmers and different stakeholders and empowerment of these stakeholders in the management of MFR was done thru the conduct of Key Informant Interviews and Focus Group Discussions. Selected stakeholders also participated in some field visits. The product also conducted capability building activities for LGUs, residents, private and government officials in Climate Change Adaption, Mitigation and Vulnerability. In recognition to the role of the youth in education and information dissemination, the project also conducted and environmental education program to enhance their knowledge and skills on environmental conservation. Policy Research was a crucial component of the project. The project team reviewed existing policies on watershed management at the local, regional and national levels. A book of these policies was produced. Policy Analysis was done thru interviews. Output of these activities resulted to policy recommendations. Some of the recommendations were: the need for vulnerability assessment study of all watershed areas in the country, strengthen forest law enforcement and forest protection activities, implementation of multi-stakeholder monitoring development of master plans of every watershed area to be effectively implemented by the LGUs to attain optimum and sustainable supply of water for rainfled agriculture and to enhance capacity building activities in communities within these watersheds.

FARMS; FORESTS; FOREST LAND; FOREST MANAGEMENT; FARMERS; WATERSHEDS; WATERSHED MANAGEMENT; FOREST PROTECTION; FOREST RESERVES; SUSTAINABILITY; ENVIRONMENTAL IMPACT ASSESSMENT; FORESTRY POLICIES; PHILIPPINES

Changing the way we look at cutting trees. **Anon**. *(Agriculture (Philippines) v. 23 (4) p. 38-39 (Apr 2019).*

TREES; FOREST MANAGEMENT; SUSTAINABILITY; RESOURCE MANAGEMENT; DEFORESTATION; LOGGING;

College students' perception of the ecosystem services and non-use values of a man-made forest in a highly urbanized city: Arroceros Forest Park, Manila, Philippines. **Lagbas, A.J.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 15.*

Investment in green spaces such as street trees and forest park may be viewed as both sustainable adaptation and mitigation strategies in responding to a variety of climate change issues and urban environmental problem in densely urbanized areas. Urban green landscapes can be considered as an important source of ecosystem services, having substantial contribution to sustainability of urban areas and cities in particular cities and urban areas in developing countries. In the highly urbanized City of Manila in the Philippines, Arroceros Forest Park (AFP) is a significant source of regulating and cultural ecosystem services (ES). In this study the perceived level of importance of 6 urban forest ecosystem services, attitude to the forest park non-use values, and the factors influencing willingness to pay (WTP) for forest park preservation was explored through a survey conducted on January 2018 among college students (17-28 years, n=684) from 4 universities in Manila City. Survey showed that air quality regulation (mean=3.73) and climate and temperature regulation (mean=3.71) were the 2 most important urban forest ecosystem service as perceived by the students. Binary logistic regression showed significant relationship of WTP decision with natural log allowance (p=0.000), air quality regulation ES and residence (p=0.007), and option value (p=0.008). The protest response was mainly influenced by economic reason and reliance to the government. The natural log of the positive WTP was weakly but highly significantly correlated with the natural lo fog students' allowance (r=0.193, p=0.000). Male students had higher WTP than female despite the lower allowance of male students. The study provided evidence that pro-environment decision is significantly influenced by attitude and socio-economic factors. The high importance value of air quality regulation, climate and temperature regulation, bequest value, and ecological value may give important insights into the students' demand for these urban green ES and non-use values.

ECOSYSTEMS; SERVICES; URBAN FORESTRY; URBAN AREAS; FORESTS; PUBLIC PARKS; STUDENTS; PHILIPPINES

Inventory and cataloguing of forest policies in relation to the non-legally binding instrument: a compendium of policies in Forestry and Natural Resources. **Palacpac, A.B., Tolentino, N.L.** *Apr 2013 TR-1708*.

FORESTRY POLICIES; REGULATIONS; FOREST MENSURATION; SURVEYS; POLICIES; LEGISLATION; PHILIPPINES

K10 Forestry production

Amazing revival in the cultivation of tropical fruit trees. **Pamplona, P.P.** Agriculture *(Philippines) v. 23 (08) p. 44-47 (Aug 2019)*.

DURIO ZIBETHINUS; MANGOSTEEN; GARCINIA MANGOSTANA; LANSIUM; FOREST TREES; PLANTING; COVER PLANTS; REFORESTATION; TECHNOLOGY; INCOME

Assessment of logging wastes of tree plantation species. **Camacho, S.C., Tolentino, N.L., Donoso, L.A., Aguilon, B.C., Villanueva, Ma.M.B., Camacho, L.D.** *2016 TR -1758*.

TREES; LOGGING WASTES; WASTE UTILIZATION; WOOD RESIDUES; PLANTATIONS; WOOD INDUSTRY; ENVIRONMENTAL IMPACT ASSESSMENT

Assessment of socio-economic impacts of Executive Order No. 23 and its implications on sustainable forest management. **Corpuz, E.B., Casin, M.C.S., Capinpin, H.L.L.** *2017 TR -1774.*

FOREST MANAGEMENT; SUSTAINABILITY; FORESTRY POLICIES; FOREST PROTECTION; DEFORESTATION; DEGRADATION; TREES; PLANTATIONS

Bamboo Lady' [Dr. Merdelyn Caosi-Lit] of Los Baños [Laguna, Philippines]. **Guerrero, R.D. III.** *Agriculture (Philippines) v. 23 (08) p. 26-27 (Aug 2019)*.

BAMBUSA; BAMBOOS; SPECIES; PLANTING; SOIL CONSERVATION; EROSION CONTROL; FLOOD CONTROL; CLIMATIC CHANGE; GREENHOUSE EFFECT; USES; EROSION; WOOD; FOOD ADDITIVES; SHOOTS; PROXIMATE COMPOSITION; PHILIPPINES

Canopy dynamics of typhoon-disturbed mahogany stand in Mount Makiling Forest Reserve, Asean Heritage Park [Philippines]. **Agudilla, M.A.R., Alegre, A.C., Israel, K.P.R., Nicmic, J.C., Reyes, J.N.I., Soriano, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Food and Agriculture Organization of the United Nations, Rome (Italy).- College, Laguna (Philippines): FORESPI, 2018. *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018.- p. 13*.

The study was carried out to analyze the bio-invasiveness and co-existence of large leaf mahogany (Swietennia macrophylla) with the native species after typhoon disturbance in PFLA3 (Permanent Forest Laboratory Area) in Mount Makiling Forest Reserve. The study was conducted by strategically laying five 10 m x 10 m quadrats. Canopy gaps were measured using hemispherical photographs with different exposure settings and Normalized Difference Vegetation Index (NDVI) was employed as a prediction model to determine the silvicultural pathways. The 5 plots yielded a total of 293 individuals shared by 23 species of trees. These species represent 21 genera under 15 families. Mahogany is the most dominant (93.4) and the most ecologically important (171.95) species. Seven new species are observed to coexist with Mahogany plantation, namely, Narra (Pterocarpus indicus), Amamali (Leea aculeata), Pararubber (Hevea brasiliensis), Lanutan (Mirephora lanotan), Tambalau (Knema glomerata), Kapulusan (Nephelium rambutan-ake), and Magabuyo (Celtis luzonica). Mahogany population structure shows a reverse J-shaped population curve which reveals that the future communities may be sustained. Hemispherical photographs revealed that light can still penetrate because the forest canopy is not totally closed such that understorey layers composed of seedlings and saplings may grow abundantly. Avenga pinnata serve as intermediate sub-canopy. NDVI findings showed a drop on vegetation cover in 2006 and 2014 which can be attributed to typhoons Milenyo and Glenda. Recovery of vegetation after the disturbance is attributed to natural recruitment and regeneration. The study

provides scientific understanding of a natural canopy dynamics and silvicultural pathways which may help in forest management and conservation of the mahogany stand.

SWIETENIA; FOREST STANDS; CANOPY; SILVICULTURE; FOREST MANAGEMENT; RESOURCE CONSERVATION; FOREST RESERVES; PHILIPPINES

Changing the way we look at cutting trees. **Anon**. *(Agriculture (Philippines) v. 23 (4) p. 38-39 (Apr 2019).*

TREES; FOREST MANAGEMENT; SUSTAINABILITY; RESOURCE MANAGEMENT; DEFORESTATION; LOGGING

College students' perception of the ecosystem services and non-use values of a man-made forest in a highly urbanized city: Arroceros Forest Park, Manila, Philippines. **Lagbas, A.J.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 15.*

Investment in green spaces such as street trees and forest park may be viewed as both sustainable adaptation and mitigation strategies in responding to a variety of climate change issues and urban environmental problem in densely urbanized areas. Urban green landscapes can be considered as an important source of ecosystem services, having substantial contribution to sustainability of urban areas and cities in particular cities and urban areas in developing countries. In the highly urbanized City of Manila in the Philippines, Arroceros Forest Park (AFP) is a significant source of regulating and cultural ecosystem services (ES). In this study the perceived level of importance of 6 urban forest ecosystem services, attitude to the forest park non-use values, and the factors influencing willingness to pay (WTP) for forest park preservation was explored through a survey conducted on January 2018 among college students (17-28 years, n=684) from 4 universities in Manila City. Survey showed that air quality regulation (mean=3.73) and climate and temperature regulation (mean=3.71) were the 2 most important urban forest ecosystem service as perceived by the students. Binary logistic regression showed significant relationship of WTP decision with natural log allowance (p=0.000), air quality regulation ES and residence (p=0.007), and option value (p=0.008). The protest response was mainly influenced by economic reason and reliance to the government. The natural log of the positive WTP was weakly but highly significantly correlated with the natural lo fog students' allowance (r=0.193, p=0.000). Male students had higher WTP than female despite the lower allowance of male students. The study provided evidence that pro-environment decision is significantly influenced by attitude and socio-economic factors. The high importance value of air quality regulation, climate and temperature regulation, bequest value, and ecological value may give important insights into the students' demand for these urban green ES and non-use values.

ECOSYSTEMS; SERVICES; URBAN FORESTRY; URBAN AREAS; FORESTS; PUBLIC PARKS; STUDENTS; PHILIPPINES

K50 Processing of forest products

Development of nanosensors and nanostructured materials from agricultural by-products for enhancement of food and agricultural productivity and for environmental sensing and remediation: Bench-scaling of the production of cellulosic nanocrystals from kawayang tinik (Bambusa blumeana) and their utilization for renewable nanomaterials. **Razal, R.A., Peralta, M.M.** *2017 TR-1766.*

Two general approaches to bench-scale the production of nanocellulose from Kawayang tinik (Bambusa blumeana J.A. and J.H. Schultes) were explored. The first approach retained acid hydrolysis with sulfuric acid as the final step to the production of cellulosic nanocrystals, but modified a number preparatory steps before Kraft pulping as well as the sequence of chemical treatment after pulping to determine the best combination that will give the highest yield while maintaining that cellulose in nano dimension is obtained as final product. Before pulping, changes employed were the use of hammermill to further physically disintegrate the cut bamboo culms for pulping, grinding of the bamboo chips using a Friction Grinder Supermass Colloider, and the use of steam explosion to soften the ligning before its removal via chemical reactions during pulping. There were no significant effects in achieving nanoscale sizes for the products via the pretreatment steps, but yield was considerably reduced with steam explosion because of material recovery issues involving minute sized particles. Consequently, only hammermilling was retained as a preparatory step prior to pulping. Pulping was also scaled up by using a 40-L pressure cooker with pressure and temperature gauges, which was heated using a LPG gas-fired stove that increased the rate at which the desired temperature was reached. After, pulping the best combination in terms of yield was produced using a route that involves the following sequence: bleaching - digestion with sodium chlorite (preparation of holocellulose) - and digestion with 17.5% sodium hydroxide (preparation for alkali insoluble cellulose). Acid hydrolysis reaction was carried out using 46% sulfuric acid, at 45 deg C for 30 minutes. Post-hydrolysis treatments involved neutralization with NaOH, centrifugation, dialysis, and sonication. Portions of the samples were freeze-dried inpreparation for analyses using FTIR, SEM, AFM, and XRD but the rest of the nanocellu lose were kept in aqueous suspension to prevent aggregation. The second approach involved using the friction grinder supermass colloider (FGSC) for the mechanical fibrillation of the material, without a final acid hydrolysis step to produce nanocellulose. Instead, the bamboo pulp, in various stages of chemical treatment after pulping, were made to pass several times through the FGSC and the yield and properties (FTIR, SEM, AFM, XRD) determined by taking samples for arbitrarily determined number of passes. It was determined that nanosize fibrils were attainable by grinding up to 200 passes bamboo pulp, but the lignin tended to form an inseparable matrix that enveloped the fibrils. Increasing the number of passes to 400 (double) did not improve lignin removal. Mechanical fibrillation of the bleached pulp was tried next, and was also able to produce nanosize fibrils, but lignin remained as a nuisance. Next, digestion of the bleached pulp with sodium chlorite removed the lignin while retaining non-cellulosic carbohydrates (low molecular weight hemicelluloses), which when passed through the FGSC resulted in nanosize fibrils without lignin. With dimensions of 100 nm or less, this indicated that further chemical treatment was no longer necessary before grinding on the FGSC. Indeed, there were no significant differences in chemical and nanoscale properties between nanocellulose from holocellulose from nanocellulose derived from alkali-insoluble cellulose. Holocellulose preparation as the starting point for grinding with FGSC saves at least one chemical step prior to the production of nanocellulose. Application trials of the bamboo nanocellulose involved incorporating bamboo nanocellulose in thermoplastic starch, modified bamboo nanocellulose in low density polyethylene film (LDPE), and in fabricating nanopaper using nanocellulose, with and without termiticide. The latter was tested as physical barrier against subterranean termite, Coptotermes gestroi. Modification of the bamboo nanocellulose was done by chemical oxidation with 2,2,6,6,-tetramethylpiperidine-1-oxyl (TEMPO) followed by reaction in excess long chain alkyl amine (1-hexadecylamine) in the presence of N,N'–diisopropylcarbodiimide (DIC) and N-hydro xysuccinimide (NHS) in dimethyl sulfoxide (DMSO) with stirring for 24 hours at less than 30 deg C temperature following the procedure of Tan et al. (2015).

BAMBUSA; SPECIES; BAMBOOS; CELLULOSE PRODUCTS; CHEMICAL PULP; RENEWABLE RESOURCES; PULPING; PAPERMAKING

Waste tobacco stalk as glue filler in plywood manufacture in the Philippines. **Acda, M., Jimenez, J.** *2017 TR-1780*.

The study investigated the use of tobacco (Nicotiana tabacum L) stalk particles as additive in urea form aldehyde glue formulation used to bond plywood. The effect of increasing amount of tobacco particles on shear strength, wood failure, formaldehyde emission and termite resistance of plywood was studied. Addition of tobacco particles from 4 to 8% tobacco particle by mass mixed well and had no significant effect on shear strength and wood failure of plywood using Paraserianthes falcataria (L) Nielsen veneers. Formaldehyde emission from specimen containing 4-12% tobacco stalk particles was reduced by 18 to 32% compared to untreated controls. The reduction could be due to the presence of nicotine in tobacco stalk particles that captured residual formaldehyde from the boards. Glueline treatment using tobacco particles at all levels used in this study showed no or limited protection against the subterranean termite Microcerotermes losbanosensis Oshima after 16 week of choice feeding bioassay. Although further research is needed, tobacco particles showed good potential as additive in plywood manufacture.

NICOTIANA TABACUM; TOBACCO; PLYWOOD; CHEMICOPHYSICAL PROPERTIES; PROCESSING; STICKINESS; FORMALDEHYDE; ISOPTERA; MICROCEROTERMES; PEST RESISTANCE

Tobacco (Nicotiana tabacum) stalk particles as additive in urea formaldehyde bonded. **Acda, M.N.** Waste tobacco stalk as glue filler in plywood manufacture in the Philippines, Acda, M.NJimenez, J. 2017 TR-1780 p. 4-19

The study investigated the use of tobacco (Nicotiana tabacum L) stalk particles as additive in urea formaldehyde glue formulation used to bond plywood. The effect of increasing amount of tobacco particles on shear strength, wood failure, formaldehyde emission and termite resistance of plywood was studied. Addition of tobacco particles from 4 to 8% tobacco particle by mass mixed well and had no significant effect on shear strength and wood failure of plywood using Paraseriant falcaria (L) Nielsen veneers. Formaldehyde emission from specimen containing 4-12% tobacco stalk particles was reduced by 18 to 32% compared to untreated controls. The reduction could be due to the presence of nicotine in tobacco stalk particles that captured residual formaldehyde from the boards. Glueline treatment using tobacco particles at all levels used in this study showed no or limited protection against the subterranean termite Microcerotermes losbanosensis Oshima after 16 week of choice feeding bioassay. Although further research is needed,tobacco particles showed good potential as additive in plywood manufacture.

TOBACCO; PETIOLES; PLYWOOD; WOOD PROPERTIES; STICKINESS; FORMALDEHYDE; ISOPTERA; PEST RESISTANCE; PARASERIANTHES FALCATARIA

L- ANIMAL SCIENCE, PRODUCTION AND PROTECTION

L01 Animal husbandry

Alaminos [Philippines] goat ties Guiness World Record, gives birth to sextuplets. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (6) p.4; 6-7 (Jun 2019)*.

GOATS; BREEDS (ANIMALS); DAIRY FARMS; MILK PRODUCTION; ANIMAL FEEDING; FEEDS; FEED LEGUMES; FEEDING; PHILIPPINES

California business raises Boer goats to manage wildfires. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (07) p. 62-64 (Jul 2019)*.

GOATS; ANIMAL HUSBANDRY; WILDFIRES; FIRE CONTROL

Carcass and meat quality characteristics of lechon-size Black Tiaong and Kalinga native pigs (organic-like farm) and landrace, Large White, and their F1 crosses (conventional farm). **Bondoc, O.L., Dominguez, J.M.D., Bueno, C.M., Santiago, R.C.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 42-55 (Mar 2019)*.

This study aimed to compare carcass characteristics and meat quality traits of lechon-size (less than 30 kg) pigs belonging to Philippine native breeds (i.e., Black Tiaong and Kalinga) raised in organic-like production system and commercial breeds [i.e., Landrace (LDR), Large White (LRW)and their F1 crosses] obtained from a conventional swine breeding farm. Native breeds had shorter body length and shorter carcass length than commercial breeds (P 0.01). Weight of ham, fore shank and hind shank were lower (P 0.01) in native breeds than in the commercial breeds. However, weight of belly was higher (P 0.01) in native pig breeds. Among the native breeds, Black Tiaong had heavier ham and higher ham proportion than Kalinga pigs (P 0.01). Among commercial breeds, Landrace had the biggest ham and the smallest was that of the F1 LRW x LDR cross (P 0.01). Pork carcass from native breeds had lower weight of lean and bones (P 0.01) but more fat and skin (P 0.01) than the commercial breeds. Loin eye area was smaller (P 0.01) in native breeds than in the commercial breeds. Pre-slaughter backfat thickness was higher in native breeds than in the commercial breeds. However, carcass backfat thickness was higher (P 0.01) in native breeds than in the commercial breeds.

SWINE; BREEDS (ANIMALS); INDIGENOUS ORGANISMS; CARCASS COMPOSITION; MEAT; QUALITY; ORGANIC AGRICULTURE; COMMERCIAL FARMING

Ex-ante analysis of PCAARD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [science and technology] plans for crops, livestock and inland aquatic resources: Ex-ante analysis of PCAARD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] industry strategic S and T [science and technology] plan (ISP) for livestock (Native Chicken). **Arapoc, J.A., Jimenez, C.D.** *2014 TR-1737.*

This study conducted an ex-ante analysis of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry Strategic S and T [science and technology] Plan for Native Chicken that aims to validate the baselines and benchmark set for the program, to map the programs adoption and impact pathway, and lastly to conduct a Benefit Cost Analysis to assess the viability of the program for each implementation sites (Bicol, Bohol, and Zamboanga Peninsula [Philippines]). By conducting a series of Key informant interviews, focus group discussions, and field surveys, the research managed to realize its objective. Upon validation of the initially set benchmarks and baselines for the Native Chicken ISP, it was discovered that these benchmarks and baselines are unfitting for the program since the data used to set them are only applicable for broiler types. The study provided a new set of benchmarks and baselines through the help of several industry and technical experts. The study also mapped the program's adoption and impact pathway in order to establish linkage between the program's expected output and target outcome. In addition, issues and challenges faced by the program were also identified and discussed. Meanwhile, results of

the Benefit Cost Analysis suggest that the program is indeed viable for all the implementing sites with the assumption of an ideal scenario. The study provided evidences that among the three implementation sites, the program implemented in Bohol is expected to generate the highest returns. However, upon performing sensitivity analysis, the study found out that the viability of the program can be easily affected by alternative state-of-the-worlds which includes following: (1) adoption of POT 1 to 3 only; (2) adoption of POT 1 and 4 only; and (3) reduction of adoption rate by 50%. The simulation of BCA for each scenario resulted in mix outcomes.

CHICKENS; INDIGENOUS ORGANISMS; COST BENEFIT ANALYSIS; LIVESTOCK MANAGEMENT; ANIMAL HEALTH; EX-ANTE IMPACT ASSESSMENT; ANIMAL PRODUCTION

Harnessing our native chickens for livelihood. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.4; 6-7 (Mar 2019)*.

CHICKENS; INDIGENOUS ORGANISMS; ANIMAL HUSBANDRY; SMALL FARMS; ANIMAL HUSBANDRY; ORGANIC AGRICULTURE; ANIMAL HUSBANDRY; TECHNOLOGY

How to build creep boxes to keep your piglets safe. **Anon**. *Agriculture (Philippines) v. 23 (5) p. 41 (May 2019)*.

PIGLETS; ANIMAL HOUSING; SAFETY; ANIMAL HUSBANDRY

PCC [Philippine Carabao Center] exec's advise to rice farmers: integrate carabao dairying. **Roque, A.S.** *Agriculture (Philippines) v. 23 (06) p. 58-59 (Jun 2019)*.

WATER BUFFALOES; DAIRY INDUSTRY; MILK PRODUCTION; ORYZA SATIVA; RICE; CROP MANAGEMENT; SUBSISTENCE FARMING; COOPERATIVES; COOPERATIVE ACTIVITIES; PHILIPPINES

Philippine's Pekin duck authority believes that quality comes from proper care. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 62-64 (Aug 2019)*.

DUCKS; DUCK MEAT; ENTERPRISES; FARMS; EGGS; EGG INCUBATION; ANIMAL FEEDING; FEEDS; VITAMINS; WATER; ADAPTATION

Raising rabbits can be a low cost but profitable business. **Tan, Y.** *Agriculture (Philippines) v. 23 (5) p. 50-53 (May 2019)*.

RABBITS; ANIMAL HUSBANDRY; SMALL FARMS; PRODUCTION; DEMAND; RABBIT MEAT; PET ANIMALS

Student's rabbit meat sideline becomes profitable business. **Tan, Y.** *Agriculture (Philippines) v. 23 (06) p. 62-64 (Jun 2019)*.

RABBITS; ANIMAL HUSBANDRY; SMALL FARMS; RABBIT MEAT; MARKETS; BYPRODUCTS

L02 Animal feeding

Pilot testing of Protein Enriched Copra Meal (PECM): a valuable protein fee ingredient for swine and poultry. **Pham, L.J.** *2017 TR-1784.*

A bioprocess system for the pilot scale production of the PECM at 1 MT capacity was established in order realize the full potential of the PECM technology as shown by its promising results at laboratory scale. The process design and construction of the pilot pant facility was jumpstarted with the construction of partial

building shell and embedded electrical roughing-ins in concrete column. Critical equipment necessary to carry out the production quota were either fabricated or purchased. Optimization if the process conditions for the production of PECM was done using Response Surface Methodology. Fractional factorial design as used to screen for factors that has significant influence on the protein enrichment of copra meal since the pilot plant facility is not yet fully functional, a 250 kg/batch PECM was done using existing facilities and equipment of the laboratory. Quality monitoring of the produced PECM showed an increase in crude protein content from 19-21% to 32-37% in dry weight basis while fiber was significantly reduced. Limiting amino acids in swine and poultry diets such as lysine, methionine+cysteine, threonine and tryptophan were improved by 89%. The PECM product showed higher degree of present in A. niger. In vitro dry matter digestibility studies showed that the bioprocessing of copra meal into PECM enhances its dry matter digestibility from 33.51% to 48.01%. The aflatoxin content of both raw copra meal and PECM falls within the tolerance limit of 20 ppb whereas Salmonella contamination was not detected in both samples. Acute toxicity testing in mice indicates that PECM is safe and non-toxic even at high levels. Process conditions for the production of PECM powder inoculants were also established. Statistical screening methods were done to establish a suitable carrier for the propagation of A. niger 3104 at high cell viability counts. The cost of producing PECM at 100kg capacity is projected to be PhP 19.77 based on the overall mass balance. Commercial testing and distribution of PECM products were conducted in collaboration with potential investors, private sectors and other small scale livestock raisers.

COPRA MEAL; SWINE; POULTRY; FEEDS; PROTEINS; NUTRITIVE VALUE; ANIMAL FEEDING

L72 Pests of animals

VSU [Visayas State University, Philippines] develops dewormer for goats. **Anon**. *Agriculture (Philippines) v. 23 (1) p.63 (Jan 2019)*

GOATS; MIMOSA PUDICA; TINOSPORA; HAEMONCHUS CONTORTUS; FLAVONOIDS; ANTHRAQUINONES; PHILIPPINES

L73 Animal Diseases

5th most common disease among pigs and how to avoid it. **Necessario, N.** *Agriculture (Philippines) v. 23 (08) p. 61 (Aug 2019)*.

PIGLETS; ANIMAL DISEASES; SYMPTOMS; DISEASE CONTROL; ANTIBIOTICS; VACCINATION; VETERINARY HYGIENE

Detection of multidrug-resistant Salmonella spp. in Philippine native swine (Sus scrofa L.) from selected municipalities of Quezon Province, Philippines. **De Mesa, C.A.E., Paller, V.G.V., Opulencia, R.B.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 56-66 (Mar 2019).*

The increasing demand for meat of Philippine native swine (PNS) has led to the expansion of its low-cost farming, which exposes both the animal and farmer to zoonotic pathogens such as Salmonella. Multidrug-resistant pathogens can hamper treatment and spread globally. This study aimed to determine the presence of multidrug resistant Salmonella in PNS from Quezon province, Philippines. Fecal matter from PNS (n = 58) and environmental samples (n = 58) from 29 farms were tested for Salmonella. Fifteen (25.6%) PNS and 14 (24.1%) environmental samples were found positive for Salmonella. Logistic regression analysis indicated that

swine age and farm management practices had no influence on the presence of Salmonella in PNS. Disk diffusion method against 11 antibiotic classes showed that Salmonella isolates from PNS were most commonly resistant to azithromycin (66.7%), tetracycline (53.3%) and ampicillin (46.7%). Five isolates exhibited multidrug resistance, namely, resistance to ampicillin, azithromycin and tetracycline (two isolates); resistance to ampicillin, azithromycin, tetracycline and amoxicillin-clavulanic acid; resistance to ampicilin, azithromycin and amoxicillin-clavulanic acid; and resistance to ampicillin, nalidixic acid and amoxicillin-clavulanic acid. These findings are the first on microbiological status of the PNS, and they provide useful information that may be adapted in developing management practices for effective and safe farming of PNS.

WILD BOAR; INDIGENOUS ORGANISMS; BREEDS (ANIMALS); SALMONELLA; DRUG RESISTANCE; ANIMAL HEALTH; DISEASE CONTROL; LIVESTOCK MANAGEMENT; ANTIBIOTICS; RESISTANCE TO CHEMICALS; PIGGERIES; PHILIPPINES

Holistic approaches in the diagnosis, prevention,control and treatment of animal pest and diseases: characterization and production of secondary metabolites from actinomycetes isolated from rare environments against methicillin-resistant Staphylococcus aureus in livestock. **Zulaybar, T.O., Papa, I.A.** 2017 TR-1761.

The Philippines, a biodiversity hotspot in the world, is an excellent source of microbes known to produce novel bioactive compounds. Actinomycetes are one of the most efficient groups in producing these bioactive compounds that have valuable medical, veterinary and agricultural applications. In particular, certain bioactive compounds from Actinomycetes have been found effective against methicillin-resistant Staphylococcus sp. (MRS), which is associated with dairy animals suffering from mastitis. From 39 milk samples collected from cows and goats suffering from mastitis from three dairy farms in CALABARZON [Cavite, Laguna, Batangas, Rizal, Quezon, Philippines], the three presumptive MRS isolates were chosen for this study. On the mannitol salt agar (MSA) with phenol red and 50 ppm oxacillin, the isolates were Gram-positive cocci, exhibited yellow colonies with red coloration and coagulase-negative. Through 16S rRNA sequencing similarity analysis, Isolate C 1225 was putatively identified as Staphylococcus lentus, and C1202 and G20 as Staphylococcus sciuri subspecies sciuri. Using three small Staphylococcus species as test organisms, 19 out of 135 actinomycete isolates from the Philippine soils were found showing antibacterial activity. The actinomycete isolate (S816), which had the most effective antibacterial property as gauged by cup cylinder method, was putatively identified as Streptomyces sp. But the species was not ascertained by 16S rRNA sequence similarity analysis. This isolate had a minimum inhibitory concentration (MIC) value lower than that of vancomycin, the only commercial antibiotic that has remained effective against MRS. Initial ethyl acetate extraction and bioautography assay detected presence of active compounds effective against MRS. A subsequent confirmatory test for methicillin resistance of the putative MRS isolates showed that only Staphylococcus G20 had stable resistance.

COWS; GOATS; STAPHYLOCOCCUS AUREUS; ACTINOMYCETALES; MASTITIS; ANTIMICROBIAL PROPERTIES; ANIMAL DISEASES; PHILIPPINES

Managing backyard swine disease. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 60-61 (Aug 2019).*

SWINE; ANIMAL DISEASES; INFECTION; DISEASE CONTROL; ANTIBIOTICS; VACCINATION; BREEDING METHODS; ANIMAL HUSBANDRY; SMALL FARMS

M- FISHERIES AND AQUACULTURE

M01 Fisheries and aquaculture - General aspects

ASEAN economic community: opportunities and challenges for the agriculture, fishery and forestry sectors. **Manalo, N.A.Q., Dorado, R.A.** *Jul 2017 TR-1798*.

FISHERIES; FISHERY PRODUCTION; FISHING OPERATIONS; FISHING METHODS; FISHERY POLICIES; EXPORTS; CONTROLLED PRICES; AQUACULTURE; ASEAN

Coral and giant clam gardens: experiences and lessons in establishing a payment for ecosystems services (PES) project in Taytay, Palawan, Philippines. **Calanog, L.A.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines): FORESPI, 2018*. *p. 16*.

This paper provides an account of the pioneering efforts of Taytay, a coastal lake municipality in Palawan, Philippines, in establishing payment for ecosystem services (PES) as a sustainable financing mechanism to protect and manage its marine resources. It describes the experiences and lessons generated in establishing coral and giant clam gardens (CGCG) as a PES scheme. These are presented according to the FOUR STAGES in establishing PES. Stage 1 describes the results of the benchmarking assessment (status of marine resources including economic valuation, socio-demographic characteristics of households, institutional/political profile of the study barangays or villages, and status of tourism), which informed the design of the PES scheme and its basic features. Stage 2 presents how CGCGs as a means of coral reef restoration and protection were established in the context of a PES scheme. It details the process of how TOURISM as ecosystem service (ES) was defined, how the CGCG was conceptualized, and how the ES buyers and sellers were identified. It also describes the establishment and monitoring of the underwater gardens, as well as the training provided to the fishermen who were involved in these activities. It likewise outlines the findings of the willingness-to-pay (WTP) study, whose results provided the basis for determining the proposed tourism fees and revenue sharing system. Stage 3 describes the structuring of the CGCG-PES deal and the crafting of the Memorandum of Understanding (MOU) that defines the roles and responsibilities of key players in the implementation of CGCG. And finally, Stage 4 focuses on the establishment of conservation and sustainable tourism development fund and its importance, as well as the process of drafting the ordinance creating the fund.

CORALS; CLAMS; CORAL REEFS; ECOSYSTEMS; SERVICES; RESOURCE MANAGEMENT; TOURISM; COSTS; ECONOMIC VALUE; PHILIPPINES

Making of our 'blue economy'. **Guerrero, R.D**. *Agriculture (Philippines) v. 23 (4) p. 30 (Apr 2019)*.

MARINE AREAS; MARINE RESOURCES; BIODIVERSITY; ECOSYSTEMS; SUSTAINABILITY; RESOURCE MANAGEMENT; ENVIRONMENTAL POLICIES; LOCAL GOVERNMENT;

M12 Aquaculture production and management

Floating tilapia hatchery in Sampaloc Lake [San Pablo City, Laguna, Philippines]. **Guerrero, R.D.M.** *Agriculture (Philippines) v. 23 (07) p. 26-27 (Jul 2019)*.

TILAPIA; FISH CULTURE; CAGE CULTURE; FINGERLINGS; PHILIPPINES

From the trap [bobo, fish traps]. **Into, A.** *Agriculture (Philippines)v. 23 (4) p. 40-44 (Apr 2019).*

FISHES; TRAPS; FISH CAGES; FISHING METHODS; FISHERMEN

Growing tilapia in a raceway. **Dela Cruz, R.T.** *Agriculture (Philippines) v. 23 (08) p. 28; 30-31 (Aug 2019)*.

TILAPIA; FISH CULTURE; FINGERLINGS; FISH PONDS; INDIGENOUS KNOWLEDGE; ETHNIC GROUPS; RESOURCE MANAGEMENT; BIODIVERSITY; SOCIAL PARTICIPATION; FARMERSPROFITABILITY; PRODUCTIVITY; PROFIT

Mamburao, Occidental Mindoro: emerging as the now 'tuna capital of the Philippines'. **Urlanda, R.V.** *Agriculture (Philippines) v. 23 (1) p.24; 26-27 (Jan 2019).*

THUNNUS; FISHERY RESOURCES; POSTHARVEST TECHNOLOGY; RESOURCE CONSERVATION; PHILIPPINES

Managing our 'Curacha' [Spanner crab, Rarina rarina] fishery. **Guerrero, R.D.III**. *Agriculture (Philippines) v. 23 (3) p.28 (Mar 2019)*.

CRABS; FISHERY RESOURCES; HARVESTING; TRAPS; RESOURCE CONSERVATION

New Buguuey [Cagayan, Philippines] hatchery launched. **Prudencio, M**. *Agriculture (Philippines) v. 23 (3) p.53 (Mar 2019*).

TILAPIA; FINGERLINGS; FISH FARMS; FISH CAGES; FISH; AQUACULTURE; PHILIPPINES

Producing insect meal and oil for fish feeds. **Guerrero, R.D.III**. *Agriculture (Philippines) v. 23 (6) p. 24-25 (Jun 2019).*

FISHES; FISH FEEDING; DIPTERA; FEEDING; FEEDS; INGREDIENTS

Retired couple runs a successful aquaculture business with their millenial 2011. **Tan, Y.** *Agriculture (Philippines) v. 23 (08) p. 32-35 (Aug 2019)*.

CHANOS; SCYLLA; CRABS; PENAEUS MONODON; FISH PONDS; FISHING METHODS; ANIMAL FEEDING; HARVESTING; WATER QUALITY; MONITORING

N-AGRICULTURAL MACHINERY AND ENGINEERING

N20 Agricultural machinery and equipment

ADAMCO distributes hugh-tech Yanmar machinery in the Philippines. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.14;16;18-19 (Mar 2019).*

TRACTORS; EQUIPMENT; DESIGN; EQUIPMENT PERFORMANCE; PHILIPPINES

Canex innovative farming solutions boost harvesting efficiency. **Anon**. *Agriculture (Philippines) v. 23 (4) p. 61 (Apr 2019)*.

MECHANIZATION; HARVESTERS; EQUIPMENT PERFORMANCE; DESIGN

Developing production and post harvest technologies for heirloom rice production in the Cordilleras [Philippines]. **Batcagan, J.D., Credo, R.M.S., Sabigan, N.A., Conception, M.S., Romero, M.V., Ilar, G.Y.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express

path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 121 (Jul-2018)*.

Heirloom rice are indigenous cultivars that have been passed down for generations through family members and are normally grown in small farms. They command higher prices in niche market locally/internationally mainly due to their excellent eating quality and nutritional value. However, potential is a lucrative livelihood is hindered by factors such as high labor demand in production and significant postharvest losses. To address such challenges, the Heirloom Rice Project introduced various farm machineries fitted for these small land holdings to mechanize land preparation and threshing operation. Testing and evaluation results of the machines recorded a significant reduction in time and labor. The field capacity of the micro tiller prototype was at 850 meters2/hr as compared to the traditional manual trampling at 50 meters2/hr. Moreover, an improved ouput of 470 kg/hr using the mini thresher was achieved from only 17 kg/hr with manual threshing. Cost analysis indicated that manual land preparation at PhP 2.35/ meters2 can be reduce to Php 0.45/ meters2 with micro tiller. Meanwhile, the cost of PhP 2.57/kg paddy threshing through flailing or manual pounding can be trimmed down to PhP 1.48/kg using the mini thresher. To maximize the usefulness of these equipment, their design should be further optimized in terms of efficiency, ease of use, and portability to suit the Cordillera terrain. Along with mechanization, postharvest technology for heirloom rice was developed through a two-way process. Existing best farming practices were documented while simultaneously identifying areas for improvement. A location-specific package of technology was generated combining such farming practices with recommended methods in each specific postharvest process like proper timing of harvest, appropriate drying practice, milling, proper storage, and packaging techniques. These are now translated into technology flipcharts as an IEC material to facilitate a more efficient transfer of knowledge from development workers to farmer beneficiaries.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; PLANT PRODUCTION; TECHNOLOGY; POSTHARVEST EQUIPMENT; TECHNOLOGY TRANSFER; SITE PREPARATION; TERRACES; PHILIPPINES

Development of sensitive prototype sensor for monitoring insecticide residues in fruits and vegetables to address current MRLS [maximum residue limits]. **Calumpang, S.M.F., Tapia, A.K.G., Manalo, A.P.A., Torrizo, L.F.B., Lacsamana, M.S.** 2017 TR-1791.

The study focused on the design and fabrication of photodiode based transducer for a diffraction based biosensor for pesticide residue detection. The transducer device features a microcontroller-based data logging unit for measuring, recording and transmitting data while the sensors of this transducer features an array of photodiode for measuring multiple diffraction spots simultaneously. The aim of the transducer is for the measurement of the intensity of diffracted light spots, varied by the change in the refractive index of the acetylcholinesterase enzyme stamped fluid cell when profenofos or malathion insecticide was introduced. In order to simulate the reaction of the biological elements, a variable intensity laser driver was used for testing the device. Based on test results, at significance level of 5% it was found out that the fabricated transducer had no significant difference in response as compared to the laboratory photodetector. In general, the study succeeded on the design and fabrication of the transducer device as the device was able to record the reaction of actual samples. For further development, additional processing for immediate diffraction spot detection and percent intensity change calculation is recommended. Using acetylcholinesterase isolated from the pig brain as binding element, the diffraction based sensor was tested for profenofos and malathion. A linear calibration curve was made and the sensor has a limit of detection of 0.092 ppm for malathion and

0.079 ppm for profenofos. The commodities were also spiked with its maximum residue limit (MRL) concentration in order to generate the percent intensity range that will indicate compliance. The percent recoveries of the extract was within the matrix spiked percent recovery range which is between 75 to 125 percent recovery. Using the data, a pass or fail mechanism can be used since further analysis is needed to validate the method that will quantify the pesticide content of the commodities.

FRUITS; VEGETABLES; INSECTICIDES; RESIDUES; SENSORS; MAXIMUM RESIDUE LIMITS; BIOSENSORS; DESIGN; TECHNOLOGY; TECHNOLOGY TRANSFER

Evaluation and analysis of two village level models for sweet sorghum cane processing in Ilocos Norte, Philippines. **Layaoen, H.D.Z.** *Philippine Journal of Crop Science (Philippines) v 38 (3) p.18-30 (Dec 2013)*.

Two sweet sorghum cane processing systems consisting of a stationary cane mill (SCM) and a mobile cane mill (MCM) that became operational as a village-level sweet sorghum processing system in Ilocos Norte [Philippines] were evaluated. With SCM, the stalk crusher was permanently established in barangay [village] Bungon, Batac, Ilocos Norte as the central processing station (CPS). Harvested stalks were hauled by trucks from production sited to the CPS for processing. For the MCM model, a reconditioned jeep carries the crusher to the plantation sire were stalks are crushed. Extracted juices were hauled to the CPS for processing. Cost wise, MCM is Php 100,000 more expensive than SCM (PhP 150,000) due to the cost of the jeep. The stakeholders had high confidence that the two village level cane mill systems could fastrack sweet sorghum processing into a desired product which could translate to income generation and profitability. The advantages of SCM over MCM are the lower energy cost and lower biomass fuel cost of pasteurization due to the 80% bagasse component of fuel. With the MCM, biomass weight lost due to staging did not occur and crushing efficiency (CE) and juice yield were greater by 5.15% and 309 kg, respectively than the SCM.This must be due to the closer roller clearance in MCM. The CE of a modified laboratory model (MCM) was reported at 51.6% greater by 22.15% than the SCM (29.45%) and by 16.95% than the MCM (34.6%). Such factors should be given particular consideration in the SCM or MCM to increase CE and make them more effective for village level sweet sorghum processing. If improved, the SCM and MCM systems will be significant initiatives which could be replicated for use in sweet sorghum communities intending to indulge in the bioethanol industry.

SORGHUM BICOLOR; BIOGAS; BIOFUELS; BIOMASS; PROCESSING; PHILIPPINES

Kubota unveils newest line of agricultural machinery. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23 (4) p. 34-37 (Apr 2019)*.

FARM EQUIPMENT; MECHANIZATION; EQUIPMENT PERFORMANCE; DESIGN; FARMS;

Villar [Senator Cynthia A. Villar] goes for farm mechanization, inbred rice seeds. **Yap, J.P.Jr**. *Agriculture (Philippines) v. 23 (3) p.24-26 (Mar 2019)*.

ORYZA SATIVA; RICE; VARIETIES; FARMS; MECHANIZATION; TECHNOLOGY; FARMERS; TECHNOLOGY TRANSFER; COOPERATIVE ACTIVITIES

P- NATURAL RESOURCES AND ENVIRONMENT

P01 Nature conservation and land resources

700,000 forest trees in Mt. Purro Nature Reserve [Talawis, Antipolo City, Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (3) p.38-39 (Mar 2019)*.

SWIETENIA; ACACIA MANGIUM; GMELINA; INDIGENOUS ORGANISMS; FOREST RESERVES; PROTECTED FORESTS; RURAL AREAS; TOURISM; FARM HOLIDAYS; PHILIPPINES

Appreciating sustainable development (4th of a series). **Hilario, F.A**. *Agriculture (Philippines) v. 23 (3) p.30-31 (Mar 2019)*.

NATURAL RESOURCES; SUSTAINABILITY; RESOURCE MANAGEMENT; ENVIRONMENTAL IMPACT; ECONOMIC VIABILITY; SOCIAL PARTICIPATION

Anthropogenic activities, water quality and phytoplankton diversity in Lake Calibato, San Pablo and Rizal, Laguna [Philippines]. **Chua, Z.R.C., Dalisay, M.G.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) : FORESPI, 2018. p. 13.*

The study aimed to contribute to the monitoring research of freshwater ecosystem by identifying the anthropogenic activities, water quality and phytoplankton diversity during the months of July to November 2016. The study area is Lake Calibato, a small crater lake in transboundary of San Pablo; Rizal, Laguna [Philippines] and one of the famous seven lakes of San Pablo. The lake is the deepest among the seven lakes and has been heavily used for economic resource that functions as aquacultures. The presence of informal settlers and illegal fish cages largely affect the quality of Lake Calibato. Nonexistence of development for tourism and usual monitoring in the Lake affected the lifestyle and economic stature of the community. The physiochemical parameters of water were measured in terms of pH, Temperature, water transparency, dissolved oxygen, biological oxygen demand (BOD), nitrate, phosphate, total dissolved solids (TSS), total suspended solids, and bacteriological properties of water (total coliform). Diversity of phytoplankton was assessed using Shannon-Weiner Index and Simpson Index. BOD, Phosphate and Nitrate exceeded the standard limit of DENR while the rest of the parameters (DO, pH, temperature, water transparency, TDS) are within the limits. There are 19 species of phytoplankton identified during the sampling period. General assessment of the anthropogenic activities is recommended. Community awareness in the Lake should also be monitored for the improvement and development of the area that is in need of the support of the related agencies and stakeholders.

LAKES; WATER QUALITY; ENVIRONMENTAL IMPACT; PHYTOPLANKTON; BIODIVERSITY; PHILIPPINES

Assessment of agroecosystem in Cambantoc Watershed Mount Makiling Forest Reserve ASEAN Heritage Park, Philippines. **Castillo, L.A., Castillo, M.L., Canceran, M.S., Barua, L.D., Breva, R.V., Alegre, A.C., Gestiada, E.C., Barredo-Parducho, V.D., Limpiada, A.A., Gonzalvo, K.J.P., Caña, M.M., Bantayan, N.C.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Changing Landscape and Climate: Proceedings,*

Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) College, Laguna (Philippines): FORESPI, 2018 p. 12.

An agroecosystem is an ecosystem where biodiversity performs a variety of ecological services. It is very necessary to maintain its biodiversity to ensure continued supply of goods and services. This paper aims to determine the stand composition and diversity to access the effects of agriculture to forest natural landscape. Fifty 20m x 20m plots were established in a 2-hectare long term ecological research plot in an agroecosystem landscape in Mount Makiling Forest Reserve ASEAN Heritage Park (MMFR AHP). Trees with at least 10cm diameter at breast height (DBH) were measured and mapped. Study revealed a dominance of forest trees in Cambantoc watershed, an agroecosystem landscape area in MMFR AHP. A total of 726 individuals distributed to 42 families, 84 genera and 112 species were recorded. Of these, about eight percent are agricultural trees represented by only four species namely: Citrus reticulata, Cocos nucifera, Coffea arabica and Theobroma cacao. Importance values showed Displodiscus paniculatus (92.20) and C. Arabica (8.08) as dominating forest and agricultural species in the area, respectively. C. Arabica is the only agricultural species among the top 10 dominant species due to the existence if civet cat and other dispersal agents in the watershed. Shannon-Weiner index showed a relatively high diversity at 3.842 and a moderately low evenness at 0.4162. Cambantoc watershed with agriculture as dominating landuse is highly diverse area and planting of agricultural species along the forest periphery has minimal effect of forest diversity. The agricultural crops support the existence of wildlife animals that thrive in the area like civet cat. Furthermore, presence of threatened species such as Diospyrosblancoi, Syzygium nitidum, and Toona calantas makes Cambatoc a highly critical watershed requiring strict conservation and protection.

WATERSHEDS; FOREST RESOURCES; FORESTS; LANDSCAPE; FOREST TREES; CROPS; BOTANICAL COMPOSITION; AGROECOSYSTEMS; FOREST RESERVES; PHILIPPINES

Attitude, knowledge and practices (KAP) of stakeholders towards sustainable management of the Mts. Palay-Palay/Mataas na Gulod Protected Landscape (MPPMGPL) Southern Luzon, Philippines. **Ching, J.A., Mercurio, A.L., Salibay, C.C., Torres, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 18.*

The Mts. PalayPalay/Mataas na Gulod Protected Landscape (MPPMGPL) is a national park which was designated as protected landscape which is located in the municipalities of Maragondon, Ternate in Cavite and Nasugbu in Batangas, Southern Luzon Philippines. The mountain range is consist of three peaks namely Mount Palay-Palay, Mount Mataas na Gulod and Pico de Loro. This study made an effort to determine the knowledge, attitudes and practices (KAP) of relevant stakeholders on management of the protected landscape. It addressed the issues relevant to the KAP of the concerned stakeholders on management issues and understanding of concepts in relation to protection and biodiversity conservation. The key target institutions of this communication project involved different stakeholders which include Protected Area Management Board (PAMB) members, local government units (LGUs), forest rangers and tenure migrants of the said protected landscape. This project emphasized communication between different stakeholders in terms of management as well as protection and conservation efforts of the biodiversity focused on its flora and fauna. To this end, clear understanding of stakeholder's current knowledge of, and responses to, the options was considered important for developing the approaches. Knowledge towards protected area management was

found satisfactory among the stakeholders. Most of the respondents have good understanding of the benefit of protection and conservation of species diversity.

PROTECTED FORESTS; LANDSCAPE; RESOURCE CONSERVATION; BIODIVERSITY; HUMAN BEHAVIOUR; INDIGENOUS KNOWLEDGE; PHILIPPINES

Coral and giant clam gardens: experiences and lessons in establishing a payment for ecosystems services (PES) project in Taytay, Palawan, Philippines. **Calanog, L.A.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines): FORESPI, 2018*. *p. 16*.

This paper provides an account of the pioneering efforts of Taytay, a coastal lake municipality in Palawan, Philippines, in establishing payment for ecosystem services (PES) as a sustainable financing mechanism to protect and manage its marine resources. It describes the experiences and lessons generated in establishing coral and giant clam gardens (CGCG) as a PES scheme. These are presented according to the FOUR STAGES in establishing PES. Stage 1 describes the results of the benchmarking assessment (status of marine resources including economic valuation, socio-demographic characteristics of households, institutional/political profile of the study barangays or villages, and status of tourism), which informed the design of the PES scheme and its basic features. Stage 2 presents how CGCGs as a means of coral reef restoration and protection were established in the context of a PES scheme. It details the process of how TOURISM as ecosystem service (ES) was defined, how the CGCG was conceptualized, and how the ES buyers and sellers were identified. It also describes the establishment and monitoring of the underwater gardens, as well as the training provided to the fishermen who were involved in these activities. It likewise outlines the findings of the willingness-to-pay (WTP) study, whose results provided the basis for determining the proposed tourism fees and revenue sharing system. Stage 3 describes the structuring of the CGCG-PES deal and the crafting of the Memorandum of Understanding (MOU) that defines the roles and responsibilities of key players in the implementation of CGCG. And finally, Stage 4 focuses on the establishment of conservation and sustainable tourism development fund and its importance, as well as the process of drafting the ordinance creating the fund.

CORALS; CLAMS; CORAL REEFS; ECOSYSTEMS; SERVICES; RESOURCE MANAGEMENT; TOURISM; COSTS; ECONOMIC VALUE; PHILIPPINES

Development of Community-Based Ecotourism Index in Pamitinan Protected Landscape in Rodriguez, Rizal [Philippines]. **Castillo, H.S., Hernandez, H.A.A., Francia, A.D., Pintor, L.L.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) 2018. p. 16*.

The study focused on the Development of Community-Based Ecotourism (CBET) Index in Pamitinan Protected Landscape (PPL) in Rodriguez, Rizal [Philippines]. The study aimed to characterize the Pamitinan Protected Landscape and develop CBET Index. Research methods used include survey, key informant interview, and focus group discussion. Data was analyzed through descriptive and inferential statistics, normalization of data, and Analytical Hierarchy Process. Findings showed that the land in PPL have an elevation of 100-200 meters above sea level (masl) which accounts to almost 40 percent of the land area. There are six types of land cover in PPL such as shrubs, wooded grassland, open/barren, grassland, built-up and inland water. There were 19

species of birds and 13 species of mammals that are found throughout the year. There were also 18 tree species and 30 plant species found in the area. The CBET Index in Pamitinan Protected landscape revealed that Community Participation obtained the highest value which is 0.2364. Implementation obtained 0.2116 while Environmental Conservation got 0.1533. Tourism Activities obtained the lowest dimension which is 0.1269. The result of CBET Index implies the outstanding implementation of the DENR, LGUs, tenured migrants, and volunteers. The active participation of the various stakeholders serves as the key for the successful implementation of community-based ecotourism in a protected landscape.

LANDSCAPE; PROTECTED FORESTS; TOURISM; RURAL AREAS; SOCIAL PARTICIPATION; PHILIPPINES

Documentation of the green practices by the selected cooperatives in Laguna [Philippines]. **Quicoy, A.R., Lawas, T.P.** *2016. TR-1793.*

Cooperative is a form of people's organization with primary goals of helping its members to help them attain their economic and social aspirations. The last PNoy's administration believes that cooperative is a good strategy for poverty alleviation and sustainable development. For cooperatives to be truly a strategy for sustainable development, it must not only be vehicle for their members' economic and social aspirations, but must also be a vehicle for environmental protection and resource conservation. This study was conducted to gather the 'green' practices of the cooperatives in Laguna [Philippines]. Specifically, the objectives were to: 1) Describe the profile of the cooperatives that perform 'green' practices; 2) Identify the bio-enterprises engaged in by the selected cooperatives and describe the processes and 'green' practices in their conduct; 3) Narrate and document the circumstances that led the cooperative to undertake measures and processes that are healthy to the environment; and 4) Identify issues/constraints/problems encountered by the cooperatives in the adoption of environment-friendly practices. It was found that not many cooperative s were consciously doing green practices and sustainably doing it yet. Six cooperatives were found to have been doing green practices that were documented in the video presentation and brochures. They serve as the outputs of the research that would inspire and motivate other cooperatives to follow. The common practices were doing organic farming, the construction of 'green' building and other simple office resource-conservation practices such as rain-water collection, water and energy conservation practices (use of LED lights, limiting the use of air-conditioning units). For transport service cooperative, it was the use of signages in the jeepneys like 'No Smoking', 'Bawal Magtapon ng Basura sa Labas ng Sasakyan', the putting of trash can inside the jeepney, and the use of bio-diesel fuel. It is the authors recommendation for the CDA or Cooperative-in-charge offices to include in their trainings/capacity-building program topics on environment to raise the cooperatives level of awareness on environment. The cooperatives can also do 'green' projects with the use of their CEDF fund thus also practicing the 7th principle of 'Concern for the community.

FARMS; COOPERATIVES; ENVIRONMENTAL PROTECTION; SUSTAINABLE DEVELOPMENT; RESOURCE CONSERVATION; COMMUNITY INVOLVEMENT; ORGANIC AGRICULTURE; WASTE MANAGEMENT; POLLUTANTS; PHILIPPINES

Integrated park restoration, protection and conservation of Mt. Palay-Palay, Mataas na Gulod Protected Landscape, Southern Luzon, Philippines. **Ching, J.A., Mercurio, A.L., Salibay, C.C., Torres, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).: FORESPI, 2018. p. 14.*

Mts. Palay-palay/Mataas-na-Gulod Protected Landscape was considered as the last frontier of Cavite province [Philippines]. The park covers three peaks, namely Pico de Loro, Mt. Palaypalay and Mt. Mataas na Gulod. Within the area, qualified Tenured Migrants were distributed specifically in the designated multiple use zones of the protected landscape covered by the Protected Area Community-based Resource Management Agreement issued by the government in 2002. The 2013 Management Effectiveness and Capacity Assessment (MECA) result conducted for the protected areas (PA) highlighted adverse claims and land disputes as the major threats in the area that resulted to biodiversity and forest degradation. This project in totality would like to focus in reducing adverse claims and encroachment/land disputes and more importantly forest cover quality degradation as these are the underlying causes of biodiversity loss in Protected Landscape (PL). In its recent findings, a vast area of the PL has been identified for rehabilitation because of the impact of the treats. Specifically, this project can improve and update baseline and protected area management plan. Such contribution may lead to (1) enhanced governance structures, plans and programs for effective management of the protected landscape; (2) resiliency thru full and effective participation of key holders at all levels in biodiversity conservation and protected landscape preservation by developing an improved attitude and perception towards protected area conservation and protection; and (3) increase in the number of collaborators that would realize the plans and programs for the PL by enforcing |Biodiversity regulations by Local Government Units and Protected Area Management Board and strengthening partnership commitment in sustaining initiatives. In addition, the project in parallel to efficient implementation can incorporate mechanisms to ensure that every activity within area is properly documented and reported. By large, the project's outcomes and lessons that were generated can be used as guides in formulating and planning forest management strategies for the sustainability of the PL.

FORESTS; PROTECTED FORESTS; LANDSCAPE CONSERVATION; NATURE RESERVES; SUSTAINABILITY; PHILIPPINES

Making of our 'blue economy'. **Guerrero, R.D**. *Agriculture (Philippines) v. 23 (4) p. 30 (Apr 2019)*.

MARINE AREAS; MARINE RESOURCES; BIODIVERSITY; ECOSYSTEMS; SUSTAINABILITY; RESOURCE MANAGEMENT; ENVIRONMENTAL POLICIES; LOCAL GOVERNMENT;

Point to surface mapping of selected soil properties using different interpolation techniques at Bangan National Park. **Vallesteros, S.F., Vallesteros, A.P., Mammuad, J.C., Tarranco, A.S., Budong, M.E.S., Rodriguez, J.M., Yogyog, R.Y., Dela Cruz, G.T., Peralta, M.J., Inaldo, B.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Changing Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 19*

Three spatial analysis algorithms, namely: Inverse Distance Weighted (IDW), Kriging, and Spline were used to interpolate soil pH, Organic Matter (OM), and soil nutrients such as Niitrogen (N), Phosphorus (P), and Potassium (K) from sample point data. A random-point sampling was carried out to collect soil samples. Samples were analyzed in the Department of Agriculture R-02, Cagayan Valley Integrated Agricultural Laboratory. Interpolation was carried out in ArcGIS 10.2. Root Mean Square Error (RMSE) was calculated to evaluate the relative precision of the interpolation methods. IDW had the lowest RMSE for pH, 0M, and K and kriging had the lowest RMSE in P. Spline had the highest RMSE for all of the four properties except for pH.

Lower RMSE implies better interpolation result. The results showed that IDW has the nearest value as compared to the soil laboratory result (Standard Deviation). Surface maps are important parameters for decision making in terms of land use, soil-plant compatibility, and soil improvement activities. Future research should take into account the topographic factors, existing vegetation, and other important site properties.

SOIL CHEMICOPHYSICAL PROPERTIES; SAMPLING; CARTOGRAPHY; DECISION MAKING; LAND USE; NATIONAL PARKS

Review and update of the 2004 National List of threatened terrestrial fauna of the Philippines. **Gonzalez, J.C.T., Layusa, C.A.A., Afuang, L.E., Duya, M.R.M., Heaney, L.R., Bolete, D.S., Tabaranza, D.G.E., Española, C.P., de Ven, W.A.C., Diesmos, A.C., Causaren, R.M., Diesmos, M.L.L., Lagat, R.T., Realubit, N.D.C., Sy, E.Y., Lit, I.L.Jr., Naredo, J.C.B., Lastica-Tennura, E.A., Pasicolan, S.A., Tagtag, A.M., De Leon, J.L., Lim, T.M.S., Ong, P.S.** *Sylvatrop (Philippines. The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 73-144 (Jan-Jun 2018)*.

In 2004, the Philippines' Department of Environment and Natural Resources issued the National List of Threatened Fauna Species. Between 2015 and 2017, this was reviewed by assessing 1994 taxa, including 57 mammals, 663 birds, 355 reptiles, 115 amphibians, and 784 invertebrates, using the threatened categories specified in the 2001 Wildlife Resources Conservation and Protection Act. Another group evaluated the initial assessment if the criteria were properly applied and the taxa were assigned to their appropriate categories. Fifty-five percent or 1105 species were place under four threatened categories: Critical Endangered (CR)-60; Endangered (EN)-61; Vulnerable (VU)-439; Other Threatened Species (OTS)-545. For the first time, invertebrates were included in the assessment and accounted for nearly 70% of species listed. Among the vertebrates, an increase in the number of taxa in all categories was notable and most pronounced in birds in all threatened categories. For reptiles, the number doubled but half of these were under OTS. For amphibians, the increase was due to species classified under CR and OTS. For mammals, the number of threatened species also increased except under VU. The number of threatened endemic species increased to 168 species, representing 15% of all threatened taxa.

FAUNA; RESOURCE CONSERVATION; ENDANGERED SPECIES; INDIGENOUS ORGANISMS; PHILIPPINES

Socio-economics survey of the local community in Mrs. Palay-Palay/Mataas na Gulod Protected Landscape, Southern Luzon, Philippines. **Ching, J.A., Mercurio, A.L., Salibay, C.C., Torres, M.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines).- College, Laguna (Philippines): FORESPI, 2018. p. 17*.

Mts. Palay-palay/Mataas-na-Gulod Protected Landscape is a biologically-rich protected landscape (PL) located in the provinces of Cavite and Batangas, Luzon island in the Philippines. It represents a priceless conservation area with its densely stocked forest cover and unique wildlife resources. The PL hosts some rare species and vulnerable species endemic to the country. In this study, the plant and animal forest resources utilized by the members of the local community were identified vis-a-vis and their perceived constraints to economic activity. The level of conservation awareness and attitudes in relation to the conservation program implemented in the protected landscape was also determined. Information on the community's socio-economic condition, awareness and attitude conservation was collected by using the Household Survey Questionnaire (HSQ)

modified. Forest resource utilization survey through personal interviews and household views were conducted to gather in-depth information on preference and utilization of forest by the community with the validation of some respondents' responses to the HSQ used. Area visitations using direct observation were also performed for confirmation and proper documentation of the forest resources. Based on the findings, the members of the community prefer 55 plant and 14 animal species they directly utilized from MPPMGPL both for subsistence and income generation. The manner of resources utilization is tied to both sustainable, such as the habit of soil composting, and destructive activities, such as involvement to large scale charcoal-making action. The members of the community exhibit high socio-economic dependence to MPPMGPL with more than half of their average monthly household earning linked to forest resources utilization. Bamboo stick production, agroforest farming including livestock and charcoal-making activities appear to be important income generating activities in the area. The members of the local community seem to acquire high level of positive biodiversity conservation attitude but low level conservation awareness.

PROTECTED FORESTS; RESOURCE MANAGEMENT; BIODIVERSITY; NATURE CONSERVATION; INDIGENOUS ORGANISMS; RURAL COMMUNITIES; HOUSEHOLDS; INCOME; PHILIPPINES

Sustainable upland farming through the establishment of 'Barangay [village] Sagip Saka' (Conservation Farming Villages project – CFVs) in General Nakar, Quezon [Philippines]. **Cruz, R.V.O., Carandang, W.M., Astejada, J .F., Aumentado, M.J., Gevana, D.T., Pilas, M.T., Galapia, G.A., Astreda, J., Ojeda, M.N., Aguilon, B.C., Magno, G.V.** *2011 TR-1802*.

The Conservation Farming Villages (CFV) is a modality for improving human lives through better livelihoods, agricultural productivity, and environmental security of communities living in the marginal sloping lands to the prevailing climate changes. It aimed to help upland farmers improve their economic conditions by strengthening their capacities to manage natural resources thereby protecting their communities against environmental degradation while sustaining their sources of livelihood. The program adopted the community-based participatory approach to technology development, promotion and utilization; and multi-level technology promotion mechanism that would capacitate local extension/change agents. Such strategies would ensure sustainability of efforts in promoting upland farming technologies and approaches, and would strengthen the 'multiplier effect' of existing technology diffusion processes at the local level. CFV in Genral Nakar was implemented in three upland barangays/villages namely: Magsikap, San Marcelino and Minahan Norte. The project included the empowerment of farmer volunteers enabling them to become vanguards of sloping land resources by providing them with skills and knowledge in food, wood and fiber production and resource management; tapping the active leadership and participation of the local government units (municipal, barangay) in carrying out program activities down to the barangays level such as extension work, community organizing and facilitating market linkages and other support services; and provision of technical expertise and guidance of a state university/college in the province or the nearest site, in this case, the University of the Philippines Los Baños. A total of three farming villages having 15 farmer volunteers participated in the implementation in 15 model farms. A total of 56 hectares of sloping lands were initially developed by the project using participatory approach. A total of nine training courses were conducted resulting in participation of 410 participants. Three training shelters cum training and technology centers have been established in each of the barangays halls. The project had also produced 10 trainers from collaborative groups and institutions, especially those from the office of the Municipal Environment and Natural Resources Office of General Nakar. CFV involves the empowerment of farmers to become vanguards of sloping land

resources by providing them with skills and knowledge in food and fiber production and resources management; tapping the active leadership and participation of the local government units (municipal and barangays) in carrying out program activities down to the barangays level as extension work, community organizing, and facilitating market linkages and other support services; and provision of technical expertise and guidance by the state university/college in the province or nearest site.

FARMLAND; FARMERS; DEVELOPMENT PROJECTS; SUSTAINABILITY; HIGHLANDS; UPLAND CROPS; COMMUNITY DEVELOPMENT; LIVING STANDARDS; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

P06 Renewable energy resources

Bioethanol production from macroalgae and socio-ecological implications. **Fernandez, P.R.,Jr, Demafelis, R.B., Geganzo, L.G.L., Subade, R.F., Napilan-Espectato, L., Santiago, D.E.O., Movillon, J.L., Hourani, K., Gatdula, K.M., Magadia, R.V.Jr.** *TR-1732 2016 .*

SARGASSUM; ALGAE; SPECIES; ETHANOL; GASES; BIOFUELS; PRODUCTION; LAW; POLICIES; SOCIAL INDICATORS

Bioethanol production from macroalgae and socio-ecological implications: Project 1: socio-ecological assessment and analysis for algal biomass production, development and promotion. **Fernandez, P.R.,Jr, Geganzo, L.G.L., Subade, R.F., Napilan-Espectato. L.** Bioethanol production from macroalgae and socio-ecological implications. Fernandez, P.R.Demafelis, R.B.Geganzo, L.G.L.Subade, R.F.Napilan-Espectato, L.Santiago, D.E.O.Movillon, J.L.Hourani, K.Gatdula, K.M.Magadia, R.V.Jr.- College, Laguna (Philippines), 2016. TR-1732.- p. 1-71

This study focuses on three parts: the overview and review of biofuel law, policy and promotion in the Philippines, the bioethanol industry stakeholder analysis, and the mapping of Sargassum (brown algae) as feedstock for the third generation of bioethanol. The literature review focuses on the main legal and institutional framework for bioenergy promotion and development in the Philippines in the last decade. The first legal instrument is Republic Act No. 9367 or the Biofuels Act of 2007. The law provides fiscal incentives and mandates the use of biofuel. The law imposes mandatory requirements to blend biofuels with gasoline and diesel in the transport sector, thus supporting the development of alternatives to fossil fuels. The second legal instrument is Republic Act 953 or the Renewable Energy (RE) Act of 2008. It was passed with the objective of specifically promoting the development of renewable resources of energy. It basically created a framework for the commercialization of renewable energy, aiming to accelerate the use of other forms of bioenergy. Other relevant laws and policies are also highlighted. An analysis of the legal framework for the promotion and development of biofuel in the Philippines is then pursued, together with additional insights on our future trends. The industry stakeholder analysis looks into the roles and participation of different actors in the society in the bioethanol industry, as well as their relationships with each other. Their optimism in the development of the industry were sought through a devised Industry Optimism Scaling and it appeared that in general, stakeholders are confident on the future biofuels. The results of the analysis were utilized to make recommendations on the improvement of the relationships among actors to facilitate advancement and growth in the industry. The study also looked into the areas where Sargassum could be found in the Philippines. Through community participatory mapping and thorough confirmation tests, the research team was able to come up with prevalence maps of the brown algae species in six different sites in the country.

However, due to some regulation on the restriction gathering, harvesting and cultivation of such species, the research team recommended several measures and studies for the Department of Energy in the future before going into a full-scale production.

Bioethanol production from macroalgae and socio-ecological implications Project 2: process economic analysis, energetic and GHG reduction potential of bioethanol production from macroalgae. **Demafelis, R. B., Santiago, D.E.O., Movillon, J.L., Hourani, K.A., Gatdula, K.M., Magadia, R.V.** Bioethanol production from macroalgae and socio-ecological implications, Fernandez, P.R.,Jr, Demafelis, R.B., Geganzo, L.G.L., Subade, R.F., Napilan-Espectato, L., Hourani, K., Gatdula, K.M., Magadia, R.V.Jr. *2016. TR-1732. p. 72-113*.

Macroalgae, being one of the promising feedstocks for ethanol production, was assessed for its process economics, and GHG reduction potential. Two scenarios were explored. Scenario 1 considered cellulose, mannitol and alginic acid as substrates for bioethanol production while Scenario 2 includes the first two including alginic acid. Scenario 1 results show that this may not be feasible for ethanol production both economically and environmentally. However, energetic of Scenario 1 shows a positive outcome having an energy ratio of about 1.81:1. On the other hand, Scenario 2 results show that it has a good potential both in terms of its energetic and GHG reduction potential. Energy ratio for Scenario 2 is found to be 6.53:1. Considering the electricity surplus, its GHG reduction potential based on its annual emissions can be as high as 86.44% and based on gasoline offset, up to 60.33%. Moreover, if electricity surplus is not considered, the GHG reduction potential would still be high at 76.49%based on annual emissions and 68.17% based on gasoline offset. All of these high GHG reduction potentials can be realized by using rice hull as feed for power plant. Still, Scenario 2 is not economically feasible considering the prevailing feedstock cost of PhP8-12/L. this case can still be economically feasible by searching for means to lower the processing cost such as by making the technology of conversion of feedstock to bioethanol more efficient.

SARGASSUM; ALGAE; SPECIES; BIOFUELS; ECONOMIC ANALYSIS; PRODUCTION; ETHANOL; MANNITOL; ALGINIC ACID; REDUCTION

Comparative analysis of sugarcane and sweet sorghum bioethanol carbon footprints, carbon savings and carbon debt payback periods. **Demafelis, R.B., Alcantara, A.J., Movillon, J.L., Pacardo, E.P., Espaldon, M.V.O., Flavier, M.E., Eleazar, P.J.M., Tongko, B.D.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 10-22 (Dec 2015)*.

One of the parameters to assess the environmental sustainability of the bioethanol industry is to conduct carbon analysis and determine its effectiveness in terms of mitigating climate change. By comparing the carbon savings and carbon debt payback periods of two bioethanol feedstocks (sugarcane and sweet sorghum), not only the more environmentally sustainable bioethanol was revealed but also the potential complementary nature of these two feedstocks to significantly reduce the GHG emissions of the transportation sector was assessed. Carbon savings of a typical Philippine bioethanol production scenario for sugarcane was determined to be equal to 218.99% with a carbon footprint of -110,045.29 t CO sub 2 e/yr; while for sweet sorghum, the calculated carbon savings was 154.32% with a carbon footprint of -34,629.57 t CO sub 2 e/yr at equivalent fuel energy basis. Meanwhile, the carbon payback periods of 2-4 mo for sugarcane and 3-5 mo for sweet sorghum were derived from the calculated carbon debt incurred from construction equal to 65,730.39 t CO sub 2 e for sugarcane and 66,226.14 t CO sub 2 e for sweet sorghum. Taking into account the percent carbon savings calculated, the following combinations revealed to be able to

meet the global climate mitigation target by 2030: 20% biodiesel and 35% sugarcane bioethanol, 20% biodiesel and 45% sweet sorghum bioethanol. Although carbon savings of sugarcane bioethanol is higher than sweet sorghum bioethanol, both carbon savings were significant to payback carbon debts from constructing new bioethanol plants and to meet the global climate mitigation target.

SUGARCANE; SORGHUM BICOLOR; CARBON; FUELS; CLIMATIC CHANGE;

Evaluation and analysis of two village level models for sweet sorghum cane processing in Ilocos Norte, Philippines. **Layaoen, H.D.Z.** *Philippine Journal of Crop Science (Philippines) v 38 (3) p.18-30 (Dec 2013)*.

Two sweet sorghum cane processing systems consisting of a stationary cane mill (SCM) and a mobile cane mill (MCM) that became operational as a village-level sweet sorghum processing system in Ilocos Norte [Philippines] were evaluated. With SCM, the stalk crusher was permanently established in barangay [village] Bungon, Batac, Ilocos Norte as the central processing station (CPS). Harvested stalks were hauled by trucks from production sited to the CPS for processing. For the MCM model, a reconditioned jeep carries the crusher to the plantation sire were stalks are crushed. Extracted juices were hauled to the CPS for processing. Cost wise, MCM is Php 100,000 more expensive than SCM (PhP 150,000) due to the cost of the jeep. The stakeholders had high confidence that the two village level cane mill systems could fastrack sweet sorghum processing into a desired product which could translate to income generation and profitability. The advantages of SCM over MCM are the lower energy cost and lower biomass fuel cost of pasteurization due to the 80% bagasse component of fuel. With the MCM, biomass weight lost due to staging did not occur and crushing efficiency (CE) and juice yield were greater by 5.15% and 309 kg, respectively than the SCM.This must be due to the closer roller clearance in MCM. The CE of a modified laboratory model (MCM) was reported at 51.6% greater by 22.15% than the SCM (29.45%) and by 16.95% than the MCM (34.6%). Such factors should be given particular consideration in the SCM or MCM to increase CE and make them more effective for village level sweet sorghum processing. If improved, the SCM and MCM systems will be significant initiatives which could be replicated for use in sweet sorghum communities intending to indulge in the bioethanol industry.

SORGHUM BICOLOR; BIOGAS; BIOFUELS; BIOMASS; PROCESSING; PHILIPPINES

Performance analysis of nanosilica-in-fluid dispersion (nanofluid) derived from rice hull ash as coolant in heat exchanger. **Ignacio, Ma.C.C.D.** *2016 TR-1744.*

The development of performance-enhancing nano-materials from renewable, readily available sources for a variety of value-added applications is one attractive area of research in our institution. This study aimed to find alternative ways of enhancing the thermal properties of heat transfer fluids and to utilize agricultural by-products like rice hull ash (RHA), which has been proven to be viable and low-cost alternative source of nanosilica particles with 92.85% purity and 82% recovery. Fluids with nano-scaled particles form a stable suspension and provide impressive improvements in the thermal properties of base fluid s. The nanofluid was prepared by dispersing the nanosilica powder from the rice hull ash into deionized water and ethylene glycol:deionized water (EG:dW) mixtures (25:75, 50:50 and 75:25) as base fluids. AFM analysis of the nanosilica powder gave a size range of 46.5nm. The stability of the nanofluids based on sediment photography and UV-Vis spectrophotometry showed that 0.5% deionized water-based nanofluids was stable for 10 days and 0.25% of 50:50 EG:dW mixture-based nanofluids was stable and without significant sedimentation for 7 to 10 days compared to other EG:dW mixture-based nanofluids. Measured density of the nanofluids did not vary much relative to the base fluids. An increase in dynamic viscosity was observed in deionized water-based

nanofluid by as much as 159.90%. it was observed that the 25:75 EG:dW ratio has the fastest flow rate while the 75:25 has the slowest. Thus, the concentration of ethylene glycol greatly affects the flow rate of the solution. Measured specific heat of the nanofluids formulated in different volume concentrations decreased compared to base fluids. The increase of thermal conductivity of water-based nanofluids compared to deionized water reached 45% after dispersing nanosilica powder at different volume concentrations measured at temperatures ranging 30-70 deg C while 55.12% for EG:dW mixture-based nanofluids. The performance of the most stable deionized water (0.5% volume concentration) in a heat exchanger was determined to be 0.57% to 6.02% and 13.49 to 35.40%, respectively. The enhancement of thermophysical properties and heat transfer of nanosilica-in-fluid dispersion suggests the potential use of the nanofluids as a heat transfer fluid.

RICE HUSKS; HEAT EXCHANGERS; FLUIDS; ETHYLENE GLYCOL; AGRICULTURAL PRODUCTS; THERMAL PROPERTIES; HEAT TRANSFER

Production of quality grade ethanol from sweet sorghum. **Demafelis, R.B., Gatdula, K.M., Dizon, L.S.H., Matanguihan, A.E.D., Calibo, J.C.M., Penisa, X.N., Gamaro, J.A.M.** *2017 TR-1820*.

This research standardizes the fundamental processes of sweet sorghum juice clarification, storage and fermentation by establishing the operating conditions on each process. The optimum conditions for the whole clarification study were found at 90 deg C, pH8, and 7 ppm polycationic flocculant solution. In the case of storage stability of sweet sorghum juice, it was found out that clarification was not an efficient way of preserving the juice the highest amount of glucose was not an efficient way of preserving the juice. The highest amount of glucose was not an efficient way of preserving the juice. The highest amount of glucose content detected or can be recovered that we can still consider the juice as stable was 52.79 mg glucose/mL from the sample treated with sorbic acid at 1000 ppm stored in a PET bottle under 4 deg C. The final pH and deg Brix that correspond to this sample were 4.700 and 10.40, respectively. The stability of sweet sorghum syrup was also assessed by storing the samples for four months. With the end-of-storage-period reducing sugar (RS) concentration as the basis for the most favorable storage conditions, it was concluded that an initial concentration of 65 deg Brix, storage temperature of 40 deg C, and HDPE as the material of construction of the storage container were the most favorable conditions, with an average RS of 558.98 mg/mL. This value was higher compared with the 113.97 mg/mL obtained from storage storability study of syrup production for storability purposes. A comparative run with flask fermentation was conducted using the best conditions of ethanol fermentation in the reactor. A clarified 20 deg Brix syrup with pH of 4 was subjected to sterile fermentation 30 deg C reaction temperature with 30% inoculums loading. An alteration was also done with the agitation to sustain the power number as well as how the mixture is homogeneously mixed. Through these runs, an average ethanol concentration of 9.82% v/v was attained.

SORGHUM BICOLOR; FERMENTATION; STORAGE; ETHANOL; CARBOHYDRATE CONTENT; PROCESSING

Total utilization of microalgae biomass for fuel production: bioethanol production from Chlorella vulgaris biomass obtained after lipid extraction. **Sanchez, P.R.P., Escobar, E.C**. *2016 TR-1718*.

The potential of producing reducing sugars from waste biomass (that which is left after lipid extraction) of Chlorella vulgaris by acid hydrolysis was investigated. Three factors, namely, temperature, acid concentration and reaction time were considered in the optimization of acid hydrolysis. Of the three, temperature was found to have no significant effect on reducing sugar yield and was not considered in optimization. Following Central Composite Design, Response Surface Methodology (RSM) predicted that the optimum acid concentration and

reaction time were 3.71% and 73.98 min, respectively, with the maximum reducing sugar yield of 44.96%. Confirmatory test was done to validate the optimum condition obtained from RSM in which a 2.5% error between the predicted and experimental value was obtained.

CHLORELLA VULGARIS; ALGAE; SPECIES; BIOMASS; BIOFUELS; LIPIDS; EXTRACTION; HYDROLYSIS; FERMENTATION

P10 Water resources and management

Anthropogenic activities, water quality and phytoplankton diversity in Lake Calibato, San Pablo and Rizal, Laguna [Philippines]. **Chua, Z.R.C., Dalisay, M.G.S.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Charging Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) : FORESPI, 2018. p. 13.*

The study aimed to contribute to the monitoring research of freshwater ecosystem by identifying the anthropogenic activities, water quality and phytoplankton diversity during the months of July to November 2016. The study area is Lake Calibato, a small crater lake in transboundary of San Pablo; Rizal, Laguna [Philippines] and one of the famous seven lakes of San Pablo. The lake is the deepest among the seven lakes and has been heavily used for economic resource that functions as aquacultures. The presence of informal settlers and illegal fish cages largely affect the quality of Lake Calibato. Nonexistence of development for tourism and usual monitoring in the Lake affected the lifestyle and economic stature of the community. The physiochemical parameters of water were measured in terms of pH, Temperature, water transparency, dissolved oxygen, biological oxygen demand (BOD), nitrate, phosphate, total dissolved solids (TSS), total suspended solids, and bacteriological properties of water (total coliform). Diversity of phytoplankton was assessed using Shannon-Weiner Index and Simpson Index. BOD, Phosphate and Nitrate exceeded the standard limit of DENR while the rest of the parameters (DO, pH, temperature, water transparency, TDS) are within the limits. There are 19 species of phytoplankton identified during the sampling period. General assessment of the anthropogenic activities is recommended. Community awareness in the Lake should also be monitored for the improvement and development of the area that is in need of the support of the related agencies and stakeholders.

LAKES; WATER QUALITY; ENVIRONMENTAL IMPACT; PHYTOPLANKTON; BIODIVERSITY; PHILIPPINES

Assessment of agroecosystem in Cambantoc Watershed Mount Makiling Forest Reserve ASEAN Heritage Park, Philippines. **Castillo, L.A., Castillo, M.L., Canceran, M.S., Barua, L.D., Breva, R.V., Alegre, A.C., Gestiada, E.C., Barredo-Parducho, V.D., Limpiada, A.A., Gonzalvo, K.J.P., Caña, M.M., Bantayan, N.C.** 14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, , College, Laguna (Philippines), 8-9 Nov 2018. *International Conference on Biodiversity in a Changing Landscape and Climate: Proceedings, Forest and Natural Resources Research Society of the Philippines, Inc., College, Laguna (Philippines) College, Laguna (Philippines): FORESPI, 2018 p. 12.*

An agroecosystem is an ecosystem where biodiversity performs a variety of ecological services. It is very necessary to maintain its biodiversity to ensure continued supply of goods and services. This paper aims to determine the stand composition and diversity to access the effects of agriculture to forest natural landscape. Fifty 20m x 20m plots were established in a 2-hectare long term ecological research plot in an agroecosystem

landscape in Mount Makiling Forest Reserve ASEAN Heritage Park (MMFR AHP). Trees with at least 10cm diameter at breast height (DBH) were measured and mapped. Study revealed a dominance of forest trees in Cambantoc watershed, an agroecosystem landscape area in MMFR AHP. A total of 726 individuals distributed to 42 families, 84 genera and 112 species were recorded. Of these, about eight percent are agricultural trees represented by only four species namely: Citrus reticulata, Cocos nucifera, Coffea arabica and Theobroma cacao. Importance values showed Displodiscus paniculatus (92.20) and C. Arabica (8.08) as dominating forest and agricultural species in the area, respectively. C. Arabica is the only agricultural species among the top 10 dominant species due to the existence if civet cat and other dispersal agents in the watershed. Shannon-Weiner index showed a relatively high diversity at 3.842 and a moderately low evenness at 0.4162. Cambantoc watershed with agriculture as dominating landuse is highly diverse area and planting of agricultural species along the forest periphery has minimal effect of forest diversity. The agricultural crops support the existence of wildlife animals that thrive in the area like civet cat. Furthermore, presence of threatened species such as Diospyrosblancoi, Syzygium nitidum, and Toona calantas makes Cambatoc a highly critical watershed requiring strict conservation and protection.

WATERSHEDS; FOREST RESOURCES; FORESTS; LANDSCAPE; FOREST TREES; CROPS; BOTANICAL COMPOSITION; AGROECOSYSTEMS; FOREST RESERVES; PHILIPPINES

Bench-scale production of filters for the removal of arsenic from contaminated water using modified biopolymer-silica nanocomposite materials. **Peralta, M.M., Salazar, M.J.V., Muncal, G.E., Britania, S.H., Manguiat, Ma.T.G.B.D., Lacsamana, M.S., Magalona, M.L.** *2016 TR-1727*.

Bench-scale production of iron-modified nanosilica beads from rice hull was done by extraction of silica from rice hull ash and titrating the purified nanosilica with acetic acid. Iron (3) sulfate was added before dropping the solution in a beaker with aqueous ammonia with surfactant and hexane to achieve the beads' spherical shape. The beads were oven-dried at 120 deg C for 2 hours. BET analysis (surface area – 348.855 sqm/g; porosity – 17.152 A) supports the AFM result (7.95 +- 1.11 nm) and confirm that the produced beads were nanosized materials. The X-ray diffraction pattern proves that the produced beads were amorphous and free from any impurity. DPASV analysis of As (3) and As (5) solutions produced LOD and LOQ for As(3): 2.25 ppb and 7.49 ppb and As(5): 9.69 and 23.19 ppb, respectively. Adsorption studies on standing mode revealed that 10 g of nanosilica beads remove 95% arsenic in standard solutions for 6 hours while shaking mode removes 98% arsenic using 2.5 g of beads for 2 hours. Water samples from the provinces of Bulacan, Batangas, and Laguna [Philippines] were collected and analyzed for As (3) and total arsenic content using voltammetry and ICP-OES. The highest total arsenic content for the water samples came from the pump houses RAC (333.024 ppb), RCS (112.789 ppb), and RLV (113.162 ppb), and RLV (113.162 ppb). These values were verified using ICP-OES and at 95% confidence level, there is no significant difference between the total arsenic content obtained from the voltammetric and ICP-OES analysis.

RICE HUSKS; SILICA; EXTRACTION; ARSENIC; CONTAMINATION; WATER; WATER PURIFICATION; BIOPOLYMERS; ACETIC ACID; CHEMICAL PRECIPITATION

Capacity building, institutional and policy mechanisms for rainfed agricultural lands at the Mt. Makiling Forest [Philippines] reserve. **Calimag, C.A., Carandang, A.P., Dolom, P.C., Mariano, R.R.E., Alcasid, E.B., Nicmic, J.C., Miranda,M.C.** *2015 TR-1733*.

The project Capacity Building Institutional and Policy Mechanisms for Rainfed Agricultural Lands at the Makiling Forest Reserve is an action – research program aimed at improving the farmers' way of the life especially those who are dependent on rainfled agriculture and the same time assess existing policies and regulations concerning the sustainable management and maintenance of the watersheds. Results of several activities and research mechanisms used in data gathering will hopefully facilitate implements to develop and design mechanisms in coping up with climate change thru the formulation of policies in support to sustainable watershed management. The project consisted of two components – capacity building and policy research in support to sustainable watershed management concerning the development and management of water resources particularly in Mt. Makiling Forest Reserve. For capacity building, activities included groundworking to establish contact with local officials and members of the community within the barangays [villages] situated around Mt. Makiling. Field and cross visits were also done to be able to gain knowledge and experience on the management practices of watershed areas in country. Assessment of the capabilities of farmers and different stakeholders and empowerment of these stakeholders in the management of MFR was done thru the conduct of Key Informant Interviews and Focus Group Discussions. Selected stakeholders also participated in some field visits. The product also conducted capability building activities for LGUs, residents, private and government officials in Climate Change Adaption, Mitigation and Vulnerability. In recognition to the role of the youth in education and information dissemination, the project also conducted and environmental education program to enhance their knowledge and skills on environmental conservation. Policy Research was a crucial component of the project. The project team reviewed existing policies on watershed management at the local, regional and national levels. A book of these policies was produced. Policy Analysis was done thru interviews. Output of these activities resulted to policy recommendations. Some of the recommendations were: the need for vulnerability assessment study of all watershed areas in the country, strengthen forest law enforcement and forest protection activities, implementation of multi-stakeholder monitoring development of master plans of every watershed area to be effectively implemented by the LGU;s to attain optimum and sustainable supply of water for rainfled agriculture and to enhance capacity building activities in communities within these watersheds.

FARMS; FORESTS; FOREST LAND; FOREST MANAGEMENT; FARMERS; WATERSHEDS; WATERSHED MANAGEMENT; FOREST PROTECTION; FOREST RESERVES; SUSTAINABILITY; ENVIRONMENTAL IMPACT ASSESSMENT; FORESTRY POLICIES; PHILIPPINESDevelopment of nanosensors and nanostructured materials from agricultural by products for enhancement of food and agricultural productivity and for environmental sensing and remediation: Bench-scale production of nanosensors for the detection and analysis of arsenic in contaminated water-development of a fluorescent nanobiosensor for the detection of arsenic. **Recuenco, M.C., Peralta, M.M.** *2016 TR-1743*.

The authors developed an electrochemical nano-biosensor for arsenic detection using an engineered bacterial periplasmic binding protein in a carbon paste electrode. The protein and its mutant having four more cysteine residues were compared in terms of arsenic binding by fluorescence quenching. The mutant had slightly better response in the presence of arsenic. The mutant protein was immobilized as a cross-linked protein aggregate and then used as modifier of a carbon paste electrode. Cyclic and differential pulse anodic stripping voltammetry analyses showed peaks that could be due to arsenic. At this stage, the authors were able to detect a response at arsenic concentrations of at least 10 ppm.

WATER; ARSENIC; ARSENIC COMPOUNDS; CYSTEINE; RESIDUES; FLUORESCENCE; TOXICITY; VOLTAMMETRY; ELECTRODES; BIOSENSORS

Isolation, identification and screening for protease activity of alkaliphilic bacteria from Manleluag Spring in Pangasinan [Philippines]. **Lantican, N.B., Montecillo, A.D.** *2015 TR-1746*.

Protease is an enzyme that hydrolyzes peptide bonds of proteins and breaks them down into polypeptides or free amino acids. This study was conducted to assess protease activities of 106 alkaliphilic bacteria isolated from water, microbial mat, and sediment samples from Manleluag Hyperalkaline Spring by Skim Milk Assay. Thirty-five isolates showed protease activity and were ranked according to their Cz values. The five isolates with the highest protease activities as suggested by the lowest Cz values were SNE 3 (Cz 0.2908), SNE 2 (Cz 0.2971), SNE 9 (Cz 0.3338), W10 (Cz 0.3426), and W1 (Cz 0.3611). Molecular identification based on 16S rDNA showed closest similarities of the five isolates with Bacillus pseudofirmus OF4 (99% similarities; SNE 3 and SNE 2), Cellulosimicrobium funkei W6122 (99% similarity; SNE 9), and Bacillus hornekiae 1P01SC (96% similarities; W10 and W1). Proteolytic activities of the enzymes for each isolates were determined by in-solution digestion using bovine serum albumin (BSA) and zymography using gelatin and casein as substrate. The presence of gelatinases and caseinases as revealed by clearing bands with proteolytic activities, suggests the molecular weights of the proteases in kDa present in the alkaliphilic or alkalitolerant isolates.

SPRING; PROTEASES; PROTEINASE INHIBITORS; ENZYMES; FREE AMINO ACIDS; ALKALINITY; NUCLEOTIDE SEQUENCE; WATER PURIFICATION; BOVINAE; ISOLATION; IDENTIFICATION; PHILIPPINES

Laguna de Bay as a water source of Metro Manila [Philippines]. *Agriculture (Philippines) v. 23 (5) p. 30-31 (May 2019).*

WATER SUPPLY; DAMS; WATER QUALITY; LAKES; WATER POLLUTION; PHILIPPINES

Proteases from alkaliphilic or alkalitolerant bacteria isolated from Manleluag hyperalkaline spring in Pangasinan [Philippines]. **Bertuso, A.L.G., Montecillo, A.D., Lantican, N.B.** [n.d.] TR-1747.

Protease is an enzyme that hydrolyzes peptide bonds of proteins and breaks them down into polypeptides or free amino acids. This study was conducted to assess protease activities of 106 alkaliphilic bacteria isolated from water, microbial mat, and sediment samples from Manleluag Hyperalkaline Spring by Skim Milk Assay. Thirty-five isolates showed protease activity and were ranked according to their Cz values. The five isolates with the highest protease activities as suggested by the lowest Cz values were SNE 3 (Cz 0.2908), SNE 2 (Cz 0.2971), SNE 9 (Cz 0.3338), W10 (Cz 0.3426), and W1 (Cz 0.3611). Molecular identification based on 16S rDNA showed closest similarities of the five isolates with Bacillus pseudofirmus OF4 (99% similarities; SNE 3 and SNE 2), Cellulosimicrobium funkei W6122 (99% similarity; SNE 9), and Bacillus hornekiae 1P01SC (96% similarities; W10 and W1). Proteolytic activities of the enzymes for each isolates were determined by in-solution digestion using bovine serum albumin (BSA) and zymography using gelatin and casein as substrate. The presence of gelatinases and caseinases as revealed by clearing bands with proteolytic activities, suggests the molecular weights of the proteases in kDa present in the alkaliphilic or alkalitolerant isolates.

SPRING; PROTEASES; PROTEINASE INHIBITORS; ENZYMES; FREE AMINO ACIDS; ALKALINITY; NUCLEOTIDE SEQUENCE; WATER PURIFICATION

Rainwater harvesting in Republic Cement Batangas Plant [Philippines]. **Anon**. *Agriculture (Philippines) v. 23 (3) p.52 (Mar 2019)*.

WATER RESOURCES; RAINWATER; HARVESTING; WATER USE; WATER CONSERVATION; PHILIPPINES

Removal of arsenic from contaminated water using modified biopolymer-silica nanocomposite materials. **Peralta, M.M., Garcia, A.E.B., Alpeche, Z.J.S., Salazar, M.J.V., Briones, C.E., Lacsamana, M.S., Magalona, M .L.** *2014 TR-1729*.

Filter materials were prepared from low-value agricultural by-products, i.e. rice hull nanosilica and chitosan, for the removal of inorganic arsenic from contaminated water. Rice hull nanosilica was obtained using two starting materials: (1) Light gray pulverized ash from whole rice hulls that were heated to ashing temperatures in the combustor, then subsequently subjected to sol-gel processing to obtain nanosilica powder with a size range of 20-80 nm by AFM analysis; (2) acid-washed ground rice hulls that were subjected to hydrothermal processing to obtain crude rice hull silica and sol-gel processing to obtain nanosilica with a size range of 5-10 nm, average BET surface area of 321 m2/g although this could reach approx 530 sq m/g, a pore radius of 17A deg and a silica content of 98-99% by EDX analysis. Because of the significantly shorter process for preparing nanosilica using the hydrothermal process, nanosilica produced from the acid-washed ground rice hulls using this process was adopted for all subsequent experiments and for the prototype fillers. The nanosilica thus obtained was modified using an iron salt in order to increase its affinity for arsenic. Two iron-modified nanosilica filter materials were produced: (a) iron-modified nanosilica powder which was prepared by mixing nanosilica, base and iron sulphate in an optimized ratio; and (b) iron-modified nanosilica aerogel beads which were prepared using the optimized ratio but at lower pH and in the presence of a non-solvent to facilitate bead formation. Commercial grade chitosan, from crab shells was modified with tyrosine and subsequently processed to obtain tyrosine-modified chitosan nanoparticles with an average size of 33 nm, a low surface area (4 sq m/g) by BET analysis and a pore radius of 17A deg. All of these materials were evaluated for their efficiency in arsenic remediation. In terms of overall cost, ease and consistency of preparation and removal efficiency, nanosilica aerogel beads modified with iron was found to be the best material for water filtration to remove arsenic. The iron-modified nanosilica beads is a novel material for removal of arsenic from contaminated water.

WATER; BIOLOGICAL CONTAMINATION; ARSENIC; RICE HUSKS; FILTRATION; BIOPOLYMERS; TYROSINE; SILICA

Use of vetiver grass for vertical subsurface flow constructed wetlands for the DTRI-UPLB [Dairy Training Inst.-University of the Philippines Los Baños] wastewater treatment. **Velasco, P.P.** *Jun 2016 TR-1705.*

A very small percentage of small dairy farms in Philippines have wastewater treatment before disposal. One of which is the Dairy Training Research Institute at the University of the Philippines Los Baños (DTRI-UPLB). It is a small dairy farm with minimal treatment before disposal. Economic constraint is the main cause of the problem and Vetiver Reed Bed Systems could be a cheaper and environment-adapted alternative. With this, it is the aim of this study to determine the effect of using vertical subsurface constructed wetlands planted with Vetiver grass to treat DTRI-UPLB effluent. Also, a design of this kind of reed bed for DTRI-UPLB was provided. It was observed that the used set-up of vertical subsurface constructed wetlands planted with Vetiver grass is very effective in treating the dairy farm's wastewater. The average removal efficiency is 35.41% for Total Suspended Solids (TSS), 93.53% for BOD for 5 Days (BOD5), 64.93% for Total Phosphorus (TP), and 81.88% Total Kjeldahl Nitrogen (TKN). A trend between the removal efficiencies with the age of the Vetiver was

established and the proposed design of the reed bed has a 4-hour retention time. Moreover, lifting-of some point values for comparison among the three scenarios: no plant, one set of vetiver grass and six sets of vetiver grass set-ups showed that there is no clear trend for this study due to the limitation in the data gathering. However, it can still be assumed given longer data gathering and additional testing, that the reed bed system will still perform better compare to simple filtration system.

VETIVERIA ZIZANIOIDES; WASTEWATER; WASTEWATER TREATMENT; WETLANDS; DAIRY FARMS; FILTRATION; PHILIPPINESVulnerability assessment to landslides and flooding along the Sta. Rosa-Silang [Philippines] Riverine system using LIDAR and GIS [Geographic Information System]-based hydrological modeling technologies. **Magcale-Macandog, D., Gunay, C.J.C., Bacani, A.J.V.** *2017 TR-1797*.

Occurrence of landslides and flooding had been increasing in the Santa Rosa-Silang sub watershed brought about by extreme weather disturbances including tropical depressions, Southwest monsoon rains, storms and typhoons. Rapid industrializations and urbanization in the past three decades in the subwatershed resulted to massive land use change involving the conversion of agricultural and agroforestry farms into built-up areas. This land use change resulted to increased impermeable soil surface altering the water balance in the subwatershed. The Santa Rosa riverine network with its headquarters from the upstream areas of Silang, Cavite passes through the city of Santa Rosa and drains into the vast Laguna de Bay [Philippines]. In this study, a GIS-based hydrological model, the Soil and Water Assessment Tool (SWAT), was used to simulate the quantities of water inflow and outflow in each of the 49 dominant hydrologic response units (HRUs) along the entire subwatershed area. Spatial information such as its digital terrain model (DTM) extracted from LIDAR and RS data, land cover map and soil map, together with its 36-year (1980 to 2015) rainfall and temperature data, were inputted in the SWAT model's platform to generate the surface flow and sediment yield during rain events in the HRUs within the subwatershed. With these outputs, the subwatershed portions and the specific HRUs vulnerable to flooding and erosion were mapped out. Simulation results showed that the low permeability of soil surface increases the occurrence of flashfloods in low-lying areas. Sloping and open surfaces in the upstream areas are however, prone to landslides. Vulnerability assessment has shown that the communities along the shoreline and riverine system are most vulnerable to flooding and landslides. These results will be useful in the development of area-specific adaptation and mitigation strategies to disasters like landslides and foods.

WATERSHED MANAGEMENT; WATERSHEDS; LAND USE; LANDSLIDES; FLOODING; SEDIMENT WATER INTERFACE; TOLERANCE; GROUNDWATER TABLE; GEOGRAPHICAL INFORMATION SYSTEMS; PHILIPPINES

P33 Soil chemistry and physics

Food quality and safety evaluation of organically grown crops versus conventionally grown crops in two types of soil. **Trinidad, L.C., Lat, E.C., Fabro, L.M., Jr, Mejia, W.B., Dino, C.P.A., Magnaye, M.J.F.A.** *2014 TR-1819.*

The quality and safety of organic and conventional produce were evaluated. The study involved two problem soil types: acidic, clay and the lowland lahar-laden soil. Soil sampling and analyses for the selected sites were done prior to planting selected crops: lettuce (Lactuca sativa cv. Orija de mulo), tomato (Solanum melongena), okra (Abelmoschus esculentus), and string beans (Vigna sesquipedalis) for Pampnga [Philippines]. Physico-chemical analyses of soil samples from both organic and conventional sites (nitrogen, potassium, phosphorus, organic matter, moisture content, and pH) showed improvement on the soil they had been treated. However,

depletion is evident as it i s picked up by the plants or washed away by heavy rains. Chromium nickel, mercury, and cadmium were not detected on the soil samples. Lead was detected, however special precautions are needed to prevent accumulation. As for the vegetables samples, chromium, nickel, lead, mercury, cadmium and pesticide residues are not detected. Microbiological analyses of both organic and conventional vegetable samples indicated the presence of Salmonella and E.coli O157:H7 in presumptive tests. However, further testing revealed that the identities of these presumptive E.coli 0O157:H7 are Stenotrophomonas maltophilia, Pseudomonas, and Pantoea while the presumptive Salmonella colonies are Citrobacter youngae, Pantoea, and Enterobacter cloacae. Thus, there is no incidence of the mentioned microbial pathogens in both organic and conventional soils and produce from the two farm sites.

LACTUCA SATIVA; LETTUCES; TOMATOES; LYCOPERSICON ESCULENTUM; CUCUMBERS; CUCUMIS SATIVUS; SWEET PEPPERS; CAPSICUM ANNUUM; MOMORDICA CHARANTIA; AUBERGINES; SOLANUM MELONGENA; OKRAS; ABELMOSCHUS ESCULENTUS; KIDNEY BEANS; VIGNA UNGUICULATA SESQUIPEDALIS; ORGANIC AGRICULTURE; SOLANUM; QUALITY; SAFETY; CLAY SOILS; SOIL ANALYSIS; SOIL CHEMICOPHYSICAL PROPERTIES; MOISTURE CONTENT; MICROBIOLOGICAL ANALYSIS; MICROORGANISMS; HEAVY METALS; PATHOGENS

P34 Soil biology

Comparative assessment of biological nitrogen fixation in Pongamia pinnata, a biofuel legume tree. **Calica, P.N., Gresshoff, P.M.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 14-23 (Mar 2019)*.

Pongamia pinnata has been established as a biofuel legume tree. Different methods such as acetylene reduction assay, ureide analysis, isotopic techniques, nitrogen difference method and isotope techniques (15 N natural abundance and 15 N enrichment technique) were employed to analyze, assess and estimate symbiotic nitrogen fixation in 16-wk-old pongamia seedlings. In the acetylene reduction assay, the uninoculated control had negligible ethylene produced while inoculated plants were shown to have increasing ethylene production from 0-min to 60-min incubation with a range of 0.03 to 2.76 mL. Pongamia was found to produce 1.19 x 10-6 mole per plant with a Rhizobum (PR-UQ-95) inoculation. Ureide analysis was also done, not only to estimate fixed nitrogen, but also to determine the presence of allantoin in the xylem of pongamia. The result showed that allantoin was present in pongamia at low levels of 143-150 nmole, which means pongamia utilizes uriedes in the form of allantoin to transport its fixed nitrogen to other plant parts to support growth and reproduction. The nitrogen difference method and isotope techniques quantified the fixed nitrogen of pongamia inoculated with PR-UQ-05 which was estimated to be 100 mg/plant (based on the difference of total N yield between the nodulated and non-nodulated pongamia seedlings) and from 20.4 mg/plant (natural abundance) to 47.4 mg/plant (enriched). The different methods used in this study showed different results based on the amount of fixed nitrogen calculated for each method. However, all of the methods employed in this study demonstrated that Pongamia inoculated with PR-UQ-05 fixed more nitrogen than the uninoculated control. The symbiotic nitrogen fixation of Pongamia demonstrated in this study is very relevant to the biofuel industries.

PONGAMIA PINNATA; LEGUMES; NITROGEN FIXATION; BIOFUELS; ISOTOPES; ETHYLENE PRODUCTION; INOCULATION

Endophytic bacteria (EBI) as inoculants for improved yield of eggplant (Solanum melongena L.). **Padilla, V.M., Masilungan, G.D., Roxas, D.M.A.** Development and promotion of new and enhanced biofertilizers,

biostimulants, and biopesticides for improved crop productivity: development and filed testing of endophytic bacterial inoculants as new biofertilizer for improved production of egpplant (Solanum melongena) and sugarcane (Saccharum officinarum L.), Padilla, V.M.Marfori, E.C.Roxas, D.M.A. Masilungan, G.D..- College, Laguna (Philippines), UP REPS 2nd Annual Scientific Conference, Tagaytay City (Philippines), 26-27 Mar 2015. *TR-1722. p. 119-124*

Eggplant (Solanum melongena L.) is number one vegetable crop in the Philippines with fertilizer requirement of 90-60-60 kg NPK per hectar (Full NPK). The use of endophytic bacterial inoculants (EBI) is one of the strategy to reduce the independence on expensive inorganic fertilizer such as nitrogen, phosphorus and potassium. Two separate experiments were conducted on new endophytic bacterial inoculants (EBI) for growth and yield of eggplant (Solanum melongena L.) The first screening of seven (7) new EBI for eggplant was conducted from November 2012 to May 2013. The second experiment was conducted to confirm the potential of the three new EBI for eggplant from October 2013 to March 2014. The first and second experiments were consisted of ten treatments and 12 treatments respectively, with four replications. Each of the EBI was sprayed separately to the plants either singly or in combination with 90-60-60 kg NPK /ha (Full NPK) or 45-30-30 kg NPK /ha (1/2 NPK) fertilization. The treatments for both experiment also included the control, full NPK or 1/2 NPK alone. Both experiments were implemented at BIOTECH experimental area and laid out in a randomized complete block design (RCBD). In the first experiment, the results showed that higher marketable fruits yields were obtained from eggplant fertilized with 45-30-30 kg NPK/ha and inoculated with EBI 3 (Enterobacter ludwigii) (59%) and EBI 5 (Bacillus sp.)(49%) compared with 45-30-30 kg NPK inorganic fertilizer alone. In terms of total cumulative fruit yield, EBI 3 and 5 with 45-30-30 kg NPK/ha gave 75% and 72% increase in yield respectively, compared with 45-30-30 alone. Plants inoculated with EBI 3 and 5 in combination with 45-30-30 kg NPK/ha produced 129% and 114% higher marketable yield compared with full rate of NPK (90-60-60 kg NPK/ha). Apparently, the performance of either EBI 3 or 5 with 45-30-30 kg NPK/ha is comparable with 90-60-60 kg NPK per hectare. Based on these results, EBI E3 or E5 are potential inoculants for improving the yield of eggplant in combination with 45-30-30 kg NPK/ha under field conditions.

SOLANUM MELONGENA; AUBERGINES; CROP YIELD; ENTEROBACTER; BACILLUS; ENDOPHYTES; INOCULATION; INORGANIC FERTILIZERS; FERTILIZER APPLICATION; PLANT DISEASES; APPLICATION RATES

Ensuring the availability of high quality microbial strains for biofertilizers, biostimulants and biopesticides production through the development of molecular markers, polyphasic identification, long-tem preservation and enhanced bio-banking system (project 8). **Monsalud, R.G., Creencia, A.R., Tan Gana, N.H., Arguelles, E.D.L.R., Brown, M.B., Tabao, N.S.C., Lagman, F.P., Lanceras, J.C., Casiñas, M.J.D., Rabino, A.M.R.** *2015 TR-1702.*

A total of 72 bacterial and/or fungal isolates from the 8 projects of the BFSP program were characterized and identified by polyphasic (phenotypic, molecular and phylogenetic) approach. A consensus of these characteristics was done to properly identify the strains. Sixty two of these 72 are newly-isolated microorganisms by the different projects of the program, the 10 are existing strains deposited at the Philippine National Collection of Microorganisms (PNCM). All 72 isolates were accessioned at the PNCM and are preserved using at least 2 different methods. Bacterial and yeast isolates were L-dried and preserved at ultra-low temperature(-80 deg C) in silica beads using glycerol; mold isolates were preserved by mineral oil overlay and ultra-low temperature (-80 deg C) with glycerol; and actinomycetes were preserved by L-drying, mineral oil overlay and sterile soil as backup. Forty-six bacteria, 10 yeast, 5 mold and 11 actinomycete isolates

had been preserved. For ease of detection in the presence of closely-related strains in the field, DNA fingerprinting using ERIC, BOX and REP-PCR was done for 16 isolates (two most promising strains from each project).

MICROORGANISMS; BIOFERTILIZERS; BIOPESTICIDES; GENETIC MARKERS; PRESERVATION; DNA; ACTINOMYCETALES; PCR

Functional genome analysis of gold nanoparticle (AuNP)-producing plant growth promoting bacteria (PGPB) isolated from Philippine soil. **Fernando, L.M., Montecillo, A.D., Baybay, Z.K., Perez, R.H., Atienza, Ma.T.J.A., Paterno, E.S., Lantican, M.Q., Merca, F.E.** *2017 TR-1763*.

SOIL; BACTERIA; PLANT GROWTH SUBSTANCES; GENOMES; BIOSYNTHESIS; ENZYMES; PHILIPPINES

P40 Meteorology and climatology

Assessment of the effects of climate change on farmers and their farming activities in selected areas, Philippines. **Quicoy, C.B., Delos Reyes, J.A.** *Aug 2015 TR-1676*.

CLIMATIC CHANGE; ENVIRONMENTAL IMPACT ASSESSMENT; DISASTERS; RISK MANAGEMENT; WEATHER HAZARDS; FARM INCOME; FARM MANAGEMENT; IRRIGATION SYSTEMS; PHILIPPINESComparative analysis of sugarcane and sweet sorghum bioethanol carbon footprints, carbon savings and carbon debt payback periods. **Demafelis, R.B., Alcantara, A.J., Movillon, J.L., Pacardo, E.P., Espaldon, M.V.O., Flavier, M.E., Eleazar, P.J.M., Tongko, B.D.** *Philippine Journal of Crop Science (Philippines) v. 40 (3) p. 10-22 (Dec 2015)*.

One of the parameters to assess the environmental sustainability of the bioethanol industry is to conduct carbon analysis and determine its effectiveness in terms of mitigating climate change. By comparing the carbon savings and carbon debt payback periods of two bioethanol feedstocks (sugarcane and sweet sorghum), not only the more environmentally sustainable bioethanol was revealed but also the potential complementary nature of these two feedstocks to significantly reduce the GHG emissions of the transportation sector was assessed. Carbon savings of a typical Philippine bioethanol production scenario for sugarcane was determined to be equal to 218.99% with a carbon footprint of -110,045.29 t CO sub 2 e/yr; while for sweet sorghum, the calculated carbon savings was 154.32% with a carbon footprint of -34,629.57 t CO sub 2 e/yr at equivalent fuel energy basis. Meanwhile, the carbon payback periods of 2-4 mo for sugarcane and 3-5 mo for sweet sorghum were derived from the calculated carbon debt incurred from construction equal to 65,730.39 t CO sub 2 e for sugarcane and 66,226.14 t CO sub 2 e for sweet sorghum. Taking into account the percent carbon savings calculated, the following combinations revealed to be able to meet the global climate mitigation target by 2030: 20% biodiesel and 35% sugarcane bioethanol, 20% biodiesel and 45% sweet sorghum bioethanol. Although carbon savings of sugarcane bioethanol is higher than sweet sorghum bioethanol, both carbon savings were significant to payback carbon debts from constructing new bioethanol plants and to meet the global climate mitigation target.

SUGARCANE; SORGHUM BICOLOR; CARBON; FUELS; CLIMATIC CHANGE

Q- PROCESSING OF AGRICULTURAL PRODUCTS

Q01 Food science and technology

Radio frequency dielectric heating combined with ultraviolet irradiation induces changes in structural, oxidative, and antioxidant properties of B-Lactoglobulin. **Yuwei Wu, Yuanrong Zheng, Danfeng Wang, Yun Deng.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 67-74 (Mar 2019)*.

The study investigated the impact of radio frequency dielectric heating (RF) alone or in combination with ultraviolet light (UVC) irradiation on structural, oxidative, and antioxidant properties of beta-lactoglobulin. All treatments decreased total sulfhydryl group (TSH), disulfide bonds (S-S), reducing power, fluorescence intensity, alpha-helix and beta-turn structures. Treatments increased random coils, free sulfhydryl group, surface hydrophobicity, 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2-ethyl benzothiazoline-6-sulfonate (ABTS). Treatment with radio frequency dielectric heating (RF) alone (5 min) resulted in the highest S-S, and the lowest carbonyl contents and antioxidant activities. RF (5 min) + ultraviolet light (UVC) (25 min) generated the maximum random coils, carbonyl and ABTS, and likewise resulted in the minimum alpha-helix, beta-turn, TSH, and S-S.

BETA LACTOGLOBULIN; WHEY PROTEIN; ANTIOXIDANTS; IRRADIATION; ULTRAVIOLET IRRADIATION; THERMAL RADIATION; OXIDATION; TECHNOLOGY TRANSFER

Q02 Food processing and preservation

12 tons of expensive mushrooms produced every day. **Sarian, Z.B**. *Agriculture (Philippines) v. 23 (07) p. 46-48 (Jul 2019)*.

EDIBLE FUNGI; VARIETIES; FARMS; PRODUCTION; FOOD PROCESSING; PROCESSED PLANT PRODUCTS

Chef [Jam Melchor] highlights the importance of local agriculture in Filipino cuisine and culture. **Tan, Y.** *Agriculture (Philippines) v. 23 (6) p. 30-31 (Jun 2019)*.

CROPS; INDIGENOUS ORGANISMS; FOOD PROCESSING; SUSTAINABILITY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; PHILIPPINES

Couple's chili sauce business helped their Davao Oriental [Philippines] community rise above adversity. **Lacson, S.P.** *Agriculture (Philippines) v. 23 (07) p. 42-44 (Jul 2019)*.

CHILLIES; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; ENTERPRISES; TECHNOLOGY; TECHNOLOGY TRANSFER; MARKETS; PHILIPPINES

Couple's curiosity led to a full-scale mushroom business. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23 (08) p. 48-50 (Aug 2019)***.**

PLEUROTUS OSTREATUS; EDIBLE FUNGI; VARIETIES; GROWING MEDIA; FOOD PROCESSING; FOOD TECHNOLOGY; PROCESSED PRODUCTS; PROCESSING; ENTERPRISES

Development of processing technologies for dragon fruit. **Ombico. M.T., Lascano, R.A.** *2016 TR-1759.*

The study was conducted to utilize red-fleshed dragon fruit into a fruit juice drink. Four formulations of fruit juice drinks were developed: 1:3, 1:5, 1:7, and 1:10 juice to water ratios. The pH and the total soluble solids

(TSS) were maintained at 3.6 and 12 deg C Brix respectively. Treatment A which has the highest amount of dragon fruit juice in the formulation obtained the highest values for total titratable acid (TTA) and Vitamin C content. This is due to the inherent organic acids and vitamins present in the dragon fruit. In terms of viscosity, a significant difference was detected among samples; treatment A being the most viscous and treatment D as the least viscous. The higher the amount of fruit juice in the sample, the higher the concentration of the solutes is, which resulted in a more viscous product. Using the chromameter, an increasing trend for the color parameters L*, a* and b* values was observed as the dilution increases. Treatment D resulted in the highest values for all the parameters while Treatment A got the lowest values. Sensory evaluation showed that color differed among all treatments. Resulting in the most intense magenta color for treatment D. A significant difference was also observed among samples in terms of aroma and flavor, and the strongest perceived treatment was treatment A, whereas the weakest was treatment D. Consequently, there was no significant difference observed among treatments in terms of sweetness, sourness, and off-flavor. The most generally acceptable dragon fruit juice drink formulation was treatment B which has 1:5 fruit juice to water ration and the total cost of the product per bottle is PhP 19.43. Dragon fruit was utilized as a flavouring agent for a cream cheese spread. The fruit was processed into jam and puree and was incorporated in the cream cheese in varying formulations: 0%, 5%, 10%, 15%, 25%, and 35%. Results show that there was no significant difference among the formulation in terms of general acceptability, aroma, and aftertaste; hence, the 35% formulation was chosen due to its lower price. The cheese spread, which was light gray in color, was subjected to chemical tests. Results revealed that it has 8.00 mg and 7.33 mg ascorbic acid per 100g sample for puree and jam treatments, respectively. The antioxidant activity results showed that the puree had the higher antioxidant activity, which is around 68.54% compared to the jam's 60.60%. Viscosity tests revealed that the cream cheese spread flavoured with jam was the most viscous, with its viscosity at 6.33 x 105 cP; and the puree's viscosity which was 5.75 x 10 sup 5 cP. The prospect for functional foods like yogurt is high and through the years there has been an increase in demand for yogurt with lower viscosity. On the other hand, tons of dragon fruit are rejected annually due to pest. To solve this problem, it is desirable to promote the use of dragon fruit as ingredient to functional food specifically yogurt drink. This study was conducted to develop a dragon fruit (Hylocereus polyrhizus) –flavored yogurt drink. Yogurt drink was added with different dragon fruit puree concentrations (0, 5, 10, 15, and 20%). The physicochemical, antioxidant and sensory properties of each treatment were determined, analyzed and compared. The results indicate that the pH increases and the titratable acidity (TA) expressed in lactic acid decreases as the dragon fruit puree concentration increases since the dragon fruit is less acidic compared to the pure yogurt drink. Consequently, the total soluble solids (TSS) increases as the dragon fruit puree concentration increases due to the high total soluble solid of the dragon fruit puree. There was a decrease in viscosity (cP) as the dragon fruit puree concentration was increased in the formulation. The color values, red, blue and green, generally decreases with increasing concentration of dragon fruit puree. Dragon fruit is said to be an excellent source of antioxidants and the antioxidant activity through % DPPH scavenging assay test showed that there is an increasing trend in antioxidant activity as the dragon fruit concentration in yogurt drink increased. Sensory analysis results showed that the highly acceptable formulation in yogurt drink was 15% dragon fruit puree although it was not significantly different with the 10% and 20%. The physicochemical, antioxidant and sensory properties revealed that the most acceptable treatment was the yogurt drink with 15% dragon fruit puree.

HYLOCEREUS; VARIETIES; FRUIT; CACTACEAE; FLAVOUR; FOOD PROCESSING; FOOD TECHNOLOGY; FRUIT JUICES; PLANT EXTRACTS; PROXIMATE COMPOSITION; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIESDrying and shrinkage characteristics of processed sandfish (Holothuria scabra). **Villamarzo, J.C.G., Ignacio, Ma.C.C.D., Yaptenco, K.F.** Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology, Yaptenco, K.F.Pangan, R.S. *2016 TR-1724 p.70-77*.

A simple drying study was performed to determine drying rates and shrinkage characteristics of processed sandfish (Holothuria scabra). Degutted, cleaned and boiled samples were dried at 60, 70, and 80 deg C. Moisture content in terms of the dimensionless moisture ratio was monitored over time; the data was fitted to three drying questions exponential model, Page model and two-compartment model. Shrinkage and volume ratios were determined through measurements or major external dimensions (Length, width and thickness) and volume before and after drying. The three drying models gave as a good fit to the drying data; the highest R sq values were given by the Page model. The estimated drying time to reach a semi-dried state (moisture content of 0.61 g/g dry matter) or fully dried condition (0.18 g/g dry matter for drying temperatures of 60-80 deg C were 1/2 day or 1 day, respectively. Shrinkage ratios showed that changes in dimensions (length, width, or thickness) could reach 25-40% of the original dimensions. In terms of volume, shrinkage was 25-33% of the original volume. Drying temperature has no significant effect on shrinkage with respect to dimension or volume.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRIED PRODUCTS; PROCESSED PRODUCTS; TEMPERATURE; SHRINKAGE; DRYING

Enhancing the Philippine sea cucumber industry through the development of an appropriate processing technology. **Pangan, R.S., Yaptenco, K.F., Pardua, S.N., Duque, A.C**. Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology Yaptenco, K.F.Pangan, R.S. *2016 TR-1724. p.109-130.*

A hygienic and profitable way of processing sea cucumber was developed which is appropriate for village-level application. The developed processing technology involved the design and fabrication of a preparation table, a boiling apparatus, a cleaning/scraping machine and a dryer. Each of the developed machine/equipment were based from the results of the survey conducted regarding the existing processing activities in different areas of the country. The system was designed to process 100 kilos of fresh sea cucumber in a single batch. As compared to the traditional processing method, product produced is of better quality resulting to a much higher selling price for the farmers. Furthermore, the developed technology complies with the processing standards set by the Bureau of Agriculture and Fisheries Products Standards (BAFPS) wherein, use corals and steel brushes in cleaning were eliminated, smoke contamination was avoided and quality was maintained wherein no smoke odor, decay and scorch marks are present in the product. The increase in income of the farmers as well as the detailed cost-benefit analysis of using the developed technology is likewise shown in this paper. The developed technology is very simple to operate and the machines are very easy to fabricate even in small shops.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRYING; DRYERS; DRIED PRODUCTS; PROCESSED PRODUCTS; FOOD TECHNOLOGY; TECHNOLOGY TRANSFER; INNOVATION; COST BENEFIT ANALYSIS; PHILIPPINES

Farm resort encourages value-added farming by turning bananas into banana chips. **Tan, Y.** *Agriculture (Philippines) v. 23 (07) p. 58-60 (Jul 2019)*.

BANANAS; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; FARMS; RURAL AREAS; TOURISM; MARKETING

Filipino chocolate brands take home international awards. **Juntilla, J.S.** *Agriculture (Philippines) v. 23 (08) p. 40-43 (Aug 2019)*.

THEOBROMA CACAO; COCOA BEANS; FOOD PROCESSING; CHOCOLATE; QUALITY; COCOA INDUSTRY; FERMENTATION

Increasing sea cucumber production and value of dried sea cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology. **Yaptenco, K.F., Pangan, R.S.** *2016 TR-1724*.

The Philippines is known to be a major supplier of dried sea cucumber products; however, the quality is substandard and requires reprocessing to pass export requirements. Due to poor quality, the buying price for dried sea cucumber is drastically reduced, resulting in less income for small fishers and processors. Defects typical of dried sea cucumber include excessive moisture presence of decay; deformed shape (bending or twisting), undersized and presence of spicules. Hence this project was conceptualized to develop technologies that are appropriate to small fisheries and processors and can improve quality of dried products. The project focused on sandfish (Holothuria scabra) as a high value species and demand for dried product. To obtain an initial overview of processing and drying of small fishers, a small survey was conducted by the project team in several sites nationwide. Practices were documented and samples of processed and dried products were obtained for analysis. A mass balance analysis of the process flow was conducted to determine product yield. Results showed that harvesting small animals led to lower product yields. Allowing sea cucumber to grow to large r sizes led to higher yield per kg of degutted weight, while also commanding higher prices due to the greater sizes of the dried product. Stability of dried product is essential for long shelf life; if sandfish is not properly dried, mold growth and decay can set in. Moisture sorption isotherms were established for dried sandfish which established the appropriate range for product moisture content(0.12-0.1 g g1 dry matter) without over- or under-drying. This information could be combined with the water vapor transmission rates of packaging film to predict shelf life and moisture gain during storage. Technologies developed for processing sandfish included a mechanical cleaner and a hybrid dryer. The mechanical cleaner was intended to reduce the labor needed to remove the spicule layer of sandfish after the boiling stage. The hybrid dryer can utilize solar radiation as its heat source during periods of good weather. A firebox fueled by biomass waste (driftwood, coconut fronds or shells) can be used during rainy weather. Both prototypes utilize readily available materials for fabrication, and are simple to and maintain. Feedback from field tests with potential users (members of fisher associations, staff of aquaculture corporations) indicate acceptability of the hybrid dryer design with some minor modifications. Furthermore, quality of dried products processed by fishers was improved using the dryer. The improvement in quality gave positive indicators of profitability of the developed technology. Output of the various components of the project were presented at technical conventions of the Philippine Society of Agricultural Engineers and the Philippine Association of Marie (DOST), and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). Presentations in technical conventions took the form in technical posters and oral papers. A draft version of a training manual on processing and drying of sandfish has also been developed.

SEA CUCUMBERS; HOLOTHURIA SCABRA; DRIED PRODUCTS; PROCESSED PRODUCTS; EXPORTS; KEEPING QUALITY; TECHNOLOGY TRANSFER; DRYING; DRYERS

Instant GABA [gamma-aminobutyric acid] rice congee: not just your typical 'lugaw'[rice congee]. **Bulatao, R.M., Castillo, M.B., Samin, J.P.A., Conde, R.M., Joson, M.J.P., Veluz, E.S., Gantioque, G.G., Romero, M.V.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 122 (Jul-2018)*.

Food innovation has provided wider selection of products where consumers can satisfy their hunger while keeping them on-the-go, through instant foods. However, these foods cannot provide enough nutrition to the body and its excessive consumption may even lead to occurrence of chronic illness. As such as, instant functional foods were developed. Germinated brown rice or gamma-aminobutyric acid (GABA) rice has great potential as functional food because it contains higher bioactive compounds and essential nutrients. Thus, this study was conducted to develop nutritious instant GABA rice congee (GBR congee) using Philippine rice cultivar NSIC Rc160. GABA rice was produced by soaking BR in water then sprouted up to 0.1-0.2mm. To assess its textural behavior, water absorption index (WAI), water solubility index (WSI), oil absorption index (OAI), and swelling power (SP) were determined. It was then used to produce GBR congee using different rice-broth ratio and cooking techniques. The eating quality and consumer acceptability of the product were assessed through sensory evaluation. GBR congee with the highest consumer acceptability was characterized for nutritional composition and microbial load. GABA rice had high WAI (1.23g/g), high OAI (2.14g/g), low WSI (0.03%) and low SP (0.02g/g), which indicate its suitability in products with thick consistency. The optimum combination of 1:6 rice-broth ratio and direct cooking for the production of GBR congee is a good source of minerals (9.1%), lipid (6.4%), and protein (24.1%), and is safe for consumption as shown by its low total plate (1.8x10 sup 6 cfu/g) and coliform (2x10 sup 3 cfu/g) counts, and no presence of E. coli and yeast/molds.

RICE; FOOD TECHNOLOGY; PROCESSING; PROCESSED FOODS; PROXIMATE COMPOSITION; NUTRITIVE VALUE; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Local brewery uses indigenous fruits to create signature spirits. **Taculao, P.A.S.** *Agriculture (Philippines) v. 23 (06) p. 50-51 (Jun 2019)*.

MANGOES; ANNONA SQUAMOSA; INDIGENOUS ORGANISMS; FOOD PROCESSING; BEERS

Malunggay [Moringa oliefera] helps in healthy nation building. **Urlanda, R.V.** *Agriculture (Philippines) v. 23 (6) p. 32-34 (Jun 2019).*

MORINGA OLEIFERA; LEAVES; DRYING; FOOD TECHNOLOGY; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; BREAST FEEDING

Modern village level muscavado sugar processing facility. **Sarian, Z.B.** *Agriculture (Philippines) v. 23 (06) p. 48-49 (Jun 2019).*

SUGAR; SUGAR TECHNOLOGY; FOOD PROCESSING; COMMINUTION; CRUSHERS; ORGANIC FOODS

Moisture sorption isotherms of dried sandfish (Holothuria scabra) for shelf life prediction. **Yaptenco, K.F., Pardua, S.N., Duque, J.A.C., Pangan, R.S.** Increasing sea cucumber production and value of dried sea

cucumber products: project 3: Enhancing the sea cucumber industry appropriate processing technology, Yaptenco, K.F.Pangan, R.S. *2016 TR- 1724 p.95-108*.

Dried sandfish (Holothuria scabra) is often poorly dried by artisinal fishers in the Philippine, resulting in downgrading of the product, this study aimed to develop moisture content sorption isotherms (MSI) at 30, 45 and 60 deg C at ten levels of water activity (alpha w) using an isopiestic method based on saturated salt solutions. MSI data was fitted to six mathematical models by non-linear regression analysis. Water vapor transmission rate (WVTR) of low-density polyethelyne (PE) and polypropylene (OPP) film was measured at 30 and 35 deg C. A mass-balance model was used to predict shelf life and moisture content during storage based on MSI and WVTR data. MSI of H.scabra followed a type III curve, which was best fitted to a Peleg model. For a stable product, the recommended range for MC during storage was 0.12- 0.18 g/g dry matter to avoid over-or under-drying, this corresponded to alpha w of 04-0.6. Predicted shelf life for PE and OPP film packs at 30 deg C reached 11 4 and 372 d, respectively; at 35 deg C, predicted shelf life was 83 d and 141 d, respectively.

HOLOTHURIA SCABRA; SEA CUCUMBERS; DRIED PRODUCTS; PROCESSED PRODUCTS; MOISTURE CONTENT; KEEPING QUALITY; WATER ACTIVITY; DRYING

Quality characteristics and consumer acceptability of cookies enriched with red mold rice. **Mamucod, H.F., Quiling, B.S., Morales, A.V., Castillo, M.B., Romero, M.V.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 113-114 (Jul-2018)*.

Utilization of natural pigment produced by red mold (RMR) has been gaining international recognition due to its good coloring property and antioxidant activity. This study evaluated the quality characteristics and consumer acceptability of cookies enriched with RMR, regardless of concentration, had significantly lower pH and moisture content than the control. All samples had water activity values below 0.4 which indicates good product stability. In terms of microbial load, all samples were found negative for coliform, E. coli, molds, and yeast. The total plate count at 10 sup 4 cfu/g is also within the acceptable limits. Cookies enriched with higher RMR concentration had significantly higher antioxidant activity (ABTS radical cation-scavenging activity and ferric reducing antioxidant power) than the control. The addition of RMR at any level did not affect the aroma, taste, mouthfeel, and tenderness of the samples. It also did not impart any significant off-odor. However, cookies with 3% RMR had pronounced off-flavor mainly attributed to bitterness resulting in significantly lower overall acceptability rating. Bitterness was not perceived at 0.5 – 2.0% RMR addition. Finally, cookies enriched with 0.5 to 1.0% RMR received overall acceptability scores comparable with the control. Samples with 0.5 and 1.0% RMR received overall acceptability of 90% and 85% ratings, respectively. When respondents were informed that the products had value-added qualities or health benefits, purchase intent ratings increased to 93.33% for 0.5% RMR and 91.67% for 1.0% RMR. Rank scores showed similar consumer preference for the control and samples with 0.5% RMR at p=0.05. These findings demonstrate the excellent market potential of cookies enriched with RMR powder at 0.5.

RICE; FOOD TECHNOLOGY; ANTIOXIDANTS; BREAD; CONSUMER BEHAVIOUR; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Quality characteristics and consumer acceptability of rice: adlai energy bar. **Morales, A.V., Manaois, R.V., Mamucod, H.F., Castillo, M.B., Belgina, P.R., Romero, M.V.** 48. Crop Science Society of the Philippines

Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 113 (Jul-2018)*.

The potential use of rice and adlai in the preparation of a nutritionally-enhanced and energy-laden snack bar was evaluated. Polished and unpolished forms of non-pigmented rice varieties NSIC Rc160 and NSIC Rc222, four pigmented rice (Chor-chor-os, Dinorado, Ittum, Ominio), and polished adlai (Gulian) were puffed and used for the preparation of the snack bar. The formulation of the samples consisted of 40:60 rice:adlai ratio. Laboratory sensory results indicated that there was no significant change in the attributes of energy bar samples, except for appearance, where in the heterogeneity increased with corresponding decrease in glossiness. Affective sensory test revealed that young (12-17 years old) consumer respondents (n=29) most preferred the bar with unpolished NSIC Rc160, while the adult group (≥18 years old, n=58) favored the unpolished Chor-chor-os:adlai bar. Nutritional analysis showed that the bar samples were generally comparable in total sugars (49.88-53.39%) and crude protein (9.20-9.27%). Bars with unpolished NSIC Rc222, Chor-chor-os and Ittum, contained slightly, but significantly higher total dietary fiber (1.94, 1.74 and 2.07%, respectively) than the sample with polished NSIC Rc222, than the sample with polished rice, indicating an improvement in the mineral content of the product. A 30-g serving of the energy bars could give 140cal of energy, which is comparable with other energy bars already available commercially. Without the addition of preservative, the energy bar packed in either polypropylene or aluminum-coated pouches remained acceptable up to eight week ambient condition. The aerobic plate count was within the allowable limit for ready-to eat foods, while the moisture content ranged 8.0-9.28%; water activity, 0.48-0.53; and free-fatty acid, 1.31-5.66%. This study demonstrated the feasibility of making rice and adlai snack bars with high energy value and acceptable sensory profile.

RICE; VARIETIES; COIX LACHRYMA JOBI; FOOD TECHNOLOGY; BREAD; PROXIMATE COMPOSITION; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Research to revenue: the feasibility of brown rice cracker ice cream sandwich. **Ballesteros, J.F., Labargan, E.S.A., Maraois, R.V., Morales, A.V., Abilgos-Ramos, R.G.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 130 (Jul-2018)*.

Brown rice cracker ice cream sandwich (BRICS), made from nutritious brown rice and buffalo's milk, is one of the rice-based value-added products that was developed by PhilRice [Philippine Rice Research Institute] to provide additional source of income and nutrition for the rice-based farm communities. To ensure marketability and profitability of the BRICS, a pre-feasibility study was conducted. Consumer acceptability of the BRICS and the feasibility of its commercialization were determined. Results showed that the respondents (n=100, 15-30 y old) rated BRICS with ''like very much'' (x raise to negative power = 8.40 plus minus 0.8; 1-dislike extremely to 9-like extremely) and 100% of them were willing to buy BRICS once available in the market. Pre-feasibility study forecasted that if 1% and 2% of the target number of consumers (n=611,473) will buy the product, the potential market demand will be 10,546 and 21,093 BRICS every month, respectively. Further, it was found that the most feasible commercialization scenario for the product is at 2% of the target number of consumers at PhP 30.00 (approx 50% mark-up) per piece. Projected 5-year financial statements showed that if the product is commercialized for 5 years, it will generate positive net profits and net cash

flows with a payback period 2.4 years, a positive net present value of PhP 688, 422.80, and an internal rate of return (37.5%) higher than the projected 12% loan interest rate for the capital. This means that the value of investment on BRICS will increase and profits will be earned even if the cost of operation will likewise increase over this period. Thus, BRICS has a high market potential and is profitable if introduced in the market at 2% market share, PhP 20.30 cost per piece, and approx 50% mark-up in selling price.

RICE; VARIETIES; MARKETS; MARKETING; FEASIBILITY STUDIES; EVALUATION; FOOD TECHNOLOGY; PROCESSING; PROCESSED PRODUCTS

Q04 Food composition

Carbohydrate profile, proximate analysis, phenolic content and antioxidant capacity of Philippine tablea. **Barrion, A.S.A., Hurtada, W.A., Amalin, D.M.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 70-74 (Apr 2016).*

The economic contribution of cacao (Theobroma cacao) is rising globally due to the growth of the chocolate industry. Farmers in the Philippines are encouraged to plant cacao to cash-in in its high demand in the world market. However, there has been limited study on the nutritional and health aspects of local varieties of cacao. At present, there are no known studies on the cooking and eating qualities of Philippine cacao tableas. The study was conducted to determine the carbohydrate profile, proximate composition, phenolic content and antioxidant capacity of cocoa tablea made from five different varieties of cacao namely K1, K2, BR-25, PBC-123 and UF-18. The highest amount of starch and amylase were obtained from the K2 (89.59%) and PBC-123 (24.796%) varieties, respectively. Cocoa tablea from K1 variety contained the highest amount of fats (45.45%) and protein (39.25%). The UF-18 variety had the highest amount of phenolic content with 1173.74 mg CE100g-1 while K2 variety had the highest antioxidant capacity which accounts for 86.9% (scavenging activity). Determining the carbohydrate profile, proximate composition, phenolic, content and antioxidant capacity of local cacao tableas are essential research tools to further elucidate the potential health benefits, nutritional, cooking and eating qualities of cacao processed products that may influence consumer preference.

THEOBROMA CACAO; PROCESSED FOODS; PROCESSED PLANT PRODUCTS; CARBOHYDRATES; PROXIMATE COMPOSITION; ANTIOXIDANTS; NUTRITIVE VALUE; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES; PHILIPPINES

Development of probiotic nutracueticals using guava leaf extract and lactic acid bacteria (year 2). **Saguibo, J.D., Elegado, F.B., Mercado, M.A., Calapardo, M.R., Perez, Ma.T.M.** 2016 TR-1741.

GUAVAS; LEAVES; PLANT EXTRACTS; PROBIOTICS; FERMENTED PRODUCTS; NUTRITIVE VALUE; SUPPLEMENTS; HERBAL TEAS; LACTIC ACID BACTERIA

In-vitro antibacterial potential of bran extracts of selected Philippine rice (Oryza sativa) cultivars. **Morales, A.V., Zapater, J.E.I., Cacerez, J.C.A., Manaois, R.V.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 111 (Jul-2018)*.

This study determined the in-vitro antibacterial activity of bran Philippine rice varieties with varying pericarp colors. Rice samples were first screened for free, bound and total phenolic content. Six samples, namely one

white (non-pigmented), two red, and three black/purple varieties were then selected and evaluated for in vitro antibacterial property. Crude bran extracts were tested against six common Foodborne pathogens, namely Salmonella enteric, Escherichia coli, Listeria monocytogenes, Clostridium perfringens, Enterococcus faecalis, and Staphylococcus aureus using agar well diffusion, bacterial growth curve, and minimum inhibitory concentration (MIC) assays. Results showed that pigmented rice generally had higher free, bound and total phenolic content than non-pigmented varieties. Agar well diffusion assay revealed that except for the extract of Black Rice 3, all selected pigmented rice brans at 100, 500 or 700 mg/mL concentrations displayed inhibitory property against S. aureus and C. perfringens only. Ethanolic extracts of the bran samples exhibited higher zones of inhibition than methanolic extracts, with the highest values observed in Black Rice 2. Growth curve assay test showed that viable cells of S. aureus decreased by 4 to 6 log using 5 to 100mg/mL ethanol extracts of pigmented rice starting at 5 hr incubation. Black Rice 2 was the most effective in preventing the growth of S. aureus and 2.5-3.125 mg/ml for C. perfringens, indicating mild antibacterial activities against the two Foodborne pathogens. In conclusion, pigmented rice bran can therefore be natural antimicrobial agents for potential use in food and/or pharmaceutical industries or other applications.

ORYZA SATIVA; RICE; VARIETIES; BRAN; EXTRACTS; PHENOLIC CONTENT; ANTIMICROBIAL PROPERTIES; CONTAMINATION; FOODS; PATHOGENS

Low-protein rice for chronic kidney disease patients and individuals requiring reduced protein diet. **Romero, M.V., Belgica, P.R., Castillo, M.B., Morales, A.V., Regalado, J.C., Mamucod, H.F.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 121-122 (Jul-2018)*.

Dietary protein restriction is used as a therapeutic measure for early onset of chronic kidney disease (CKD) to retard progressive deterioration in renal function that will require dialysis. A dietary intake of 0.6 to 0.8g protein/kg/day is usually recommended. In our country where rice is the staple food, reducing its protein content would be an excellent strategy to help CKD patients and other individuals who require a low-protein diet. This study was conducted to evaluate the suitability of Philippine rice varieties in the preparation of low-protein rice. Five varieties with varying sizes, shapes, and amylase content (AC) were used: Japonica-type NSIC Rc304 (low-AC) and NSIC Rc242 (low-AC), and Indica-type NSIC Rc160 (low-AC), NSIC Rc222 (intermediate-AC), and NSIC Rc152 (high-AC). The preparation followed the process established by Biotech Japan Corporation, a leading manufacturer of low-protein rice. The samples were then evaluated for content, sensory attributes, Instron hardness, and color (L and b values). The process was found to be effective in reducing the protein to 0.25-1.55%. The samples had comparable aroma and taste with no off-taste. In terms of texture, the Japonica-type varieties were too cohesive and tender with low Instron hardness values: 0.68 kg/cm sup 2 (NSIC Rc304) and 1.04 kg/cm2 (NSIC Rc242). The intermediate-AC NSIC Rc222 and high-AC NSIC Rc 152 had higher tendency to become hard and separated at room temperature. Both Japonica-type varieties had unpleasant yellowish color which was also manifested in their lower L and higher b values. With its considerable good sensory attributes and cooked rice texture, the Indica-type, low-AC NSIC Rc160 was the most acceptable. This study shows that local rice varieties with appropriate quality characteristics can be used in the development of low-protein rice which can be consumed by Filipinos requiring reduced protein diet.

ORYZA SATIVA; RICE; VARIETIES; PROTEINS; PROXIMATE COMPOSITION; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES; KIDNEY DISEASES

Optimization of process parameters for the extraction of anthocyanins from black rice bran using response surface methodology. **Bulatao, R.M., Samin, J.P.A., Tubera, R.P., Rubio, M.M.M., Romano, D.C., Rafael, R.R.** *Philippine Agricultural Scientist (Philippines) v. 102 (1) p. 1-13 (Mar 2019)*.

This study aimed to optimize different process parameters for the extraction of anthocyanins from black rice bran using Response Surface Methodology (RSM). To determine its degradation profile, the stability of crude anthocyanin extract (CAE) against selected biologically relevant buffers was also evaluated. Two-level full factorial and Box-Behnken designs were employed in the screening and optimization of extraction parameters, respectively. CAE was prepared from black rice bran using conventional and optimized methods and the resulting extract was determined for their phytochemical content and antioxidant scavenging activities. Stability of the optimized CAE was further evaluated using biologically relevant buffers for 48 h. Results showed that the optimum conditions for the extraction of anthocyanins were 60% ethanol, 0.2% hydrochloric acid, and 215 min of extraction. The CAE obtained from the optimized method was 4 times higher in anthocyanins, 2.3 times higher in 2,2-diphenyl-1picrylhydrazyl (DPPH) radical scavenging activity, 1.7 times higher in phenolics and ferric reducing antioxidant power (FRAP) values, and 1.5 times higher in flavonoids than that obtained from the conventional method. In terms of its stability, the optimized CAE did not undergo substantial degradation at pH 1, while significant degradation was observed at pH 7.4. Addition of 10% newborn calf serum had no significant effect on the stability of anthocyanin. The half-life of anthocyanins from the optimized CAE ranged from 29.0 to 32.5 h based on first order kinetics. The study suggests that RSM is a practical and effective statistical tool that can be used to optimize the best conditions in extracting anthocyanins from black rice bran.

RICE; BRAN; MILLING BYPRODUCTS; EXTRACTION; ANTHOCYANINS; PIGMENTS; BUFFERING CAPACITY; SEPARATORS; OPTIMIZATION METHODS

Quality characteristics and consumer acceptability of cookies enriched with red mold rice. **Mamucod, H.F., Quiling, B.S., Morales, A.V., Castillo, M.B., Romero, M.V.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 113-114 (Jul-2018)*.

Utilization of natural pigment produced by red mold (RMR) has been gaining international recognition due to its good coloring property and antioxidant activity. This study evaluated the quality characteristics and consumer acceptability of cookies enriched with RMR, regardless of concentration, had significantly lower pH and moisture content than the control. All samples had water activity values below 0.4 which indicates good product stability. In terms of microbial load, all samples were found negative for coliform, E. coli, molds, and yeast. The total plate count at 10 sup 4 cfu/g is also within the acceptable limits. Cookies enriched with higher RMR concentration had significantly higher antioxidant activity (ABTS radical cation-scavenging activity and ferric reducing antioxidant power) than the control. The addition of RMR at any level did not affect the aroma, taste, mouthfeel, and tenderness of the samples. It also did not impart any significant off-odor. However, cookies with 3% RMR had pronounced off-flavor mainly attributed to bitterness resulting in significantly lower overall acceptability rating. Bitterness was not perceived at 0.5 – 2.0% RMR addition. Finally, cookies enriched with 0.5 to 1.0% RMR received overall acceptability scores comparable with the control. Samples with 0.5 and 1.0% RMR received overall acceptability of 90% and 85% ratings, respectively. When respondents were informed that the products had value-added qualities or health benefits, purchase intent ratings increased to

93.33% for 0.5% RMR and 91.67% for 1.0% RMR. Rank scores showed similar consumer preference for the control and samples with 0.5% RMR at p=0.05. These findings demonstrate the excellent market potential of cookies enriched with RMR powder at 0.5.

RICE; FOOD TECHNOLOGY; ANTIOXIDANTS; BREAD; CONSUMER BEHAVIOUR; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Rice quality preference of consumers in adverse ecosystems of Luzon [Philippines]. **Bandonill, E., Castillo, M., Cacerez, J.C., Soco, O., Castillo, L.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine *Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 112 (Jul-2018)*.

Consumers are now becoming more selective in the quality of rice they eat. To determine the quality preference of consumers in the adverse ecosystems in Luzon and compare their perceived and preferred rice characteristics, consumer survey and sensory evaluation were conducted in rainfed lowland, saline, cool elevated, and upland ecosystems in North (Ifugao, Isabela), Central (Pangasinan, Nueva Ecija), and South (Batangas and Quezon) Luzon. Cooked rice representing aromatic, soft, medium, and hard texture and raw rice with varying color, length and shape, and translucency, as well as varieties released in the adverse ecosystem were utilized. The respondents (n=210) with age ranging from 23-81 y/o, were mostly female (30-63%), married (70-93%), and were either farmer or housewife (10-70%). Consumers looked for white, soft, aromatic, cohesive, and tasty cooked rice with long and whole grains. When presented with actual raw rice samples, respondents in the rainfed lowland, saline, and upland areas chose very white, translucent, and long and slender grains while short and bold grains in the cool elevated area. In the cooked form, aromatic and soft rice was preferred showing similarity between their perceived and preferred rice qualities across all locations. Higher acceptability was also obtained for varieties with soft to medium texture with long and slender grains in the three adverse ecosystem, while short and bold grain was highly acceptable in the Ifugao area. This study confirmed similar preference for soft and aromatic cooked rice with long and slender grains in adverse environments of Luzon as in the past 10 years. This will guide breeders to continue developing rice varieties with soft to medium texture with long and slender grains for the adverse ecosystems but short and bold grains in the cool elevated areas.

RICE; GRAIN; QUALITY; CONSUMER BEHAVIOUR; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES; PHILIPPINES

Short-term satiety of brown rice and milled rice. **Felix, A.dR., Tuaño, A.P.P., Mallillin, A.C., Trinidad, T.P., Juliano, B.O**. *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 52-59 (Apr 2016)*.

The study was conducted to determine the short-term satiety of brown and milled rice forms of modern Philippine rice varieties of wider range of apparent amylose content (AC) types, and differing in glycemic index (GI). Brown and milled rices representing waxy, low-AC, intermediate-AC and high-AC types were cooked to comparable hardness by adjusting water-rice ratio. The rice samples were subjected to estimation of satiety in 12 normal Filipino subjects using a randomized, crossover study design. Short-term satiety indexes used were: 1) satiety quotient (SQ) for four parameters, namely hunger, fullness, desire to eat, and prospective consumption; 2) overall satiety index (SI); and 3) 2-h post meal common cooked rice intake. SQ for the four parameters and SI were comparable across AC types. Consistent with earlier studies, milled rice satiety was

independent of AC, as well as of its GI. Meanwhile, there was a tendency for both SQ and SI to be higher in brown rice than milled rice, and SI had strong positive correlation with dietary fiber (DF) content. Contrary however to hypothesis, the higher SQ and SI for brown rice was not translated into lower subsequent food intake after 2 h. Common cooked rice intake was not affected by DF content. Cooking method, water-rice ratio, water content, hardness (tenderness) and stickiness of cooked rice may have complicated the findings. These have to be further elucidated, together with the roles of cognitive cues and sensory qualities. Follow-up studies of longer duration and to include physiological biomarkers are likewise suggested.

ORYZA SATIVA; RICE; VARIETIES; APPETITE; AMYLOSE; FOOD INTAKE; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Why do you need to eat your pigmented rice unpolished? **Bulatao, R.M., Tubera, R.P., Samin, J.P.A., Zapanta, C.S., Monserate, J.J., Salazar, J.R.** 48. Crop Science Society of the Philippines Scientific Conference : Proceedings; Crop Science Innovations : express path towards countryside development, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines) v.43 (Supplement no. 1) p. 111-112 (Jul-2018)*.

Pigmented rice cultivars are reported to contain high levels of phytochemicals that are capable of reducing the risks of certain chronic diseases. In rice, these phtyochemicals are concentrated mainly in the bran layer. Since polishing of rice grain removes the bran layer, this process plays a significant role in the retention of phytochemicals since it may degrade the heat-sensitive bioactive compounds in rice. Thus, the effect of different polishing times and cooking on the phytochemical and antioxidant properties of pigmented rice cultivars were investigated in this study. Two pigmented rice cultivars, namely, Minaangan (red) and Brillante (black) were polished for 0, 15, 30 and 45 sec and were subjected to cooking. Their phytochemical properties were evaluated by determining the total anthocyanin content (TAC), total phenolic content (TPC), total flavanoid content (TFC), DPPH radical scavenging activity (DPPH-RSA) and Ferric reducing antioxidant power (FRAP) assay. Between the two pigmented rice cultivars, black rice Brillante had significantly higher reduction in TAC (52.7%), TPC (65.4%), TFC (61.4%), DPPH-RSA (79.9%) and FRAP value (66.0%) compared with red rice Minaangan (TAC-25.3, TPC-52.2%), TFC-49.2%, DPPH-RSA-75.6%, FRAP-58.9%) after polishing for 45 sec. After cooking, opposite trend was obtained wherein Minaangan had higher losses of phytochemicals than Brillante. The reduction of phytochemicals after cooking were 97-100% for TAC, 77.2-88.4% for TPC, 61.9-68.1% for TFC, 73.6-85.8 for DPPH RSA and 78.0-89% for FRAP. The results indicated that polishing and cooking significantly reduced the phytochemical content and antioxidant activities of pigmented rice cultivars.

ORYZA SATIVA; VARIETIES; RICE; PIGMENTS; COOKING; ANTIOXIDANTS; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Q05 Food additives

Enzyme-mediated extraction of colorants from by-products of agricultural processing wastes. **Ramirez, T.J., Sapin, A.B.** 2016 TR-1736.

There is a growing preference for natural products as consumers become more conscious of their health. Many researches had been undertaken to meet the demand for natural additives as consumers shift from the use of the synthetic ones. The demand is great in the food, pharmaceutical and cosmetic industries. The wastes and by-products from agricultural production offer alternatives to sources of natural colorants. One

biotechnological approach to extract these natural colors is the use of enzymes. Thus, this study aimed to develop an easy, effective and eco-friendly extraction method for colorant from various agricultural processing industries, such as yam peel, luyang dilaw meal, luyang dilaw tubers, chili pepper, annatto, dragon fruit peel and matured camote leaves, through enzyme-meditated process. In this investigation, enzymatic pre-treatment was applied to plant materials prior to ethanol extraction of colorants. The results so far showed that yields of plant pigments/colorants from the by-products tested can be enhanced by enzymatic action. The enzymatic pretreatment conditions and solvent extraction steps were optimized for each plant material tested. The colorants obtained possessed certain characteristics that may be tapped in various applications. With their properties determined and evaluated for toxicity, the pigments have potential use as additive in food, pharmaceutical and cosmetic industries as substitute for synthetic colorants.

FOOD COLOURANTS; WASTES; PIGMENTS; AGRICULTURAL PRODUCTS; ENZYMES; ETHANOL; SOLVENT EXTRACTION; ANALYTICAL METHODS

Q53 Feed contamination and toxicology

Development of a dipstick assay format for detection of Salmonellae in food and feeds. **Sedano, S.A., Tavanlar, M.A.T., Perez, MA.T.M., Araguirang, G.E., de Padua, Z.P., Alip, T.G.** *2015 TR-1757.*

Salmonellosis remains a public health concern and a problem in the livestock industry. Early detection of the causal organism is a major strategy for control and management of the spread of the disease. Contaminated water, food, feed and infected animals/animal products are the vectors of Salmonellae. Current methods for Salmonella detection include antibody or DNA-based formats or a combination of both. DNA-based detection shows more reliability, particularly when applied through exponential amplification of the target sequences e.g. via the polymerase chain reaction. A dipstick assay was established for the detection of Salmonella via DNA hybridization. This utilized DIG-labeled and unlabeled DNA fragments generated in a PCR reaction using specifically designed primers. The established assay involved the sequential hybridization of the capture probe fixed on the dipstick with the target DNA followed by the detection of the labeled probe. Consistent detection results at 55 deg C hybridization temperature, a 50ng of unlabeled fragment fixed on the nylon membrane can capture a minimum of 10ng Salmonella target DNA were observed. This was detected upon the addition of DIG-labeled detector fragment. The appearance of a definite blue colored spot was observed for positive result on the prepared dipsticks. Initial storage studies of prepared dipsticks at room temperature and 10 deg C for seven weeks in air-tight container exhibited similar positive results. Selective enrichment procedures to complete the dipstick assay protocol were tested on selected food samples. A two-step enrichment was employed to provide a next-day result of the analysis and convenience to the analyst. Other medium for the second stage enrichment which will provide better selectivity in the presence of other pathogens will be evaluated. Some modifications on the hybridization conditions will be conducted to establish the dipstick assay protocol.

SALMONELLA; FOODS; FEEDS; DNA HYBRIDIZATION; BACTERIA; DISEASE TRANSMISSION; PCR; ANALYTICAL METHODS

Q54 Feed composition

Pilot testing of Protein Enriched Copra Meal (PECM): a valuable protein fee ingredient for swine and poultry. **Pham, L.J.** *2017 TR-1784.*

A bioprocess system for the pilot scale production of the PECM at 1 MT capacity was established in order realize the full potential of the PECM technology as shown by its promising results at laboratory scale. The process design and construction of the pilot pant facility was jumpstarted with the construction of partial building shell and embedded electrical roughing-ins in concrete column. Critical equipment necessary to carry out the production quota were either fabricated or purchased. Optimization if the process conditions for the production of PECM was done using Response Surface Methodology. Fractional factorial design as used to screen for factors that has significant influence on the protein enrichment of copra meal since the pilot plant facility is not yet fully functional, a 250 kg/batch PECM was done using existing facilities and equipment of the laboratory. Quality monitoring of the produced PECM showed an increase in crude protein content from 19-21% to 32-37% in dry weight basis while fiber was significantly reduced. Limiting amino acids in swine and poultry diets such as lysine, methionine+cysteine, threonine and tryptophan were improved by 89%. The PECM product showed higher degree of present in A. niger. In vitro dry matter digestibility studies showed that the bioprocessing of copra meal into PECM enhances its dry matter digestibility from 33.51% to 48.01%. The aflatoxin content of both raw copra meal and PECM falls within the tolerance limit of 20 ppb whereas Salmonella contamination was not detected in both samples. Acute toxicity testing in mice indicates that PECM is safe and non-toxic even at high levels. Process conditions for the production of PECM powder inoculants were also established. Statistical screening methods were done to establish a suitable carrier for the propagation of A. niger 3104 at high cell viability counts. The cost of producing PECM at 100kg capacity is projected to be PhP 19.77 based on the overall mass balance. Commercial testing and distribution of PECM products were conducted in collaboration with potential investors, private sectors and other small scale livestock raisers.

COPRA MEAL; SWINE; POULTRY; FEEDS; PROTEINS; NUTRITIVE VALUE; ANIMAL FEEDING

Q70 Processing of agricultural wastes

Development of nanosensors and nanostructured materials from agricultrural by-products for enhancement of food and agricultrural productivity and for environmental sensing and remediation: Performance analysis of nanosilica powder from rice hull ash for use in vario us agricultural applications: Characterization and performance analysis of nanosilica powder incorporated in biodegradable film based on cassava starch for food packaging applications. **Peralta, E.K., Rubio, M.G.A., Viado, L.N.T., Alpeche, Z.J.S.** *2014 TR-1726*.

The use of biological films in food packaging application has drawn the attention of researchers as an alternative way to deal with the problem of waste packaging disposal. To be effective as food packaging material, biological films should have good mechanical and barrier properties. Today, researches on biological films for food packaging focus on improving these properties to make them comparable to commonly used plastic packaging materials. Nanomaterials are attracting a great deal of attention due to new potential uses of materials in nanometer scale. The modification of the biodegradable film through nanotechnology could be an effective way in improving the properties of the films. Silica particles were successfully produced from rice hull (7-13 nm particle) and rice hull ash (35-90 nm particle) using the hydrothermal method and the solgel method, respectively. The hydrothermal method which involves acid leaching and calcination at 650 deg C for 6.5 hours is a more economical and efficient way of producing quality nanosilica. A combustor was also fabricated for the production of white rice hull ash. Thermoplastic starch formulations were prepared by mixing glutaraldehyde-crosslinked cassava starch, glycerol as plasticizer and nanosilica. Different additives like PVA-CMC and plasticizers like monolaurin and citric acid were also tried. The addition of nanosilica in some

formulations showed improvement in tensie strength and water resistance. The films did not disintegrate in water when incorporated with nanosilica. Modification of starch using acetic anhydride and butyric anhydride was done to improve these properties. The degrees of substitution are 2.7 for starch acetate and 2.1 for starch butyrate. Modifying starch made it hydrophobic. The maximum water uptake significantly decreased to 30% for starch acetate and 20% for starch butyrate.

RICE HUSKS; CASSAVA; STARCH; EDIBLE FILMS; PACKAGING; PACKAGING MATERIALS; WASTE DISPOSAL; WASTE UTILIZATION

Enzyme-mediated extraction of colorants from by-products of agricultural processing wastes. **Ramirez, T.J., Sapin, A.B.** 2016 TR-1736.

There is a growing preference for natural products as consumers become more conscious of their health. Many researches had been undertaken to meet the demand for natural additives as consumers shift from the use of the synthetic ones. The demand is great in the food, pharmaceutical and cosmetic industries. The wastes and by-products from agricultural production offer alternatives to sources of natural colorants. One biotechnological approach to extract these natural colors is the use of enzymes. Thus, this study aimed to develop an easy, effective and eco-friendly extraction method for colorant from various agricultural processing industries, such as yam peel, luyang dilaw meal, luyang dilaw tubers, chili pepper, annatto, dragon fruit peel and matured camote leaves, through enzyme-meditated process. In this investigation, enzymatic pre-treatment was applied to plant materials prior to ethanol extraction of colorants. The results so far showed that yields of plant pigments/colorants from the by-products tested can be enhanced by enzymatic action. The enzymatic pretreatment conditions and solvent extraction steps were optimized for each plant material tested. The colorants obtained possessed certain characteristics that may be tapped in various applications. With their properties determined and evaluated for toxicity, the pigments have potential use as additive in food, pharmaceutical and cosmetic industries as substitute for synthetic colorants.

FOOD COLOURANTS; WASTES; PIGMENTS; AGRICULTURAL PRODUCTS; ENZYMES; ETHANOL; SOLVENT EXTRACTION; ANALYTICAL METHODS

Microbial load, physical properties and molecular assessment of microbial community structure in rapid composting system. **Pedro, M.S., Ishii, M., Igarashi, Y.** *Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 11-19 (Apr 2014).*

The predominant microbial communities involved in rapid composing system (RCS) were determined using terminal-restriction Fragment Length Polymorphism (T-RFLP) coupled with Denaturing Gradient Electrophoresis (DGGE) to further understand the role of microbial community structures in RCS. The RCS treats organic residues by batch in compost bins for 11-14 d and operates in a self-induced heat generation, creating an initial mesophilic stage (45 deg C) and subsequent thermophilic stage (62 deg C). Population level of the final product was 5.68 x 10 sup 5 cfu/g dry samples and 2.26 x 10 sup 6 cfu/g dry samples at 37 deg C or 50 deg C incubation, respectively. The pH values during the operation did not vary significantly (pH 7.3-7.9), while moisture content was reduced from 17% to 3.5% T-RFLP analysis of the samples during degradation exhibited two major ribotypes (T-rfs), 167.4 and 162.6 which relative population level of 49.6% (early stage) and 64.3% (final product), respectively. DGGE and 16S rDNA analysis revealed that the system consisted of the following genera : Lactococcus sp., Bacillus sp. Geobacillus or Aeribacillus sp. Corynebacterium sp or Amycolatopsis sp., Saccharopolyspora sp. and Staphylococcus sp. The strain Lactococcus sp. was found in early

stages, while Bacillus sp.Corynebacterium sp. and/or Amycolatopsis seemed to predominate during the early and subsequent periods, respectively. Staphylococcus sp. and Saccharopolyspora sp. only existed at the last stage of composing period. The two major ribotypes in T-RFLP analysis and two major bands on DGGE analysis seemingly followed similar population patterns. DGGE revealed that though the samples analyzed came from different batches, results showed that the microbial population fingerprints were well represented and were simultaneously detected in the different batches of samples. This result could indicate that a preparation of composite microflora from each composting stage could be developed and used as a seeding materials for improved composting process.

COMPOSTING; ORGANIC WASTES; MICROORGANISMS; MICROBIAL FLORA; LACTOCOCCUS; BACILLUS; STAPHYLOCOCCUS; POLYMORPHISM; CHEMICOPHYSICAL PROPERTIES

Microbial production of xylitol from the hydrolysis products of selected agricultural wastes. **Nayve, F.R.P., Jr, Tambalo, R.D.** *2017 TR-1794*.

Three kinds of lignocellulosic agricultural wastes, sugarcane bagasse (SB), corn cobs (CC) and corn stovers(CS) were hydrolyzed as sources of xylose sugars for biotechnogical production of xyitol. After comparing, different methods used to pretreat ground SB namely: Acid Hydrolysis using Oil Bath, acid Hydrolysis using Autoclave, Steam Explosion and Steam Explosion of Acid-Treated SB, highest xylose concentration was obtained from acid hydrolysis via autoclaving followed by acid hydrolysis using an oil bath. Acid hydrolysis combined with high temperature treatment using oil bath was used for future scale up purposes and to study statistically the effect of temperature, acid concentration and time on the hydrolysis and xylose yield. This is the first time that optimization studies on the hydrolysis of agricultural feedstocks were conducted using Response Surface methodology which combines factorial experiment designs, statistical models and actual experimentation. The optimum conditions for the high temperature-dilute acid hydrolysis of ground sugar cane bagasse, corn cobs and corn stovers were obtained. Initial detoxification of the resulting hydrolysate was done by pH adjustment. Based on the analysis of variance of the responses (final biomass concentration, final xylose concentration, final xylitol concentration, growth yield, xylitol yield, specific growth rate, and specific xylitol production rate), both Candida tropicalis BIOTECH 2085 or Canada guillermondii BIOTECH 2172, can be used for the fermentation experiments for the production of xylitol from xylose sugars. Using SB hydroysate as substrate and C. tropicalis BIOTECH 2085 as organism, the optimum conditions for the production of xylitol under shake flask scale was obtained with a yield of 4.95 g xylitol/L medium. The optimum conditions for the production of xylitol from CS hydrosylate and C. guilliermondii BIOTECH 2172 as organism was obtained resulting to a yield of 9.63 g xylitol/L medium. Optimization studies for the production of xylitol from CC hydrosylate and C. guilliermondii BIOTECH 2172 as organism were aso conducted, however problems with the growth of the organism in the fermentation medium were encountered. Using SB hydrosylate as substrate, C. tropicalis BIOTECH 2085 as organism and the determined optimum conditions, preliminary kinetic studies of xyitol production was done in a 5-L stirred tank bioreactor. The fermentation profile showed a rapid decrease in xylose concentration with concomitant increase in xylitol during the exponential phase of growth of the organism. At optimum biomass concentration, xylose concentration was the limiting factor for xylitol production. Interestingly, higher xylitol concentration was observed at lower aeration conditions.

SUGARCANE; MAIZE; BYPRODUCTS; LIGNOCELLULOSE; XYLOSE; AGRICULTURAL WASTES; ENZYMATIC HYDROLYSIS; XYLOSE; XYLITOLMillenial from Rizal [Philippines] creates do-it-yourself vermicomposting kit to help reduce household food waste. **Necessario, N**. Agriculture *(Philippines) v. 23 (08) p. 16; 18 (Aug 2019)*.

COMPOSTING; OLIGOCHAETA; HOUSEHOLD WASTES; FOOD WASTES; URBAN AREAS; PHILIPPINES

Performance analysis of nanosilica-in-fluid dispersion (nanofluid) derived from rice hull ash as coolant in heat exchanger. **Ignacio, Ma.C.C.D.** *2016 TR-1744.*

The development of performance-enhancing nano-materials from renewable, readily available sources for a variety of value-added applications is one attractive area of research in our institution. This study aimed to find alternative ways of enhancing the thermal properties of heat transfer fluids and to utilize agricultural by-products like rice hull ash (RHA), which has been proven to be viable and low-cost alternative source of nanosilica particles with 92.85% purity and 82% recovery. Fluids with nano-scaled particles form a stable suspension and provide impressive improvements in the thermal properties of base fluid s. The nanofluid was prepared by dispersing the nanosilica powder from the rice hull ash into deionized water and ethylene glycol:deionized water (EG:dW) mixtures (25:75, 50:50 and 75:25) as base fluids. AFM analysis of the nanosilica powder gave a size range of 46.5nm. The stability of the nanofluids based on sediment photography and UV-Vis spectrophotometry showed that 0.5% deionized water-based nanofluids was stable for 10 days and 0.25% of 50:50 EG:dW mixture-based nanofluids was stable and without significant sedimentation for 7 to 10 days compared to other EG:dW mixture-based nanofluids. Measured density of the nanofluids did not vary much relative to the base fluids. An increase in dynamic viscosity was observed in deionized water-based nanofluid by as much as 159.90%. it was observed that the 25:75 EG:dW ratio has the fastest flow rate while the 75:25 has the slowest. Thus, the concentration of ethylene glycol greatly affects the flow rate of the solution. Measured specific heat of the nanofluids formulated in different volume concentrations decreased compared to base fluids. The increase of thermal conductivity of water-based nanofluids compared to deionized water reached 45% after dispersing nanosilica powder at different volume concentrations measured at temperatures ranging 30-70 deg C while 55.12% for EG:dW mixture-based nanofluids. The performance of the most stable deionized water (0.5% volume concentration) in a heat exchanger was determined to be 0.57% to 6.02% and 13.49 to 35.40%, respectively. The enhancement of thermophysical properties and heat transfer of nanosilica-in-fluid dispersion suggests the potential use of the nanofluids as a heat transfer fluid.

RICE HUSKS; HEAT EXCHANGERS; FLUIDS; ETHYLENE GLYCOL; AGRICULTURAL PRODUCTS; THERMAL PROPERTIES; HEAT TRANSFER

Thermophysical properties of nanosilica-in-fluid dispersion (nanofluid) derived from rice hull ash. **Ignacio, Ma.C.C.D., Peralta, E.K., Peralta, M.M., Elepaño, A.R., Suministrado, D.C.** *Philippine Journal of Crop Science (Philippines) v. 39 (1) p. 20-29 (Apr 2014)*.

The study aimed to find an alternative way of enhancing the thermal properties of heat transfer fluids, and utilizing agricultural by-products such as rice hull ash (RHA) which has been proven to be viable and low cost alternative source of nanosilica silica particles. Fluids with nano-scaled particles form a stable suspension and provide impressive improvements in the thermal properties of base fluids. Nanofluid was prepared by dispersing the nanosilica powder from rice hull ash into deionised water as base fluid. SEM analysis of the nanosilica powder gave a size range of 40 to 65nm. The stability of nanofluids based on sediment photography and UV-Vis spectrophotometry showed that nanofluids of 1, 2, and 3% volume were stable and without significant sedimentation for 5 d compared to nanofluids with 4 and 5% volume concentration which were stable for 2 d only. Measured density of the nanofluids did not vary much relative to the base fluid. An increase of dynamic viscosity was observed in nanosilica-in-fluid dispersion (nanofluids) by as much as 202%.

Measured specific heat of the nanofluids formulated in five volume concentrations decreased by 3-25% to base fluid. The enhancement of thermal conductivity of water reached 50% after dispersing nanosilica powder at different volume concentrations measured at temperature ranging 30-70 deg C. The enhancement of thermophysical properties of nanosilica-in-fluid dispersion suggest the potential use of the nanofluids as a heat transfer fluid.

RICE; RICE HUSKS; ASHES; THERMAL PROPERTIES; HEAT TRANSFER; HEAT; THERMAL ENERGY; VISCOSITY; SEDIMENTATION; DENSITY

Tobacco (Nicotiana tabacum) stalk particles as additive in urea formaldehyde bonded. **Acda, M.N.** Waste tobacco stalk as glue filler in plywood manufacture in the Philippines, Acda, M.NJimenez, J. 2017 TR-1780 p. 4-19

The study investigated the use of tobacco (Nicotiana tabacum L) stalk particles as additive in urea formaldehyde glue formulation used to bond plywood. The effect of increasing amount of tobacco particles on shear strength, wood failure, formaldehyde emission and termite resistance of plywood was studied. Addition of tobacco particles from 4 to 8% tobacco particle by mass mixed well and had no significant effect on shear strength and wood failure of plywood using Paraseriant falcaria (L) Nielsen veneers. Formaldehyde emission from specimen containing 4-12% tobacco stalk particles was reduced by 18 to 32% compared to untreated controls. The reduction could be due to the presence of nicotine in tobacco stalk particles that captured residual formaldehyde from the boards. Glueline treatment using tobacco particles at all levels used in this study showed no or limited protection against the subterranean termite Microcerotermes losbanosensis Oshima after 16 week of choice feeding bioassay. Although further research is needed,tobacco particles showed good potential as additive in plywood manufacture.

TOBACCO; PETIOLES; PLYWOOD; WOOD PROPERTIES; STICKINESS; FORMALDEHYDE; ISOPTERA; PEST RESISTANCE; PARASERIANTHES FALCATARIA

Q80 Packaging

Development of nanosensors and nanostructured materials from agricultrural by-products for enhancement of food and agricultrural productivity and for environmental sensing and remediation: Performance analysis of nanosilica powder from rice hull ash for use in vario us agricultural applications: Characterization and performance analysis of nanosilica powder incorporated in biodegradable film based on cassava starch for food packaging applications. **Peralta, E.K., Rubio, M.G.A., Viado, L.N.T., Alpeche, Z.J.S.** *2014 TR-1726*.

The use of biological films in food packaging application has drawn the attention of researchers as an alternative way to deal with the problem of waste packaging disposal. To be effective as food packaging material, biological films should have good mechanical and barrier properties. Today, researches on biological films for food packaging focus on improving these properties to make them comparable to commonly used plastic packaging materials. Nanomaterials are attracting a great deal of attention due to new potential uses of materials in nanometer scale. The modification of the biodegradable film through nanotechnology could be an effective way in improving the properties of the films. Silica particles were successfully produced from rice hull (7-13 nm particle) and rice hull ash (35-90 nm particle) using the hydrothermal method and the solgel method, respectively. The hydrothermal method which involves acid leaching and calcination at 650 deg C for 6.5 hours is a more economical and efficient way of producing quality nanosilica. A combustor was also

fabricated for the production of white rice hull ash. Thermoplastic starch formulations were prepared by mixing glutaraldehyde-crosslinked cassava starch, glycerol as plasticizer and nanosilica. Different additives like PVA-CMC and plasticizers like monolaurin and citric acid were also tried. The addition of nanosilica in some formulations showed improvement in tensie strength and water resistance. The films did not disintegrate in water when incorporated with nanosilica. Modification of starch using acetic anhydride and butyric anhydride was done to improve these properties. The degrees of substitution are 2.7 for starch acetate and 2.1 for starch butyrate. Modifying starch made it hydrophobic. The maximum water uptake significantly decreased to 30% for starch acetate and 20% for starch butyrate.

RICE HUSKS; CASSAVA; STARCH; EDIBLE FILMS; PACKAGING; PACKAGING MATERIALS; WASTE DISPOSAL; WASTE UTILIZATION

T - POLLUTION

T01 Pollution

Electrolytic recovery of low-grade nickel from Ni-rich soil. **Laurio, M.V.O., Alfafara, C.G., Migo, V.P.** 2016 *TR-1710*.

Heavy metal contamination of the soil is a serious threat to human health, plants, animals and microorganisms if left untreated if left untreated in the soil matrix. Hence, remediation is deemed necessary for soils with heavy metal concentration exceeding the threshold limits for plant and soil toxicity. In this study, removal of nickel from contaminated soil by soil washing using chelating agents such as chitosan and ethylenediaminetetraacetic acid (EDTA) was explored. The extent of heavy metal contamination in Sta. Cruz, Zambales [Philippines] was initially evaluated by analyzing twelve soil samples collected from various agricultural sites (i.e. fishponds, rice fields). Metal profiling by X-Ray Fluorescence (XRF) showed that the dominant metal in all soil samples is iron with concentrations ranging from 272,000 to 404,000 mg/kg in rice field soil samples and 76,000 to 101,000 mg/kg in fishpond soil samples, followed by chromium (7,700 to 10, 000 mg/kg in rice fields and 3,000 to 3,700 mg/kg in fishponds) and nickel (5,900 to 7,700 mg/kg in rice fields and 2,700 to 3,400 mg/kg in fishponds). All of these heavy metals far exceed their allowable concentration in the soil (1,000 mg/kg for Fe, 150 mg/kg for Cr and 100 mg/kg for Ni); hence, the soil in this area needs remediation to prevent further environmental degradation and improve soil productivity. Among the twelve soil samples, the soil with t he highest nickel concentration of about 7,658 mg Ni/kg soil (RF1 R1) was selected for further characterization and soil washing experiments. Physico-chemical characterization of RF1 R1 was done to determine soil pH (7.63), particle size distribution (25% w/w sand, 36% w/w clay), cation exchange capacity (25.47 meq/kg soil), organic matter (1% w/w), and organic carbon (0.378% w/w). Using sequential extraction, nickel distribution in different soil fractions – exchangeable (3.56% w/w), reducible (7.44% w/w), organics (7.70% w/w), and residual (81.31% w/w)was determined. Soil washing experiments for both chitosan and EDTA was initially done by evaluating the factors (solution pH, chelating agent concentration and soil loading) based on their effect on nickel removal from the soil by implementing a two-level factorial experimental design. This was followed by numerical optimization using Design Expert v7.0.0 to determine the soil washing conditions that maximizes the amount of nickel removed from the soil. For chitosan, only solution pH was found to have significant effect on nickel removal based on ANOVA results at alpha = 0.05. An increasing trend in nickel removal was observed as solution pH was decreased. Optimum soil washing conditions was predicted using One Factor Design Design Expert v7.0.0 to be at pH 0.5, 0.1 g/L chitosan

concentration and 0.10 g/ml soil loading. At this condition, the predicted amount of nickel which can be removed from the soil is approximately equal to 2,336 +- 19.47 mg Ni/kg soil. For EDTA, on the other hand, all three (3) main factors (solution pH, EDTA concentration and soil loading) as well as their interactions were found to have significant effects on nickel removal during soil washing. Generally, decreasing the solution pH and soil loading and increasing EDTA concentration increased nickel removal. Optimization using Box-Behnken experimental design resulted to a quadratic log10 model which was used to predict the highest nickel removal of about 1160.86 +- 176.49 mg Ni/kg soil at the optimum conditions of pH 3,0.1375 M EDTA, and 0.05 g/mL soil loading. Using these optimum conditions, the preliminary cost of the soil washing technology was calculated to be about Php 1.95 per mg of Ni removed for chitosan and Php 1.52 per mg of Ni removed for EDTA.

SOIL; NICKEL; SOIL TOXICITY; CHELATING AGENTS; CHITOSAN; SOIL FERTILITY; HEAVY METALS; POLLUTION

Fabrication of photocatalytic oxide semiconductor-based composites with diode-type interfaces for possible application in environmental cleaning. **Herrara, M., Gillado, A., Garcia, Ma.C., Almanza, D.L.** *2016 TR-1740.*

Photocatalytic materials use light energy to produce radicals (e.g. OH radicals) from a series of reactions that can be used for environmental cleaning. The said radicals can degrade organic pollutants (in water and in air), and inhibit the growth (or kill) living organisms (e.g. bacteria, fungi). Common photocatalytic oxides are TiO2 and ZnO, however, due to their large band gap; they can be triggered by ultraviolet light and not by visible light. Common indoor lights and sunlight hitting the earth's surface are mostly visible light, thus it would be more practical if photocatalytic material are visible light-light triggered. Visible light-triggered photocatalytic materials are created by mixing p-type CuO and n-type ZnO to form composites with p-n heterojunctions (interfaces). Due to the low energy gap of CuO, the difference between the energy levels at the interface are expected to be low, thus has ability to respond with visible light. The creation of CuO-ZnO interfaces is viewed to be the primarily responsible for the visible light-active photocatalysis. The fabrications of such composite were achieved using two techniques: (1) Heterogeneous mixing technique and (2) Chemical precipitation technique. Heterogeneous mixing techniques involved creating ZnO and CuO interfaces by simple mixing of pre-fabricated oxides powders from series of chemical reactions using salt pre-cursors.

CATALYTIC ACTIVITY; OXIDES; COMPOSITE POPULATIONS; INTERFACE PHENOMENA; PROCESSING; COPPER; ZINC; OXIDES; POLLUTION CONTROL; ENVIRONMENTAL PROTECTION; POLLUTANTS

U- METHODOLOGY

U10 Mathematical and statistical methods

Development and evaluation of an Android application for the MOET-based Mathematical Model or MOET App. **Capistrano, A.O.V., Aungon, J.J.E., Hernandez, J.E.G.** *Philippine Journal of Crop Science (Philippines) v. 41 (1) p. 33-41 (Apr 2016)*.

This paper discusses the development and evaluation of the MOET 3-in-1 Android App (MOET App) after having proven the functionality of the MOET-based Mathematical Model (MMM) in 2011 at PhilRice Negros. The model, developed because of the identified limitations of the MOET kit fertilizer guideline, proved to be very capable of computing the precise amount of nutrients that are needed by a particular Philippine rice cultivar for a given yield target. However, due to the complexity of using the mathematical model manually, automating the entire computation process of the model has been deemed necessary, hence, the MOET 3-in-1

Android App was created in 2013. To evaluate the App's effectiveness as a fertilizer recommendation tool, yield trials were conducted in 2014. These trials aimed to compare yield outputs of NSIC Rc216 fertilized via the MOET 3-in-1 Android App recommendation, MOET kit fertilizer guideline and farmers' practice. Results of the yield trial showed significant advantages in yield as well as in other agronomic parameters of NSIC Rc216 fertilized via the MOET 3-in-1 Android App. The MOET 3-in-1 Android App was also evaluated in terms of yield target probability and deviation analysis which showed a 92% chance of target yield attainment with a +-16% deviation of the actual yield if its fertilizer recommendations are followed and no biotic or abiotic stress was suffered by the crop. Further, comparison of the target and actual yields via a normalized root mean square error (nRMSE) showed that the yield setting capability of the MOET 3-in-1 Android App was found 'fairly acceptable'.

INFORMATION PROCESSING; INFORMATION TECHNOLOGY; INFORMATION SYSTEMS; MATHEMATICAL MODELS; YIELDS; TECHNOLOGY TRANSFER; FERTILIZER APPLICATION; NUTRIENT AVAILABILITY; EXPERIMENTATION

Vulnerability assessment to landslides and flooding along the Sta. Rosa-Silang [Philippines] Riverine system using LIDAR and GIS [Geographic Information System]-based hydrological modeling technologies. **Magcale-Macandog, D., Gunay, C.J.C., Bacani, A.J.V.** *2017 TR-1797*.

Occurrence of landslides and flooding had been increasing in the Santa Rosa-Silang sub watershed brought about by extreme weather disturbances including tropical depressions, Southwest monsoon rains, storms and typhoons. Rapid industrializations and urbanization in the past three decades in the subwatershed resulted to massive land use change involving the conversion of agricultural and agroforestry farms into built-up areas. This land use change resulted to increased impermeable soil surface altering the water balance in the subwatershed. The Santa Rosa riverine network with its headquarters from the upstream areas of Silang, Cavite passes through the city of Santa Rosa and drains into the vast Laguna de Bay [Philippines]. In this study, a GIS-based hydrological model, the Soil and Water Assessment Tool (SWAT), was used to simulate the quantities of water inflow and outflow in each of the 49 dominant hydrologic response units (HRUs) along the entire subwatershed area. Spatial information such as its digital terrain model (DTM) extracted from LIDAR and RS data, land cover map and soil map, together with its 36-year (1980 to 2015) rainfall and temperature data, were inputted in the SWAT model's platform to generate the surface flow and sediment yield during rain events in the HRUs within the subwatershed. With these outputs, the subwatershed portions and the specific HRUs vulnerable to flooding and erosion were mapped out. Simulation results showed that the low permeability of soil surface increases the occurrence of flashfloods in low-lying areas. Sloping and open surfaces in the upstream areas are however, prone to landslides. Vulnerability assessment has shown that the communities along the shoreline and riverine system are most vulnerable to flooding and landslides. These results will be useful in the development of area-specific adaptation and mitigation strategies to disasters like landslides and foods.

WATERSHED MANAGEMENT; WATERSHEDS; LAND USE; LANDSLIDES; FLOODING; SEDIMENT WATER INTERFACE; TOLERANCE; GROUNDWATER TABLE; GEOGRAPHICAL INFORMATION SYSTEMS; PHILIPPINES

Wiser with WAISS [Water Advisory for Irrigation Scheduling System]: introducing SARAI's [Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines] smart irrigation technology. **Domingo, O.F.** *Agriculture (Philippines) v. 23 (06) p. 40-41 (Jun 2019)*.

COMPUTER SOFTWARE; MONITORING; TECHNOLOGY; IRRIGATION SYSTEMS; IRRIGATION SCHEDULING; SENSORS;

U40 Surveying methods

GIS [Geographic information system]-based inventory and sustainability assessment if rubber and cacao in major production areas of the Philippines. **Bantayan, N.C., Tiburan, C.L., Balahadia, N .M., Canceran, M.S., Barua, E.P., Visco, R.G. Lapitan, M.K.A.S.** *2017 TR-1772.*

Rubber and cacao are considered high value commercial crops in the Philippines due to its high global and local demand. Identification of potential expansion areas for these commodities is essential to increase local production and improve their quality while taking advantage of the market demand. A database on existing plantation of nine provinces in the Philippines identified as major production areas of rubber and cacao was developed. Secondary data was gathered to assess the current situation and production volume through plantation key informant interviews and focus group discussions. Using geographic information system (GIS), remote sensing (RS) and other inventory techniques, habitat suitability and niche modeling were conducted to determine the potential expansion of production areas after culling out restricted areas and existing plantation areas. Zamboanga Sibugay shows that 33% of the province is suitable for rubber plantations, the largest expanse in all provinces visited. Areas determined as suitable are concentrated within the municipalities of Tungawan and Roseller Lim. Compostela Valley and North Cotabato ranked next in provinces with the highest suitability consisting of 30% and 21%,respectively of the total area of the province. Basilan and Bukidnon provinces were determined to be most suitable to cacao farming. In Bukidnon, high suitability areas concentrate within the municipalities of Talakag and Kalilangan. In Basilan, suitable areas are within the municipalities of Tipo-tipo and Al-barka. In Isabela and Lamitan City, 15% of their respective land areas were determined to have high suitability to rubber plantations. In Davao del Sur, 80% of the land area were determined as moderately suitable to cacao. The authors propose a continuation of the positive outputs of the project by providing additional capacity building activities in the study provinces as well as applying the niche modeling.

RUBBER; THEOBROMA CACAO; PRODUCTION LOCATION; GEOGRAPHICAL INFORMATION SYSTEMS; SURVEYS; REMOTE SENSING; MODELS; DATABASES; COMPUTER APPLICATIONS; COMPUTER SOFTWARE; PHILIPPINES

Protecting onion and garlic from infestation through smart ICT [information and communication technology] application. **Domingo, O.F.** *Agriculture (Philippines) v. 23 (06) p. 38-39 (Jun 2019*).

ALLIUM CEPA; ALLIUM SATIVUM; PEST INSECTS; INFESTATION; PLANT DISEASES; MONITORING; REMOTE SENSING; SATELLITES; IMAGERY; DIFFUSION OF INFORMATION