PHILIPPINE AGRICULTURAL BIBLIOGRAPHY

January to March 2021

Vol. 2 No. 1

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MONOGRAPH

1 **C10**

2 Enhancement of the forest genetics laboratory of the College of Forestry and 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.* 2016 *TR-1826.*

3 4 6 5

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

10 FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES;

BOOK CHAPTER

1 **E14**

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

3 **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 .*

11 12 6 5

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

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

SERIAL ARTICLE

1 **E16 Production economics**

2 Enhancing soybean productivity and local availability in Region 2 [Cagayan Valley, Philippines]. 3 **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. 7 Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi City, Albay (Philippines), 2-7 Jul 2018. 8 *Philippine Journal of Crop Science (Philippines) . v.43 (Supplement no. 1) p. 43-44 (Jul-2018).*

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

1. Subject category
2. Title
3. Author (s)
4. Corporate author
5. Date
6. TR No.
7. Conference title, place, and date
8. Journal title, volume, number, page and date of publication
9. Abstract
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C- EDUCATION, EXTENSION AND INFORMATION

C10 - Education

Enhancement of the forest genetics laboratory of the College of Forestry and 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. 2018 TR-1826.*

Laboratory mass rearing of the five lepidopteran pests of corn namely the Asia acorn borer (ACB Ostrinia furnacalis), Corn earworm (CEW Helicoverpa armigera). Common cutworm ((CCW Spodoptera litura), Corn semi-looper (CSL Chrysodeixis eriosoma) and True armyworm TAW (MYthimna separata), was done from 2011-2016 with the principal focus on rearing ACB. Field collection of Laguna and Isabela ACB populations were conducted in several sites to cater test insects requirements of the different externally funded and core funded studies. In summary the IPB Entomology Laboratory was able to produce 786, 320 ACB, 1,640 ACB egg masses 363,825 CEW, 28,160 CCW, 27,830 CSL and 343,820 TAW. Several studies were conducted using the IPB modified artificial diet. Study 1 aims to determine the optimal temperature for rearing under laboratory conditions by subjecting CB rearing under different temperatures. Results showed that ACB performed better under normal room condition. In study 2, different techniques for infestation of Asian corn borer were evaluated. Results showed that infestation technique using corn stalk at 25 DAP was more efficient and infestation rate using 50 four-day old ACB larvae showed the most severe damage on the corn plants. Study 3, aims to lessen the cost of the rearing diet by substituting varying amounts of Baker's yeast and corn oil. The experiment showed promising result but this is yet to be confirmed. An on-going experiment is being conducted to compare this method to the existing standard artificial diet. Study 4 determines the effect of X solution in egg mass production of ACB adult female. Result showed that the addition of the X solution to the honey/sugar solution in the ACB adult diet greatly improved the production of viable eggs by female ACB adults. With the improvement or rearing facilities, rearing methodologies and acquisition of skills by laboratory personnel, the Entomology Laboratory has established itself as the national center for mass rearing of Asian corn bore and other lepidopterous pests of corn.

FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES; PHILIPPINES

C20 - Extension

Engaging the youth in agriculture through MB AgriKids. **Anon.** *Agriculture (Philippines) v. 28(10) p. 52-53 Oct 2019.*

FARMING SYSTEMS; CROP MANAGEMENT; PLANTING; GARDENING; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; EXTENSION ACTIVITIES; YOUTH; STUDENTS

C30 Documentation and information

FRExLS [Forest Resource Extraction from LiDAR Surveys] component. *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling*

and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines), *2017 TR-1835.- p. 147-202*

FORESTS; GEOGRAPHICAL INFORMATION SYSTEMS; DATA COLLECTION; INFORMATION STORAGE; DATABASES; INFORMATION MANAGEMENT; INFORMATION TECHNOLOGY; INFORMATION TRANSFER

GIS-based land suitability assessment of C. arabica and C. liberica in the Philippines using multi-criteria decision making approach. **Umali, B.P., Garcia, K.R.S., Flores, J.A., Videña, B.S., Rivera, A.F., Bagasin, C.C., Herrera, J.L.B.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 92-93 Sep 2019.*

Suitability assessment was undertaken to develop a method and design a spatial model to help in identifying sites in the Philippines that are suitable for production of C. arabica and C. liberica. The methodology used for this study integrates Remote Sensing (RS), Geographic Information System (GIS) and Multi-Criteria Decision Making (MCDM) techniques to analyze topography, soils, climate and socio-economic factors by matching them with the requirements for the growth of C. arabica and C. liberica. These factors were evaluated based on existing literature and expert knowledge. An Analytical Hierarchy Process (AHP) was used to rank the relative importance of each criteria to determine the suitable areas for coffee production and the resulting weights were used to create the suitability maps. In doing so, the derived weights were processed in ArcGIS software to combine suitability criteria, and subsequently land suitability maps for C. arabica and C. liberica were created and then classified using the Food and Agriculture Organization (FAO) land suitability classes. The study results indicate that the places suitable for C. arabica and C. liberica production cover an area of 176.235.7 sq km (61.7%) and 193.261.08 sq km (68.59%). The relationship of the suitability maps and the current production maps was also investigated and the result shows a direct relationship between the identified suitable areas and existing coffee production areas in the country. Field validation also showed promising relevance with the generated suitability maps. These results could be used by farmers, agricultural extension officers and the country government to devise new strategies on practical sustainable coffee farming in the Philippines.

COFFEA ARABICA; COFFEA LIBERICA; PLANT PRODUCTS; REMOTE SENSING; GEOGRAPHICAL INFORMATION SYSTEMS; LAND SUITABILITY; PRODUCTION LOCATION; PRODUCTS; PHILIPPINES

PARMap component. *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines), 2017. TR-1835 p. 249-346.*

DIFFUSION OF INFORMATION; INFORMATION SYSTEMS; INFORMATION MANAGEMENT; INFORMATION TECHNOLOGY; DATABASES; AGRICULTURAL RESOURCES; LAND COVER

REMap [Renewable Energy Resource Mapping from LiDAR Surveys] component. *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro,*

Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines), 2017. TR-1835 p.203-248.

DIFFUSION OF INFORMATION; REMOTE SENSING; RENEWABLE ENERGY; RENEWABLE RESOURCES; LIGHT; SENSORS

E- ECONOMICS, DEVELOPMENT AND RURAL SOCIOLOGY

E10 Agricultural economics and policies

Economic value of biodiversity in Korea with respect to social and ecological conditions. **So-Hee, P., Yeo-Chang, Y., Minkyung, K.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018* FORESP 2018 p. 27 .

To conserve biodiversity, South Korean government signed the UN Convention on Biological Diversity (CBD) in 1994 and established the 3rd national biodiversity strategies in 2014. Part of the strategy is the implementation of regulation policies that designated protected areas and protected species such as endangered species. These policies can be supported by people's evaluation of biodiversity conservation. However, economic value of biodiversity can be influenced by social conditions such as institutions and regimes as well as ecological conditions such as ecosystem type. In this study, the researchers aim to analyse the economic value of biodiversity in Korea with respect to social and ecological conditions using meta-analysis. Data was collected by searching keywords related to biodiversity on Research Information Service System (RISS) and National Discovery for Science Library (NDSL) database from 1990 to 2017. After data screening, 31 researches were included in data analysis. Number of researches on biodiversity increased since the Nagoya Protocol in 2010. Result indicates that biodiversity value of urban ecosystem and cultivated land tends to be higher than that of natural ecosystems including river, forest, wetland and ocean.

BIODIVERSITY; RESOURCE MANAGEMENT; ECONOMIC POLICIES; PROTECTED FORESTS; ENDANGERED SPECIES; EVALUATION; ECONOMIC VALUE; KOREA REPUBLIC

Economic values of ecosystem services in Asia-Pacific Region. **Eun-Kyung, J., Yeo-Chang, Y.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Regional estimates of ecosystem services can play a critical role in raising awareness and emphasizing the importance of regional ecosystem. A good understanding of the economic and geographic characteristic of ecosystems and their economic value may inform policy decisions related to their use and conservation. The Asia-Pacific Region (APR) accounts for 60% of world's population and geographically covers a wide range, from the tropics to the tundra as well as across the Pacific Ocean. Increasing interest and significance of the ecosystems in the Asia-Pacific Region requires a valuation of ecosystem services in this region. For the maintenance and promotion of ecosystem services in the Asia-Pacific region, it is necessary to identify current state of the research carried out so far and synthesize the value of ecosystem services in APR. This study identifies the distribution of researches on valuation of ecosystem services in APR. It also integrates economic value of ecosystem services according to the 11 ecosystems and 18 ecosystems services classified for the APR in IPBES, using Systemic Review methodology. This will generate the unit

value of ecosystem services of APR and the five sub-regions of APR. The estimates will be compared according to the 11 ecosystems and 18 ecosystem services. This study may contribute to establishing the foundation of sound decision-making pertaining to the use of regional ecosystems.

ECOSYSTEMS; SERVICES; VALUATION; COSTS; DECISION MAKING; POLICIES; RESOURCE MANAGEMENT

Ex-ante analysis of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry Strategic S and T [science and technology] Plans (ISP) for crops, livestock (swine). **Catelo, Ma.A.O., Daite, R.B., Evangelista, G.B.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Laguna (Philippines). TR-1870.*

This research involved doing a before-the-fact economic appraisal of the likely benefits and costs of executing the Swine ISP. The said ISP [Industry Strategic S and T [science and technology] Plans] contains S and T interventions embodied in two research programs and three stand-alone projects, with a total budget of Php 101 million for implementation from 2011 to 2015. The baselines, benchmarks and targets set by the ISP were generally reasonable and technically feasible. However, the issue of timing of delivery of project outputs in order to reach the 2020 targets is a significant concern. The time horizon involved in the ISP's production of technologies and their adoption along the commodity chain are not in sync with the target dates of industry impact realization. The mapping of impact pathways of the ISP projects showed the difficulty in assuming that S&T outputs can easily deliver the envisioned results. The targeted outcomes of the ISP were found to be too far from project reach. There are many crucial post-project relay activities beyond the control of the interventions, and technology transfer and utilization are subject to the behavior of private actors which cannot be assumed to be favorable. Assuming project success and that the technical, financial and market constraints along the impact pathways are overcome, the cost-benefit analysis showed that the investments on the ISP can bring fair rates of return. However, bottlenecks along the impact pathways affect the economic viability of the R&D investments, and many critical activities related to technology delivery and adoption—which can determine economic success—are beyond the scope of the ISP. It is recommended that future ISPs should consider the temporal dimension of the entire research and development process. Periodic milestones would be useful to track not only technology development, but vital forward activities beyond the project. Also, the ISP designers should already build the impact pathways and understand the important issues along them before the plans are approved. Finally, ex ante studies would stand to benefit when farm-level data such as on production, costs-and returns, market prices, and adoption are compiled and made available. Fresh studies along these areas (especially on adoption) would serve as important inputs in ex ante evaluation of proposed projects.

SWINE; EX-ANTE IMPACT ASSESSMENT; COST BENEFIT ANALYSIS; LIVESTOCK; TECHNOLOGY TRANSFER; ECONOMIC ANALYSIS; MARKET RESEARCH

Ex-ante analysis of PCAARRD's [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry strategic S and T [science and technology] plans for crops: ex-ante analysis of PCAARRD's Industry strategic S and T plans for coffee. **Elauria, M.A., Lapiña, G.F., Padua, A.M.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development.* 2016 TR-1731.

Different set of interventions are being implemented by the coffee ISPs [Industry Strategic Plans] in order to help the Philippine coffee industry. The coffee ISPs set a baseline yield of 0.30 MT/Ha for Arabica and location-specific baseline coffee quality. The benchmark of the coffee ISPs is 2.1 MT/Ha of Vietnam. Through all these interventions, the target yield of 2.1 MT/Ha and Grade 1 coffee quality are expected to be achieved. There are ten on-going and three completed projects under the coffee ISP. These projects were bundled into three: improved yield (Bundle 1), organic Arabica coffee in Sagada and Benguet (Bunde 2), and improved coffee quality (Bundle 3). Descriptive analyses were done for other projects that have no direct effect to either yield or coffee quality. The total budget for the coffee ISP is PhP75,568,361. The results showed that in terms of improvement in yield, the 600,000 coffee seedlings to be produced through somatic embryogenesis are higher yielding varieties since the parent materials used are NSIC-registered. The seedlings will be planted in the suitable areas identified by Project 1.3 and the recommended nutrient and water management by Project 4.2 will also be applied to increase the yield. When the coffee seedlings will be given free to the cooperating agencies, the computed NPV I PhP 126,714,103 and the IRR is 23% which is higher than the opportunity cost of money, 6%. The BCR was found to be 5.03 and the payback period for this bundle is 10.04 years. For Bundle 2, it considers the application of S and T interventions on STCBFs. It is assumed that coffee farmers apply organic fertilizers, use bio-control agents, and follow protocols on appropriate harvesting and post-harvest to produce quality beans. In the base case scenario for this bundle, the computed NPV is 12,121,497 and the BCR is 1.57. The IRR is 27% and the investment can be recovered after 8.02 years. For the last bundle, there would be expected decrease in losses because of increase in recovery rates in using the developed machineries and equipment. It would also result in improved coffee bean quality through the application of harvesting and post-harvest protocols. Moreover, the cup profiles established and continuous post-harvest and cupping trainings in different coffee producing areas in the country will help in attaining the target Grade 1 in coffee beans quality. The BCA analysis for base case scenario for bundle 3 revealed a positive NPV of 308,349,416 with an IRR of 86% and payback period of 3.65 years. Overall, the results of the analysis showed positive NPVs in all the interventions. It was found out that for base case scenarios, the IRR is 44% and the investment can be recovered after 5.30 years while for scenario 1 of all the bundles, the IRR is 28% with a payback period of 7.11 years. This further means that the investments made through the coffee ISP are financially viable and worthwhile.

COFFEE; COFFEE INDUSTRY; VARIETIES; QUALITY; SEEDLINGS; SOMATIC EMBRYOGENESIS; FERTILIZER APPLICATION; FARMERS; COST BENEFIT ANALYSIS

Ex-ante analysis of PCAARD's [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] ISP [Industry Strategic S and T Plans] for the duck industry. **Baldovino, H.V.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Philippines Univ. Los Baños, College, Laguna (Philippines). Coll. of Economics and Management* 2018 TR-1869.

An ex-ante Benefit-Cost Analysis (BCA) method was used to assess the Industry Strategic S and T Plans (ISP) of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] for the Duck Industry. The main goal of the ISP is to increase duck egg production rate to 70% and improving the uniformity of the eggs produced through selection and breeding of the Philippine Mallard Duck and other complementary projects. The steps in conducting a BCA were followed and both primary and secondary data were used to calculate and project benefits and costs of the Duck ISP from 2013 to 2022. Given a social discount rate of 6%, the study found that positive net benefits may be derived from

the Duck ISP with a Net Present Value of Php 213 million and an Internal Rate of Return of 46.7%. However, the value of the benefits can be significantly affected by the accuracy of the baseline data and the ability of selected breeder farms to supply certified PMD stock to local duck farmers.

DUCKS; LIVESTOCK; POULTRY; EX-ANTE IMPACT ASSESSMENT; COST BENEFIT ANALYSIS

Ex-ante evaluation of Industry Strategic S and T [science and technology] Plans (ISPs) for sugarcane. *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Philippines Univ. Los Baños, College, Laguna (Philippines). 2015 TR-1753.*

SUGARCANE; EX-ANTE IMPACT ASSESSMENT; PRODUCTION; IMPORTS; EXPORTS; FERTILIZER APPLICATION; HARVESTING; COST ANALYSIS; COST BENEFIT ANALYSIS; DEMAND

E11 Land economics and policies

GIS-based land suitability assessment of C. arabica and C. liberica in the Philippines using multi-criteria decision making approach. **Umali, B.P., Garcia, K.R.S., Flores, J.A., Videña, B.S., Rivera, A.F., Bagasin, C.C., Herrera, J.L.B.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 92-93 Sep 2019.*

Suitability assessment was undertaken to develop a method and design a spatial model to help in identifying sites in the Philippines that are suitable for production of C. arabica and C. liberica. The methodology used for this study integrates Remote Sensing (RS), Geographic Information System (GIS) and Multi-Criteria Decision Making (MCDM) techniques to analyze topography, soils, climate and socio-economic factors by matching them with the requirements for the growth of C. arabica and C. liberica. These factors were evaluated based on existing literature and expert knowledge. An Analytical Hierarchy Process (AHP) was used to rank the relative importance of each criteria to determine the suitable areas for coffee production and the resulting weights were used to create the suitability maps. In doing so, the derived weights were processed in ArcGIS software to combine suitability criteria, and subsequently land suitability maps for C. arabica and C. liberica were created and then classified using the Food and Agriculture Organization (FAO) land suitability classes. The study results indicate that the places suitable for C. arabica and C. liberica production cover an area of 176.235.7 sq km (61.7%) and 193.261.08 sq km (68.59%). The relationship of the suitability maps and the current production maps was also investigated and the result shows a direct relationship between the identified suitable areas and existing coffee production areas in the country. Field validation also showed promising relevance with the generated suitability maps. These results could be used by farmers, agricultural extension officers and the country government to devise new strategies on practical sustainable coffee farming in the Philippines.

COFFEA ARABICA; COFFEA LIBERICA; PLANT PRODUCTS; REMOTE SENSING; GEOGRAPHICAL INFORMATION SYSTEMS; LAND SUITABILITY; PRODUCTION LOCATION; PRODUCTS; PHILIPPINES

Land use change and impacts on watersheds of large urban lakes (Project 3). **Bantayan, N.C., Tiburan, C.L., Avellabo, J.A., Carada, C.E.D., Montecillo, E.V.** 2018 TR-1861.

This project was characterized the biological and physical components of three watersheds of Laguna de Bay [Philippines] with the intention of identifying critical areas within the study area through vulnerability

assessment. Major activities included land cover/land use characterization using satellite images covering two decades and six time periods, spatio-temporal land cover/land use change analysis, and assessment of the hydrologic regime through the installation of automatic weather system (AWS) and water level (AWLS) instruments in various sites of the study area. The hydrologic and land use/land cover analysis became the basis for identifying criteria of watershed health, namely: hydrologic response, biodiversity and connectivity, socio-ecological system, hazards assessment, and ecological footprint analysis.All these criteria are anchored on land use/land cover dynamics. This project used the GAME [Geographic Information System-Based Assessment Monitoring and Evaluation] Model gridding system for vegetation assessment, ArcSWAT for modeling the hydrologic response of the watershed to land management practices, and unit hydrographs from storm and heavy rainfall events for vulnerability assessment. Results of the biophysical assessment show that majority of the watershed exhibit Macolod soil (Undifferentiated) series, and the geology is mostly under Pliocene-Quaternary. Analysis of the land cover changes reveal that Tigbi has the largest increase of built-up area from 2003 to 2010, but it also has the largest increase in area for closed forest (387.57 ha to 628.86 ha). In terms of the overall area of the watersheds, only the closed forests and cultivated lands (annual copy) have decreased, while the rest of the other land classes reported in increase in area. The vegetation surveys showed that Family Moraceae has the most number of representatives for each family (26 species), while Fabaceae and Sapindacceae have the lowest number (nine species each). Results from the key information interviews showed that farmers within the boundary of MFR use traditional agroforestry practices. The analysis of vulnerability to landslide showed that in Cambantoc Watershed. only about 7% or 132 ha are found to ave high vulnerability to landslide. Most of these are located in Brgy. [village] Batong Malake (55 ha) in Los Baños and in Brgy Bitin (28 ha) in Bay. For the Molawin-Dampalit Watershed, about 4% or 149 ha are highly vulnerable to landslide. These are situated mostly in Brgy Anos (66 ha), Brgy Bambang (53 ha), and Brgy Batong Malake (22 ha) in Los Baños Large portions of the moderate vulnerable areas are observed in the same barangays with high vulnerabilities in Los Baños including Bagong Silang (128 ha) and in Brgy Santa Cruz (126 ha) in Bay. Meanwhile for Tigbi Watershed, an approximate of 8% or 157 ha are classified as high and most of the barangays affected are Brgy Bambang (76 ha) and Brgy Lalakay (76 ha) in Los Baños. Moderate areas to landslide are situated mostly in Brgy. Puting Lupa (246 ha) in Calamba City and in Brgy Lalakay (275 ha) in Los Baños. Flood-prone areas were identified in In Cambantoc Watershed, about 20% or 395 ha are classified under high vulnerable areas with Brgy Maitim (99 ha) and Santo Domingo (164 ha) having the largest areas prone to flooding in Bay. Meanwhile in Molawin-Dampalit Watershed, approximately 26% or around 1,071 ha have high vulnerabilities. Mostly these are located in Brgy. Maahas (288 ha), Brgy Batong Malake (221 ha), Brgy Putho Tuntungin (170 ha), and Brgy Anos (128 ha in the municipality of Los Baños. As for the Tigbi Watershed,about 20% or 378 ha are vulnerable to flooding and these are mostly located in Brgy Sucol (124 ha). Brgy Bagong Kalsada (47 ha), Brgy Masili (42 ha), and Brgy Pansol (41 ha) in Calamba City and Lalakay (115 ha) in Los Baños. On the other hand, Cambantoc (approx. 9% or 166 ha) and Molawin-Dampalit (approx 11% or 472 ha) are vulnerable to drought. These are located in barangays Santo Domingo (76 ha), Paciano Rizal (43 ha), and Maitim (35 ha) in Los Baños in Cambantoc. Meanwhile in the Molawin-Dampalit Watershed, affected areas are in Brgy Batong Malake (93 ha), Brgy Mayondon (84 ha), and Brgy Bayog (76 ha) in Los Baños while part of Brgy Paciano Rizal (38 ha) is also classified under high vulnerabilities. However, in Tigbi Watershed, only 5% or roughly 90% ha are affected with high vulnerability to drought. Brgy Sucol (39 ha) has the highest vulnerable areas to drought in Calamba City while Brgy Lalakay (25 ha) in Los Baños. Assessment of the hydrologic behavior of the study areas using SWAT [Soil and Water Assessment Tool] modeling suggest that water yield and surface runoff may be substantial. In other words, the water balance ratios indicate taht majority of the precipitation goes to streamflow while majority of the total flow is composed of surface runoff. Results of this study can be used in the

development of a Watershed Vulnerability Index (WVI) that is based to a large extent on land use/land cover change dynamics using the criteria listed earlier. The WVI can be a useful basis for policy actions on a watershed scale.

LAND USE; WATERSHEDS; WATERSHED MANAGEMENT; LAKES; AGROFORESTRY; LANDSLIDES; RISK ASSESSMENT; GEOGRAPHICAL INFORMATION SYSTEMS; MONITORING; MODELS; PHILIPPINES

E13 Investment, finance and credit

DBP [Development Bank of the Philippines] financing program for solid waste management investments. **Salayon, A.C.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823 p. 66-68.*

SOLID WASTES; WASTE MANAGEMENT; FINANCING; INVESTMENT; LOANS

Financing green projects. **Lledo, J.B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 68-70.*

BANKING; FINANCING; LOANS; BIOMASS; PHILIPPINES

LBP [Landbank of the Philippines] bioenergy loan facility. **Ramos, J.A.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 71-72.*

BIOENERGY; COOPERATIVE BANKS; LOANS; RENEWABLE ENERGY; PHILIPPINES

Sikat Saka Program and its benefits and impacts to small farmer-borrowers. **Quilloy, K.P., Asma, J.D.S., Buencillo, D.D.** *Agricultural Credit Policy Council, San Miguel Avenue, Ortigas Center, Pasig (Philippines).; National Irrigation Administration, Quezon City (Philippines) 2015 TR-1855.*

This study is an assessment of Sikat Saka Program, a direct lending program of the Department of Agriculture (DA) in collaboration with the Land Bank of the Philippines. The program, which is the credit

component of the Philippine government's Food Staples Sufficiency Program (FSSP), aims to provide timely, adequate and affordable production credit to small palay farmers, to improve the viability of their palay production, establish their credit worthiness with a financial institution, and strengthen them as organized groups. Under this study, the performance of the program was assessed mainly from the farmers' point of view in terms of its effectiveness in delivering credit and other services and the benefits and positive impacts that it creates for its farmer beneficiaries. A quasi-experimental design was used in the survey of small palay farmers. Descriptive analysis and Ordered Probit model were employed to describe the characteristics of farmer-respondents, their acceptance and satisfaction rates for the program and their perceived program impacts. For the impact evaluation, three estimation procedures were used to measure the impacts on palay yield, gross palay sales, and net farm income of farmers in one cropping using three different treatment variables. The first estimation procedure, which is a regression analysis, used availing loan as the treatment variable. Two models for each outcome variable were estimated namely, the Least Squares (LS) regression and the Instrumental Variable (IV) or Two-Stage Least Squares (2SLS) regression. Of the two models, the LS estimates were found to be more efficient. The other estimation procedure employed is the Difference-in-Difference (DID) evaluation method. The impact of the program in terms of the length of program implementation or the presence in the area, was measured using two treatment variables: type of implementation site – whether a pilot or an expansion province and the number of program implementation month in the area. The survey results show that the design of Sikat Saka Program is acceptable to small palay farmers in the six implementation sites covered in this study. Most of the farmers are very satisfied with the program eligibility criteria, requirements and loan features, especially the low and declining interest rate on Sikat Saka loan. The very satisfactory credit service of the program has been translated into significant impacts on its farmer beneficiaries. From the interview, the farmer beneficiaries expressed their strong agreement that the program has improved their financial access and inclusion, farm production and marketing, and farm income. Results of the LS estimation show that availing the Sikat Saka Program had a positive impact on yield of palay and net farm income of farmers per cropping. However, the impact on yield was only exhibited after the program has been implemented in the area for quite some time already while the impact (or maybe effect) on gross palay sales was only short-term and was not sustained over the months or years of program implementation. While the program is undoubtedly performing well in providing timely, adequate and affordable production loan to small palay farmers, findings reveal the shortcomings of the program in terms of fulfilling its commitment to provide extension services and assured market for their produce. These have also been the source of the problems and concerns raised by the farmers. Thus, it is strongly suggested that non-financial components of the program be strengthened, especially marketing component of the program. Conducive marketing arrangements and strategies for the farmer beneficiaries in partnership with NFA must be explored. Developing capacity building program to complement the financial component is also suggested if the program wants to have significant impact on the viability of palay production and to support the Food Staples Sufficiency Program of DA.

ORYZA SATIVA; RICE; FARMERS; SMALL FARMS; COOPERATIVE CREDIT; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES

E14 Development economics and policies

Bayer and Department of Agriculture RFO [Regional Field Office] 12 L. accelerate hybrid adoption in Mindanao [Philippines]. **Anon.** *Agriculture (Philippines) v. 23(10) p. 32-35 Oct 2019.*

ORYZA SATIVA; HYBRIDS; HYBRIDIZATION; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS; PRODUCTIVITY; PROFITABILITY; LOCAL GOVERNMENT; RESEARCH INSTITUTIONS; PHILIPPINES

Beyond CPAR [Community-based Participatory Action Research]: organic farmer continues to expand horizons. **Hermoso, R.S.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(5) p. 10 May 2018.*

ORGANIC AGRICULTURE; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMS; FARMERS; ORGANIC FERTILIZERS; FERTILIZER APPLICATION

Cultivating a sustainable future in cacao production. **Anon.** *Agriculture (Philippines) v. 23(12) p. 12-14 Dec 2019.*

THEOBROMA CACAO; CROP MANAGEMENT; FARMS; POSTHARVEST TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; PRODUCTIVITY; EFFICIENCY; SUSTAINABILITY

Engaging the youth in agriculture through MB AgriKids. **Anon.** *Agriculture (Philippines) v. 28(10) p. 52-53 Oct 2019.*

FARMING SYSTEMS; CROP MANAGEMENT; PLANTING; GARDENING; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; EXTENSION ACTIVITIES; YOUTH; STUDENTS

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: project title: ex-ante analysis of PCAARD Industry strategic S and T for livestock (layer). **Valientes, R.M., Diona, D.L.Z., II.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Laguna (Philippines), 2014 TR-1868.*

The objective of the PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development]ISP [Industry strategic S and T]for Layer is to increase egg production by 2% and stabilize the supply of eggs by 2016 to 2020 through the following strategic interventions: (1) development of QPM [quality protein maize] cultivar for layer feedings; (2) developing value-added egg products thru processing and packaging; (3) promotion of value-added egg products; (4) technology assessment and audit for potential intellectual property; and (5) provision of non-cash incentives to poultry raisers. Of these interventions, only (1) is on-going while the rest are yet to be proposed and implemented. This study estimated the economic value of the Layer ISP in the livestock sector using ex-ante assessments as well as validated the assumptions related to the baseline indicators and targets set by the ISP, traced the impact pathway by which the Layer S and T interventions and monetized the likely benefits and costs of the interventions for Layer ISP. The ex-ante assessment shows that the interventions cannot deliver the objective targeted for the Layer-ISP and no positive net benefits for layer farms can be derived within the targeted period. As a long-horizon intervention, the impact pathway of the QPM project is packed with technical and adoption constraints that need to be hurdled at different levels, the planned period of intervention is no enough to solicit an impact that is worthy of public investments. The prospect for the rest of the ISP interventions is appealing but is largely dependent on successful private-public partnership

in developing the technology, critical infrastructure/facility, business development services, operation and financing. The study suggested that it may be necessary to rethink ad reconfigure the entire ISP for Layer to align industry targets with proposed S and T interventions. Deferring the implementation of the Layer ISP until appropriate alignment of goals and interventions may be optimal. Furthermore, the study recommends that since the layer industry is largely commercial and thriving with large commercial players with own R and D efforts, it may be high time for PCAARRD to focus on developing other industries instead like the native layer where private sector S and T effort are almost absent and let go of the largely commercial layer industries.

LIVESTOCK; LAYER CHICKENS; LAYING PERFORMANCE; EGG PRODUCTION; EX-ANTE IMPACT ASSESSMENT; TECHNOLOGY ASSESSMENT

Father and daughter put up an organization to teach Mindanao [Philippines] youth the basics of urban gardening. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 43-45 Dec 2019.*

ORGANIC AGRICULTURE; URBAN AGRICULTURE; DOMESTIC GARDENS; YOUTH; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; PHILIPPINES

Village-level processing, technology development and promotion of Dillenia philippinensis (Katmon): an underutilized fruit in Quezon Province [Philippines]. **Wagan, A.D.M., Agangan, N.S., Artes, L.A., Ombico, M.T., Tamisin, L.L., Jr., Omaña, M.E.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1844.*

This is an R and Project in support of the development of Katmon (Dillenia philippinensis) for rural livelihood in Quezon province [Philippines] specially Real, Infanta and General Nakar, Quezon, where Katmon is still abundant. The aim of the project is to provide agricultural production technology and technical support to product development of Katnon. As such the project conducted on-station and on-site studies on seedling establishment using stem cuttings; on site and on-station and on-site and on-station test on postharvest handling and storage of fresh Katmon fruits for processing of Katmon fruits to rural women's groups; provided technical support to three rural women's groups who pursued processing and product development of Katmon and developed scientific and extension materials about Katmon and Katmon product development. Results showed that Katmon can be propagated using either matured or juvenile stem cuttings and their growth are best when treated with UPLB [University of the Philippines Los Baños]-developed biofertilizer MykoVAM combined with vermicompost or with chicken manure. Katmon propagated using matured stem cuttings also exhibited early fruiting at 14 months after planting while the use of juvenile stem cuttings provided an alternative propagation technique to current practice of collecting wildings from their natural habitat. A protocol of obtaining quality fruits for processing was also developed where information on proper harvesting, handling and storage before processing are provided. For longer storage life, Modified Atmospheric Packaging and low temperature (15 deg C) are recommended for Katmon fruits. On capability enhancement on UPLB-developed procedures on processing Katmon food products, about 75 women representing at least 19 rural women's groups from Real, Infanta and General Nakar benefitted from the series of on-site and hands-on training activities conducted by the project. Among the products, Katmon powder, Katmon juice and Katmon jelly were introduced by these women's groups to potential consumers from urban and rural areas in local and national fests and fares. Katmon juice and jelly were rated highly acceptable by the respondents during product evaluation. Katmon pure powder on the other hand, is the sole product identified by Quezon DOST [Department of Science and

Technology and DTI [Department Trade and Industry] as having the best potential for further development. There is continuous processing of Katmon powder by one of the trained women in Real Quezon but in Real Quezon but in very limited capacity using the fruit dryer fabricated by the project for training purpose. Furthermore, five extension materials about Katmon propagation, harvesting and postharvest handling of Katmon for livelihood exhibits great potential in the project sites. Sustaining the interest and achieving the full potential of developing Katmon for natural livelihood in the study sites will depend on how well this venture will further be supported by the local stakeholders and agencies.

DILLENIACEAE; FOREST TREES; SPECIES; FRUITS; FRUIT PRODUCTS; CHEMICOPHYSICAL PROPERTIES; TECHNOLOGY TRANSFER; FOOD TECHNOLOGY; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES; RURAL COMMUNITIES; RURAL DEVELOPMENT; SEEDLINGS; PLANT ESTABLISHMENT;PHILIPPINES

E20 Organization, administration and management of agricultural enterprises or farms

Century-old farm in Benguet [Philippines] endures. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(11) p. 26-29 Nov 2019.*

FARMS; VEGETABLE CROPS; CROP MANAGEMENT; TOURISM; RURAL AREAS; FLOWERS; PHILIPPINES

Eco-resort in Pampanga [Philippines] offers respite from the city. **Necessario, N.** *Agriculture (Philippines) v. 28(10) p. 56-57 Oct 2019.*

FARMS; RURAL AREAS; TOURISM; GARDENS; ORGANIC AGRICULTURE; LIVESTOCK; SUSTAINABILITY; PHILIPPINES

Farm tour destinations you'd love to visit in Iloilo and Guimaras [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(12) p. 4-10 Dec 2019.*

FARMS; FARM HOLIDAYS; RURAL AREAS; TOURISM; VEGETABLE CROPS; LIVESTOCK; ORGANIC AGRICULTURE

Iligan [Philippines] farm counts value-added goods as a secret to its success. **Tan, Y.** *Agriculture (Philippines) v. 28(10) p. 8; 10; 12 Oct 2019.*

FARMS; ORGANIC AGRICULTURE; TOURISM; RURAL AREAS; LIVESTOCK; ANIMAL HUSBANDRY; FRUIT TREES; PHILIPPINES

Innovativeness is the name of the game for this Bacolod [Philippines]-based entrepreneur. **Lacson, S.P.** *Agriculture (Philippines) v. 23(12) p. 46-48 Dec 2019.*

FISH PASTES; FOOD TECHNOLOGY; PROCESSING; PROCESSED PRODUCTS; INNOVATION ADOPTION; MARKET RESEARCH; PHILIPPINES

Negros Occidental [Philippines] farm advocates the use of medicinal plants. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(12) p. 34-36 Dec 2019.*

DRUG PLANTS; MEDICINAL PROPERTIES; INDIGENOUS ORGANISMS; FARMS; GARDENS; TOURISM; RURAL AREAS; PHILIPPINES

Retiree couple's edible garden inspires others to farm. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 52-54 Dec 2019.*

FARMS; GARDENS; GARDENING; RURAL AREAS; TOURISM; VEGETABLES; HERBACEOUS PLANTS; ORNAMENTAL PLANTS; LIVESTOCK; CHICKENS; GOATS; RABBITS; ORGANIC AGRICULTURE

E21 Agro-industry

Assessment of status and trends of forestry investments in the Philippines. **Bugayong, L.A., Tolentino, N.L.** *2017 TR-1865.*

The demand for forest-based goods and services has shifted in the past decades from mainly timber-based harvesting to the provision of ecosystem-based goods and services. Ecosystem provisioning goods and services include food, timber, fuelwood, non-timber forest products, medicine, resin, and latex, among other things. Among the regulating services are carbon sequestration, soil and water conservation, clean air, watershed services, and biodiversity conservation. Cultural services provide ecotourism, aesthetic value, and education. There is heightened appreciation and demand for these ecosystem goods and services due to globalization of technology and information. Investments in the forestry sector have been declining over the years due to major policy changes such as the 1987 Philippine Constitution where the timber license agreements (TLAs) were replaced by co-production, production sharing, and joint production agreements. The timber harvesting ban in primary forests in the 1990s and the recent logging moratorium in residual natural forests in 2011 significantly shifted wood production from naturally grown timber to plantation wood. These have led to increasing imports for wood to supply the wood processing industry. However, there remain opportunities for investments in the forest-based industry such as the availability of forestlands (about 4M has open access areas) where ecosystem goods and services can be developed and sustainably managed to address the continuously growing demand for such. The areas planted with tree species and high value crops such as rubber, coffee, cacao and rattan under the National Greening Program (NGP) also serve as investment opportunities for development of processing industries. This study discusses the issues and concerns that need to be addressed so that the forestry investments can become attractive and viable to interested entities. Among the recommendations are an investor-friendly policy environment and a forestry investments road map.

FORESTRY; FOREST PRODUCTS; FOREST PRODUCTS INDUSTRY; TRENDS; INVESTMENT; PHILIPPINES

Couple successfully grows cacao and makes products without owning a farm or a factory. **Tan, Y.** *Agriculture (Philippines) v. 23(11) p. 48-51 Nov 2019.*

THEOBROMA CACAO; MUSA (BANANAS); PROCESSED PLANT PRODUCTS; PROCESSING; MARKETING

Couple's business helps small native handcrafters as well as backyard coconut farmers earn a modest, yet steady income. **Lacson, S.P.** *Agriculture (Philippines) v. 23(12) p. 62-63 Dec 2019.*

COCONUTS; BYPRODUCTS; HANDICRAFTS; ENTERPRISES; MARKETS; FARMERS; INCOME

Former OFW [overseas Filipino worker] promotes Sulu coffee culture through her family business. **Dukha, A.B. III.** *Agriculture (Philippines) v. 23(12) p. 40-42 Dec 2019.*

COFFEE; QUALITY; COFFEE INDUSTRY; ENTERPRISES; FARMERS; MARKETS; PHILIPPINES

How to start and run a community shared Agriculture Program. **Tan, Y.** *Agriculture (Philippines) v. 28(10) p. 44-46 Oct 2019.*

VEGETABLES; FARMERS; FARMERS ASSOCIATIONS; MARKETS; MARKETING; CONSUMERS; RURAL COMMUNITIES

Opportunities and challenges confronting high-value fruit farmers in Mindanao [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 4-9 Nov 2019.*

FRUITS; INDUSTRY; MARKETS; EXPORTS; IMPORTS; CROP MANAGEMENT; HARVESTING; POSTHARVEST TECHNOLOGY; PROCESSED PLANT PRODUCTS; PHILIPPINES

Sweet, sweet wine: Deewan's [social enterprise] dragon fruit artisan wine. **Malabed, L.** *Agriculture (Philippines) v. 28(10) p. 48-49 Oct 2019.*

HYLOCEREUS UNDATUS; FOOD PROCESSING; ENTERPRISES; AGROINDUSTRIAL SECTOR; WINES; WINEMAKING; FARMERS

Twenty somethings start agritech business that link farmers to consumers. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 55-57 Dec 2019.*

AGROINDUSTRIAL SECTOR; ENTERPRISES; INNOVATION ADOPTION; MARKETING; DIFFUSION OF INFORMATION; ENVIRONMENTAL IMPACT; FARMERS; CONSUMERS

E40 Cooperatives

Nueva Ecija [Philippines] cooperative [Golden Beans and Grains Produce Cooperative] promotes soybean production while creating livelihood opportunities for farmers. **Taculao, P.B.S.** *Agriculture (Philippines) v. 28(10) p. 14; 16; 18 Oct 2019.*

GLYCINE MAX; SOYBEANS; PRODUCTION; COOPERATIVES; COOPERATIVE ACTIVITIES; FARMERS; FOOD PROCESSING; PROCESSED FOODS; HEALTH FOODS; PHILIPPINES

E50 Rural sociology and social security

Gender and forest land management: when women take key roles in watershed rehabilitation. **Gendrano, M.M.B., Bator, N.J.B.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018 p. 24.*

Despite the global recognition of the pivotal role of women in the protection and conservation of natural resources as inspired by various environmental movements lead by women (such as the Chipko movement in India and Igorot women struggles against Chico dam project in the Cordilleras, northern Philippines), the forestry sector in the country remains to be male-dominated, often setting women's participation as secondary to that of men. What happens when women claim key roles in watershed rehabilitation? This paper features two women's organizations as partner people's organizations (POs) of the Department of Environment and Natural Resources (DENR) in the development and protection of two critical watershed in the Philippines. The Samahan ng Kababaihang Makakalikasan ng Segium (SKMS) in Segium Subwatershed in Nueva Ecija and Pullaan Women's Organization in Ibulao Subwatershed in Ifugao are primarily involved in the planning and implementation of reforestation and agroforestry activities as well as maintenance and protection activities in their respective subwatersheds. These 2 POs are the only women's groups among the 147 POs engaged in the DENR watershed rehab project (FMP). Through focus group discussions, key informant interviews and life stories, the study (1) explores the rationale and motivation behind the organizations; (2) articulates the successes of the women's groups in terms of implementing watershed rehabilitation activities and contributing to the enhancement of the socio-economic well-being of the women in their communities; and (3) identifies the challenges the women's organizations confront in carrying out their watershed rehabilitation initiatives as well as the factors influential to the presence of these constraints. At the end, it highlights that organizing women upland farmers, whether self-initiated or project-oriented, and empowering them to formally participate actively in the forestry sector is a vital ingredient for an effective, sustainable and pro-people forest management.

WOMEN; ROLE OF WOMEN; SEX; WATERSHED MANAGEMENT; WATERSHEDS; FORESTS; HIGHLANDS; FARMERS

Social imageability and socio-cultural economics and biophysical contexts of selected Philippine carabao festivals. **Del Rosario, P.J.B., Battad, L.G., Montes, A.R.J., Fajardo, A.R.** 2017 *TR-1897.*

Festivals that celebrate harvests represent the meaning of the carabao, agriculture, and community in various places in the Philippines. The general objective of the study was to analyze selected carabao festivals in terms of social imageability and biophysical, economic and socio-cultural contexts.The specific objectives were: 1)to describe the various contexts of the festivals namely biophysical, economic, and socio-cultural, 2)to describe the social imageability of the festivals specifically their icons and images in the displays , decorations, parade and participants in terms of clarity, heterogeniety, distorations, contradictions, and complexity; and 3)to interpret the meanings of the festivals' representations and expressions related to the carabao. agriculture, and community. Based on the PCC book and Newsletter, nine festivals were selected for the study: 1)Viva Vigan Festival of the Arts, 2)Nuang Festival, 3)Gatas ng Kalabaw, 4)Kneeling Carabao, 5)San Isidro Labrador, 6)Pahiyas 7)Turugpo, 8)Carabao-Carroza, and 9)Katigbawan. The qualitative exploratory study employed two research methods: field methods particularly photo documentation, observation, and informal interviews, and review of documents. Results of the study showed and the biophysical, economic and socio-cultural contexts of the festivals influence the festivals' high degree of social imageability. The festivals varied in their social imageability's clarity, heterogeneity, distortions, contradictions, and complexity. The meaning of the representations of the carabao, agriculture and community were nostalgic and referred exclusively to positive rural experience.

WATER BUFFALOES; SOCIOCULTURAL ENVIRONMENT; SOCIAL PARTICIPATION; HARVESTING; PHILIPPINES

E51 Rural population

Exploring the links of the incidence of teenage pregnancy and natural disaster: the case of Eastern Visayas, Philipiines. **Nelson, G.L.M., Rodriguez, M.V.C.** *2016 TR-1783.*

The survey on the 742 female youth, 12 to 21 years old from Eastern Visayas [Philippines] who have experienced severe typhoon (Yolanda) or moderate typhoon (Ruby) aims to explore the links of natural disaster and the likelihood of increase in teenage pregnancy. The Eastern Visayas youth who reported being pregnant in 2013-2016, was found to be 22% in severely hit areas (Tacloban-Palo) and 15% in moderately hit areas (Dolores and CanAvid). The study identified the differential characteristics (socio-economic, sexual risk behavior, non-sexual risk behaviors and disaster experience characteristics) of the Eastern Visayas youth that were associated with both severity of typhoon experience and incidence of pregnancy. These are the age of the youth, household type (extended family and two or more non-related families), are in a consensual union, living in own permanent housing, out of school but are high school graduate, and have reported monthly income between 5,001 to 10,000 pesos. Furthermore, significant relationship was also found among the youth who had alcohol, had been exposed to pornography and have attempted suicide, had premarital sexual experience between 15 to 19 years old with either their own spouses or partners, have had three or more boyfriends when they were between 15 to 19 years old. The youth that had that experience only 1 move while in the emergency shelter, or had been relocated for 91 to 180 days, had stayed less than 330 days in transitional shelters, and had been staying less than 120 days in donated permanent housing, and had been living in their own houses from 666 to 730 days were also found to be related to incidence of pregnancy and severity of typhoon. Significant difference was also found among the ever-pregnant youth in their age of initiation to premarital sex (PMS). Those in severely hit areas had PMS at age 16.75 and 17.23 for those in the moderately hit typhoon areas.

ADOLESCENTS; PREGNANCY; CYCLONES; STORMS; DISASTERS; PHILIPPINES

E70 Trade, marketing and distribution

How to put up and run a weekend market. **Tan, Y.** *Agriculture (Philippines) v. 23(11) p. 56-57 Nov 201).*

PRODUCTS; MARKETS; MARKETING; RURAL COMMUNITIES; SOCIAL GROUPS

Twenty somethings start agritech business that link farmers to consumers. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 55-57 Dec 2019.*

AGROINDUSTRIAL SECTOR; ENTERPRISES; INNOVATION ADOPTION; MARKETING; DIFFUSION OF INFORMATION; ENVIRONMENTAL IMPACT; FARMERS; CONSUMERS

E73 Consumer economics

Consumer for sustainable forest management. **Buot, M.K.M.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 4-5 Jan-Dec 2017.*

FORESTS; FOREST MANAGEMENT; SUSTAINABILITY; WOOD PRODUCTS; CONSUMER BEHAVIOUR; CONSUMERS; STANDARDS; CERTIFICATION

Customer satisfaction survey (CSS) on the LLDA's [Laguna [Philippines] Lake Development Authorities'] overall performance. **Abrigo, C.S.** *Laguna Lake Development Authority, LLDA Bldg., National Ecology Center, East Ave, Diliman, Quezon City (Philippines). 2016 TR-1847.*

This report explains the findings of the satisfaction study conducted to determine the perception of the level of satisfaction of stakeholders of the LLDA's [Laguna [Philippines] Lake Development Authority] programs and project implemented in the Laguna de Bay (LDB) region. Specifically, it aimed to: 1. determine the level of stakeholders awareness of the LLDA's mandate vision, mission and objectives; 2. identify issues and concerns about the lake that confront the stakeholders and recommend measures that shall address gaps in the perception and satisfaction of the respondents on the service quality given by the LLDA; 3. identify the programs, projects and activities wherein stakeholders relate with the LLDA; 4. identify specific collaborative approaches/strategies/mechanisms among the stakeholders that would pursue or intensify institutional relationship; and 5. to analyze the factors associated with the overall rating of the respondents. In this study, satisfaction refers to the act of fulfilling the needs and managing expectations of the stakeholders in relation to their mission and mandate of (Market and Opinion Research Institute, 2004). Based on the said research, there are several key drivers that affect the satisfaction of stakeholders and costumers to the service provided by company institution. In this study, four drivers were considered. These are: 1. delivery and quality of services; 2. staff attitude and professionalism; 3. transparency to stakeholders; and 4. office operations and environment guidelines. To measure the stakeholders' satisfaction for driver, several statements were rated by the respondents/key informants (KIs). The samples was derived from the population of 35,930 stakeholders of the LLDA. These stakeholders were categorized into five such as: industries, fisheries and aquatics resources management councils (FARMCs),fishpen/cage operators, local government units (LGUs), non-government organizations (NGOs) and people's organizations (POs). With only a few number of individuals to be interviewed in the national government agencies (NGAs) and the academe, complete enumeration was used. Stratified random sampling was used to determine the samples for the remaining five categories. From the population, a sample of 290 was derived. With the LLDA setting the sample size of 300, the research group decided to add 26 more respondents from various categories of stakeholders to make sample size more representatives of the stakeholders. A Likert-scale was used to measure the ratings of the respondents/KIs for each statement. Results showed that based on the four drivers of satisfaction, the 2015 overall performance of the LLDA is 'Very Good' (4). Only the academe gave them a rating of 'Good' (3). All other stakeholders rated them 'Very Good' (4). This result is consistent with the respondents' perceived overall performance of the LLDA in 2015. The respondents rated them 'Very Satisfactory' (4). This time, only the FARMCS gave them a rating of 'Neutral' (3). All other stakeholders rated the LLDA as 'Good' and 'Neutral', it is important to look closely why such as rating was given. For the awareness, most (88%) of them are aware to the mandate, vision, mission and objectives (MVMO) of the LLDA. As to their awareness level, they claimed to be 'Moderately Aware' (4). For the issues and concerns about the lake that confront the stakeholders, the following issues were identified: 1. process of accreditation/permitting takes time; 2. communication lapses; 3.inspection and monitoring related problems, 4. environmental/enforcement concerns; 5. service delivery concerns; 6. accessibility of the LLDA office of the stakeholders; 7. honoring agreements with institutional partners; 8. tedious requirements on the LLDA's projects; and livelihood concerns, they suggested the following: 1. improve communication advocacy; 2. be where the actors are; 3. improve service delivery on community development obligations; 4. increase human resources of the LLDA for monitoring and enforcement and partnership buildings; 5. appropriate and prompt response to stakeholder concerns; 6. moratorium of fees after disasters and calamities; and 7. enforce environmental

laws. The respondents also identified the programs, projects, and activities that they were involved. Finally, to enhance the LLDA's institutional collaboration among their stakeholder's some approaches were determined. In terms of determining the factors associated with overall rating of the LLDA, Spearman Rank Order Correlation Analysis was done for each stakeholder. While the LLDA stakeholders rated them 'Very Good' (4) and 'Satisfactory' (4) in their 2015 overall performance, it is important that the LLDA should sustain and probably enhance their performance to maintain or even get a higher rating in the future. Beyond the 'Very Good' and 'Satisfactory' ratings, they need to address the issues and concerns that were identified by the stakeholders. It is also important to determine why some stakeholders, like the FARMCs and the academe gave them 'Neutral' and 'Good' ratings. These stakeholders, like the other stakeholders, are equally important partners in the LLDA's quest to become not only on a regulatory agency but a role model of environmental governance in the future.

WATER QUALITY; QUALITY ASSURANCE; PERFORMANCE TESTING; GROWTH RATE; WORK SATISFACTION; MONITORING; COMMUNITY DEVELOPMENT; DEVELOPMENT POLICIES; INNOVATION ADOPTION; POLLUTION CONTROL; CONSUMER BEHAVIOUR; PHILIPPINES

PNOC [Philippine National Oil Company] stakeholder's satisfaction survey for CY 2017. **Jimena, C.E.G.** *Philippine National Oil Company, Taguig City [Philippines]., University of the Philippines Los Baños Foundation, Inc., 4030, College, Laguna (Philippines). 2017 TR-1850.*

This report explains the findings of the stakeholders' satisfaction survey conducted to measure the level of satisfaction of all PNOC [Philippine National Oil Company] stakeholders on the company's role as a holding company as it transforms into an operating company. This is in terms of its conduct of its projects activities and day-to-day operations for CY 2017 relative to its compliance with regulatory requirements of oversight agencies (OAs), and engagement with its subsidiaries including the company's lessees. Especially, it aimed to: 1) quantify the overall stakeholder specific satisfaction level per stakeholder specific satisfaction level per stakeholder group (oversight agencies, subsidiaries and lessees); 2) determine the factors associated with PNOC's overall performance rating; 3)determine the progress or change in the level of satisfaction of stakeholders from the previous survey (2016); and 4) identify gaps and opportunities to improvement to enhance stakeholder satisfaction. The stakeholder satisfaction survey is integral to PNOC's Quality Management System as it commits to continual improvement in its company operations. In this study, satisfaction refers to the act of fulfilling the needs and managing the expectations of the stakeholders in relation to their organization's mission and mandate (Market and Opinion Research Institute, 2004). The method to collect data was complete enumeration or census. All 21 respondents identified were interviewed. Results showed that based on the five drivers of satisfaction, the stakeholders rated the PNOC's 2017 overall performance 'Very Satisfactory' (4.6). The respondents from OAs and Lessees rated PNOC (overall across drivers) Very Satisfactory (4.8, 4.9), followed by the PNOC subsidiaries (4.0). Among the five drivers of satisfaction, a)driver 5: quality of support provided to stakeholders (5.0-Very Satisfactory) and b) driver 3: the staff attitude and professionalism (4.8-Very Satisfactory) garnered the highest rating. This was followed by c)driver 1: delivery of requirements/services (4.4), d) driver 4: transparency to stakeholders (4.4) and e) driver 2: quality and timeliness of the requirements (4.3). This means that stakeholders are very satisfied with the performance of the PNOC in terms of delivering what was required or expected of them. Aside from measuring the respondent's level of satisfaction, this study also determined the factors associated in the overall performance rating of PNOC using Spearman Rank-Order Analysis. The overall performance rating of PNOC for CY 2017 is 4.6 or Very Satisfactory. The said rating is consistent to GCG's rating of companies with Very Satisfactory rating score of 90-99 scale.

Furthermore, in order to compare the ratings given in 2016, variables were matched with the 2017 survey. With these findings, it is important for PNOC to sustain and enhance their excellent performance rating to ensure a continued 'Very Satisfactory' rating from their stakeholders. While they received a 'Very Satisfactory' rating this calendar year 2017, it is prudent for PNOC to continuously improve their performance by addressing the stakeholder's concern and look into their recommendations. There is a need to fast track the Reorganization Plan of PNOC by next year as it fully transitions to a full operating company.

OILS INDUSTRY; CONSUMER BEHAVIOUR; PARTICIPATION; CONSUMER SURVEYS; PHILIPPINES

Stakeholder's satisfaction study for PNOC EC[Philippine National Oil Company Exploration Company] CY [Calendar] 2016. **Jimena, C.E.G., Visco, E.S., Amparo, J.M.S., Malenab, Ma.C.T., Geges, D.B., Fellizar, F.M.D.R., Consignado, G.D., Palumbarit, C.C., Mendoza, M.E.T.** *2016 TR-1846.*

This report explains the findings of the satisfaction conducted to determine the level of satisfaction of all PNOC EC [Philippine National Oil Company Exploration Corporation] stakeholders on the conduct of projects being explored, developed and implemented by the company. Specifically, it aimed to: 1. quantify the overall and the stakeholder-specific satisfaction level for business activity (petroleum exploration, coal exploration and production, and port services; 2. determine the factors and relationships affecting stakeholders satisfaction; 3. determine the progress or change in the level of satisfaction of stakeholders the from the previous survey (CY 2015); and 4. identify opportunities for improvement to enhance stakeholders' satisfaction. In this study, satisfaction refers to the act of fulfilling the needs and managing expectations of the stakeholders in relation to their organization's mission and mandate (Market and Opinion Research Institute, 2004). The sample for this study was derived from the population of all PNOC EC stakeholders. A Likert scale was used to determine the rating of the respondents with 5 as Excellent and 1 as Poor. In order to determine the progress or change in the level of satisfaction of stakeholders from CY 2015 and 2016, the Mann Whitney U tests for median ratings were used. Results showed that the median rating of PNOC EC's overall performance (2016) based on drivers is 4.125 with driver 1:Staff Attitude and Professionalism as 'Excellent' (5.0) followed by a rating of 'Very Good' for the 3 drivers, namely: driver 1-delivery of services and programs (4.0); driver 3-transparency to stakeholders (4.25); and driver 4- office project operations (4.0). In addition for CY 2016, looking at the nature of operations of JV partners, PNOC and COC 122 Isabela gave PNOC EC a rating of 5.0 or Excellent and Highly Satisfactory with COC 122 Isabela significantly increasing this year compared to 2015. A slight decrease in the overall rating based on drivers were observed in COC 41 (Zamboanga) from 4.5 in 2015 to 4.0 for this year. Relatively the same overall rating based on drivers was computed in CY 2015 and CY 2016 for ESB Batangas (4.0), DOE (4.0), and COC 185 and 186 (4.0). The overall rating of PNOC EC performance for 2016 results showed that statistically, (using the Mann Whitney U Test for median ratings) the rest of variables for CY 2016 Stakeholders' Satisfaction Survey have the same rating with the CY 2015 survey (4.5. The factors strongly related with the overall satisfaction rating of Highly Satisfactory or Excellent as statistically inferred and computed for 2016 was driven by specific statements with greater than 50% factor load. Driver 2 or Staff Attitude and Professionalism (range 0.70-0.88), led the way of seven influential statements driving this year's satisfaction rating. While the overall performance of PNOC EC for CY 2015 and CY 2016 was rated Highly Satisfactory by their stakeholders as validated by the Mann Whitney U Test for median ratings for CY 2016 vis-a-vis VY 2015 results, there are issues and concerns which raised.

OILS INDUSTRY; CONSUMER BEHAVIOUR; CONSUMERS; PARTICIPATION; DEVELOPMENT PLANS; DEVELOPMENT POLICIES

F- PLANT SCIENCE AND PRODUCTION

F01 Crop husbandry

Century-old farm in Benguet [Philippines] endures. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(11) p. 26-29 Nov 2019.*

FARMS; VEGETABLE CROPS; CROP MANAGEMENT; TOURISM; RURAL AREAS; FLOWERS; PHILIPPINES

Chocolate brand's search for the 'Prince of Cacao' **Taculao, P.B.S.** *Agriculture (Philippines) v. 28(10) p. 54-55 (Oct 2019).*

THEOBROMA CACAO; VARIETIES; INDIGENOUS ORGANISMS; CROP MANAGEMENT; HARVESTING; POSTHARVEST TECHNOLOGY; THEOBROMA CACAO

Cultivating a sustainable future in cacao production. **Anon.** *Agriculture (Philippines) v. 23(12) p. 12-14 (Dec 2019).*

THEOBROMA CACAO; CROP MANAGEMENT; FARMS; POSTHARVEST TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; PRODUCTIVITY; EFFICIENCY; SUSTAINABILITY

Do you want to be a red hot millionaire? **Dela Paz, M.** *Agriculture (Philippines) v. 23(11) p. 10; 12 Nov 2019.*

CHILLIES; VARIETIES; CROP MANAGEMENT; PLANT ESTABLISHMENT; COST BENEFIT ANALYSIS; PRICES; PRODUCTION COSTS; INCOME

Doctor-farmer [Dr. Richard Torno] now Phl [Philippines] top cassava grower. **Battad, D.L.A.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(4) p. 14-15 Apr 2019*

MANIHOT ESCULENTA; CASSAVA; PLANTING; CROP MANAGEMENT; NUTRITIONAL REQUIREMENTS; TECHNOLOGY; FERTILIZERS; CROP YIELD; FOODS; FEEDS

Effects of coconut coir dust on the growth of pili (Canarium ovatum) seedling. **Vallesteros, S.F., Saluderez, M.U., Vallesteros, A.P.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

The study was conducted to determine the growth performance of pili (Canarium ovatum) using coconut coir dust as growing substrate. Specifically, this study aimed to determine the effects of coconut coir dust on seedling height, number of leaves, and diameter; and determine the effects of coconut coir dust on the growth of roots of seedling. The experiment was conducted from October 2017 to February 2018 at the Experimental Station of College of Forestry, Nueva Vizcaya State University, Bayombong, Nueva Vizcaya, Philippines. The experiment was laid out in a row-column design with 2 treatments replicated 3 times. The treatments evaluated were as follows: control (garden soil), and garden soil with coconut coir dust.

Effectiveness of each treatment was based on the height of the seedling, stem diameter, number of leaves, leaf area, root length and weight. It was concluded that the use of coconut coir dust has significant effect on the growth of the Pili seedling.

CANARIUM OVATUM; SEEDLINGS; GROWTH; ROOTS; LEAVES; COCONUTS; COIR

Ex-ante analysis of PCAARRD's [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry strategic S and T [science and technology] plans for crops: ex-ante analysis of PCAARRD's Industry strategic S and T plans for coffee. **Elauria, M.A., Lapiña, G.F., Padua, A.M.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. TR-1731.*

Different set of interventions are being implemented by the coffee ISPs [Industry Strategic Plans] in order to help the Philippine coffee industry. The coffee ISPs set a baseline yield of 0.30 MT/Ha for Arabica and location-specific baseline coffee quality. The benchmark of the coffee ISPs is 2.1 MT/Ha of Vietnam. Through all these interventions, the target yield of 2.1 MT/Ha and Grade 1 coffee quality are expected to be achieved. There are ten on-going and three completed projects under the coffee ISP. These projects were bundled into three: improved yield (Bundle 1), organic Arabica coffee in Sagada and Benguet (Bunde 2), and improved coffee quality (Bundle 3). Descriptive analyses were done for other projects that have no direct effect to either yield or coffee quality. The total budget for the coffee ISP is PhP75,568,361. The results showed that in terms of improvement in yield, the 600,000 coffee seedlings to be produced through somatic embryogenesis are higher yielding varieties since the parent materials used are NSIC-registered. The seedlings will be planted in the suitable areas identified by Project 1.3 and the recommended nutrient and water management by Project 4.2 will also be applied to increase the yield. When the coffee seedlings will be given free to the cooperating agencies, the computed NPV I PhP 126,714,103 and the IRR is 23% which is higher than the opportunity cost of money, 6%. The BCR was found to be 5.03 and the payback period for this bundle is 10.04 years. For Bundle 2, it considers the application of S and T interventions on STCBFs. It is assumed that coffee farmers apply organic fertilizers, use bio-control agents, and follow protocols on appropriate harvesting and post-harvest to produce quality beans. In the base case scenario for this bundle, the computed NPV is 12,121,497 and the BCR is 1.57. The IRR is 27% and the investment can be recovered after 8.02 years. For the last bundle, there would be expected decrease in losses because of increase in recovery rates in using the developed machineries and equipment. It would also result in improved coffee bean quality through the application of harvesting and post-harvest protocols. Moreover, the cup profiles established and continuous post-harvest and cupping trainings in different coffee producing areas in the country will help in attaining the target Grade 1 in coffee beans quality. The BCA analysis for base case scenario for bundle 3 revealed a positive NPV of 308,349,416 with an IRR of 86% and payback period of 3.65 years. Overall, the results of the analysis showed positive NPVs in all the interventions. It was found out that for base case scenarios, the IRR is 44% and the investment can be recovered after 5.30 years while for scenario 1 of all the bundles, the IRR is 28% with a payback period of 7.11 years. This further means that the investments made through the coffee ISP are financially viable and worthwhile.

COFFEE; COFFEE INDUSTRY; VARIETIES; QUALITY; SEEDLINGS; SOMATIC EMBRYOGENESIS; FERTILIZER APPLICATION; FARMERS; COST BENEFIT ANALYSIS

Ex-ante evaluation of Industry Strategic S and T [science and technology] Plans (ISPs) for sugarcane. *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Philippines Univ. Los Baños, College, Laguna (Philippines). TR-1753.*

SUGARCANE; EX-ANTE IMPACT ASSESSMENT; PRODUCTION; IMPORTS; EXPORTS; FERTILIZER APPLICATION; HARVESTING; COST ANALYSIS; COST BENEFIT ANALYSIS; DEMAND

Farm-to-table concept works best for this organic farming advocate. **Lacson, S.P.** *Agriculture (Philippines) v. 23(11) p. 40-44 (Nov 2019).*

ORGANIC AGRICULTURE; CROP MANAGEMENT; FARMS; PLANT ESTABLISHMENT

Father and daughter duo tell the story of T'boli farmers through coffee. **Dukha, A.B. III.** *Agriculture (Philippines) v. 23(12) p. 37-39 (Dec 2019).*

COFFEA ARABICA; COFFEA CANEPHORA; CROP MANAGEMENT; HARVESTING; MARKETS; FARMERS; ETHNIC GROUPS

Father and daughter put up an organization to teach Mindanao [Philippines] youth the basics of urban gardening. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 43-45 (Dec 2019).*

ORGANIC AGRICULTURE; URBAN AGRICULTURE; DOMESTIC GARDENS; YOUTH; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; PHILIPPINES

Growth and yield of edible canna (Canna indica Linn.) propagated using different rhizone size. **Odejar, F.M., Tayobong, R.R.P., Algar, A.F.C., Sanchez, F.C.Jr., Balladares, M.C.E., Medina, N.G.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 93 (Sep 2019).*

The edible canna (Canna indica L.) is a rhizomatous flowering herb under the order Zingiberales and is indigenized in the Philippines. Its rhizome is considered edible and can be processed into flour and starch like its counterpart species from Australia - Canna edulis. In the Philippines, this plant is underutilized and commonly considered weed in the wild and urban areas. There are limited information on its potential uses and requires further research on its utilization, production, and processing. To create recommended production practices, an initial study was done to determine the effect of rhizome size on the growth and yield of edible canna. Different rhizome sizes: (T1) 20g, (T2) 50g, and (T3) 100g, were planted in the field at the central experiment station, UPLB [University of the Philippines Los Baños, Laguna, Philippines] and harvested after six months. Regardless of rhizome size, majority of the rhizomes produced shoots/active buds in 12-15 DAP and had almost same shoot growth and development (not significant at alpha=0.05). At harvest, T1 had the heaviest fresh rhizome weight (approx 600g/plant) compared to T2 (576g/plant) and T3 (477g/plant) however, only 12-13% of the peeled rhizome was processed into flour regardless of treatment during planting. From the raw harvested rhizome materials, 6-7% recovery was computed after producing the processed flour. The initial result of this study showed no significant difference between rhizome size but the flour produced is of high quality and had low gluten content.

CANNA INDICA; PLANT PROPAGATION; SETS; DIMENSIONS; GROWTH; CROP YIELD

He [Mr. Florencio Sudoy of Barangay, [village] Mabini, Sto. Domingo, Nueva Ecija, Philippines] produced 14 tons of palay in one hectare. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 16; 18 (Nov 2019).*

ORYZA SATIVA; HYBRIDS; CROP YIELD; PEST RESISTANCE; DISEASE RESISTANCE; FERTILIZER APPLICATION; PRODUCTION COSTS; COST BENEFIT ANALYSIS; PHILIPPINES; FARMERS

Iligan [Philippines] farm counts value-added goods as a secret to its success. **Tan, Y.** *Agriculture (Philippines) v. 28(10) p. 8; 10; 12)Oct 2019).*

FARMS; ORGANIC AGRICULTURE; TOURISM; RURAL AREAS; LIVESTOCK; ANIMAL HUSBANDRY; FRUIT TREES; PHILIPPINES

Improving productivity and local utilization of mungbean: Project title: improvement of mungbean seed production and management system in Region 2 [Cagayan Valley], 3 [Central Luzon], 6 [Western Visayas] and 11 [Davao Region]. **Aquino, R.M.G., Timbol, R., Arroyo, C., Regulacion, A.** Department of Agriculture Regional Integrated Agricultural Research Center (Philippines)., Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines). *Improving productivity and local utilization of mungbean: Project 1: development of mungbean varieties for drought and partial shade tolerance, Maghirang, R.G.Angeles, L.O.Del Rosario, L.A.Rodriguez, M.C.P.B.Sabanal, A.Q.C.Reyes, D.H.Torillos, R.M.S.Ocampo, J.A.O.delos Reyes, A.M.M.Reyes, E.L.de Mesa, S.Delfin, E.F.Alip, R.C.G.Deseo, N.Dalisay, E.A.Lalap, C.M.Makiling, A.T.Punzalan, F.V.Welgas, J.N..- College, Laguna (Philippines), 2018. TR-1886.- p. 167-231.*

The project was implemented to increase and sustain mungbean production in Regions 2 [Cagayan Valley], 3 [Central Luzon], 6 [Western Visayas] and 11 [Davao Region] through the establishment of efficient formal and informal seed system backed-up by the development and promotion of improved seed storage technologies. The project had resulted to the development of improved seed technology through the use of plastic drum + PE lining and tin cans + PE lining further treated with rice hull ash and wood ash can maintain germination of 80-85% even after 12 months of storage. Considering the local availability, affordability and recycling ability of these storage technology/packaging materials, it is recommended as economical storage technology options for mungbean of farmers who traditionally experience fast seed deterioration due to attack of storage pests on their stored pests. Further, the availability of high quality seeds of improved varieties during planting months of Region 2, 3, 6 and 11 had gradually relieved farmers from repeated planting of old varieties that produce poor quality of seeds thus contributory to expansion of production areas of mungbean to 8,032 hectares for the four major mungbean growing areas of mungbean after 2 croppings of rice and corn as 'singit and cash' crop had resulted to improved soil fertility and job generation through households' members utilization as farm laborers.

MUNG BEANS; VIGNA RADIATA; SEED PRODUCTION; TECHNOLOGY TRANSFER; SEED STORAGE; TECHNOLOGY

Interplot competition in cassava (Manihot esculenta Crantz) variety trials. **Carpena, A.L.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 180-185. (Jun 2019).*

Interplot competition for root yield in three-row plot variety trials in cassava (Manihot esculenta Crantz) was determined using data from six and 14 varieties evaluated in two cropping years in two sets of trials each (one with unbordered three-row plots and another with bordered three-row plots) and comparing yield performance of each entry in unbordered and bordered plots. In spite of significant differences among the varietal entries in plant height, a trait that could cause competition between adjacent cassava varieties in a trial, analyses of variance showed no significant differences between the two plot types in both crop years in terms of root yield, indicating the absence of intergenotypic competition for root yield in these experiments. The rank correlation of varietal rankings between bordered and unbordered plot trials was highly significant in the crop year with 14 entries, supporting the result of the analysis of variance. Thus, at least for three-row plot trials that usually involve several varieties, this study has indicated that the extra or guard row on each side of the effective plot can be done away with without affecting varietal comparisons.

MANIHOT ESCULENTA; CASSAVA; VARIETY TRIALS; FIELDS; FIELD SIZE; PLOT DESIGN; SPACING; ROOT SYSTEMS

Kale (Brassica oleracea varaceplhala) production using irradiated carrageenan plant growth promoter in passive hydroponics systems. **Antonio, T.I., Bayla, J.A., Sace, C.F., Aurique, F.B.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 97-98 (Sep 2019).*

In passive hydroponic system, nutrient solution alone is not enough to supply nutrients to the plants especially when root absorption is impaired. Supplementation is sometimes needed to attain optimum growth. This study was conducted to determine the effect and frequency of application of carrageenan plant growth promoter (PGP) as supplement to kale under passive hydroponic system. The following treatments were evaluated. Factor A-Type of Variety (Kailaan and Toscana) and Factor B-Frequency of Application (Control-No carrageenan application, Carrageenan application at 7 days interval and Carrageenan application at 14 days interval). Application of carrageenan either 7 or 14 days interval significantly improved growth and yield parameters such as plant height, number of leaves, width of leaves, root length, weight per plant, weight of leaves, yield per box, and total marketable yield in both varieties of kale while higher number of leaves and dry matter yield was obtained in 7-day interval application. Chlorophyll content of the two kale varieties at different frequency of carrageenan had no significant differences.

BRASSICA OLERACEA ACEPHALA; KALES; CARRAGEENANS; HYDROPONICS; NUTRIENT SOLUTIONS

Keep your durian low-growing. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 12 (Nov 2019).*

DURIO ZIBETHINUS; PLANT ESTABLISHMENT; PRUNING; HARVESTING; FRUITS; MATURITY

Laser treatment enhances mungbean germination. **Guerrero, R.D. III.** *Agriculture (Philippines) v. 23(12) p. 22 (Dec 2019).*

MUNG BEANS; SEEDS; GERMINATION; LASER RADIATION; ENZYME ACTIVITY

Leading coco sugar producer has El Niño to thank for. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 62-63 (Nov 2019).*

COCOS NUCIFERA; COCONUTS; SEEDLINGS; ORGANIC AGRICULTURE; PROCESSED PLANT PRODUCTS; FOOD PROCESSING; CERTIFICATION

Localizing developed lowland technologies to address constraints in heirloom rice production. **Ilar, G.Y., Batcagan, J.D., Credo, R.M.S., Rocabo, V.S.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 98 (Sep 2019).*

Heirloom Rice is one of the prized products of the Cordillera Administrative Region highlands. These varieties have exceptional cooking quality, flavor, aroma, texture, color and nutritional value, commanding high demand and price in local and international market. However, there are several snags in the heirloom rice production, including low yield due to nutrient deficiencies, rice diseases such as blast and bacterial blight, and pest like rats and aquatic worms. Recently developed technologies, proven to have improved productivity and sustainability in lowland rice production, could potentially address such constraints when introduced in the highlands. During the 2018-2019 cropping season, the Heirloom Rice Project conducted on-site field testing of four mature lowland technologies namely Rice Duck Technology (RDT), Controlled Irrigation (CI), Modified Dapog Technology (MDT), and Community Rat Trap Barrier System Technology (CRTBS) in strategic heirloom rice producing areas in the Cordilleras. Ten technology demonstration set-ups were established for each technology. The objective of the activity was to gather information needed in crafting location-specific technology versions of such innovations suitable for highland condition. Initial observations showed positive results. The MDT was observed to lessen seedling damage and improved low seed germination caused by the presence of aquatic worms. The Carbonized Rice Hull (CRH) used limited the aquatic worm activities as indicated by reduced castings in the seedbed. Aside from providing additional income, integrated farming through RDT served as alternative natural management of snails and weeds. From the CI plots in suspected zinc-deficient terraces due to waterlogged practice of irrigation, better tillering and plant growth was observed. Soil analysis using Minus One Element Technique (MOET) showed Nitrogen, Phosphorus, and Zinc deficiencies. Longer gap of the CRTBS establishment from the rest of the area is needed for it to be more effective. The development of a localize package of these technologies is vital in the effective promotion for farmer adoption.

ORYZA SATIVA; RICE; VARIETIES; GROWTH; LOWLAND; TECHNOLOGY; IRRIGATION; RATS; TRAPS; PHILIPPINES

Luccide: following the principle of nature in farming. **Dukha, A.B. III.** *Agriculture (Philippines) v. 23(12) p. 49-51 (Dec 2019).*

VEGETABLE CROPS; FARMING SYSTEMS; INDIGENOUS KNOWLEDGE; SWINE; COMPOSTING; NATURAL RESOURCES

Makati store and cafe sources its products fresh from it Bukidnon Farm [Philippines]. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(11) p. 38-39 (Nov 2019).*

VEGETABLES; ORGANIC AGRICULTURE; CROP MANAGEMENT; PLANT ESTABLISHMENT; CULTURAL METHODS; FOOD PROCESSING; URBAN AGRICULTURE; FARMS; PHILIPPINES

Millennial turns family farm into successful agribusiness. **Dukha, A.B. III.** *Agriculture (Philippines) v. 23(11) p. 58-60 (Nov 2019).*

VEGETABLE CROPS; CROP MANAGEMENT; PLANT ESTABLISHMENT; ORGANIC AGRICULTURE; AGROINDUSTRIAL SECTOR; DIVERSIFICATION

National R and D [Research and Development] Program for vegetables: project 1: vegetable varieties for sustainable yields, quality, and seed supply. **Maghirang, R.G., Reyes, M.E.C., Dolores, L.M., Pascual, C.B., Taylo, L.D., Elmundo, E.M., Ramirez, E.L.** *Philippine Nuclear Research Inst., Commonwealth Avenue, Diliman, Quezon City (Philippines).; Department of Agriculture 2nd Floor BSWM Bldg. Elliptical Rd., Diliman, Quezon City (Philippines). TR-1872.*

MOMORDICA CHARANTIA; COWPEAS; HIGH YIELDING VARIETIES; SUPPLY; SEED PRODUCTION; PEST CONTROL; DISEASE RESISTANCE; CROP YIELD

No time to manage your own farm? get a JV [joint venture] partner. **Sarian, J.V.** *Agriculture (Philippines) v. 23(11) p. 45 (Nov 2019).*

ORYZA SATIVA; HYBRIDS; CROP YIELD; FARMS; FERTILIZER APPLICATION; CROP MANAGEMENT; SHARE CROPPING

Opportunities and challenges confronting high-value fruit farmers in Mindanao [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 4-9 (Nov 2019).*

FRUITS; INDUSTRY; MARKETS; EXPORTS; IMPORTS; CROP MANAGEMENT; HARVESTING; POSTHARVEST TECHNOLOGY; PROCESSED PLANT PRODUCTS; PHILIPPINES

Processing can triple the income from mangosteen. **Sarian, Z.B.** *Agriculture (Philippines) v. 28(10) p. 4; 6-7 (Oct 2019).*

GARCINIA MANGOSTANA; PLANTING; CROP MANAGEMENT; FOOD PROCESSING; FRUITS; BYPRODUCTS; KEEPING QUALITY; MEDICINAL PROPERTIES

Quality makes this dragon fruit farm in Cavite [Philippines] endure stiff competition in the market. **Lacson, S.P.** *Agriculture (Philippines) v. 23(12) p. 24-26; 28-29 (Dec 2019).*

HYLOCEREUS UNDATUS; FRUITS; CROP MANAGEMENT; QUALITY; HARVESTING; PRICES; SUSTAINABILITY; ECONOMIC COMPETITION; PHILIPPINES

Retiree couple's edible garden inspires others to farm. **Tan, Y.** *Agriculture (Philippines) v. 23(12) p. 52-54 (Dec 2019).*

FARMS; GARDENS; GARDENING; RURAL AREAS; TOURISM; VEGETABLES; HERBACEOUS PLANTS; ORNAMENTAL PLANTS; LIVESTOCK; CHICKENS; GOATS; RABBITS; ORGANIC AGRICULTURE

Ricebusiness cravings. **Frediles, C.** *Agriculture (Philippines) v. 23(11) p. 20; 22 (Nov 2019).*

ORYZA SATIVA; VARIETIES; CROP YIELD; CROP PERFORMANCE; PEST RESISTANCE; DISEASE RESISTANCE; SEEDS; QUALITY; BREEDING METHODS

Smarter approaches to reinvigorate agriculture as an industry in the Philippines (project SARAI). **Espaldon. Ma.V.O., Lansigan, F.P., Salazar, A.M., Khan, C.L., Faustino-Eslava, D.V., Luyun, R.A., Saludes, R.B., Cayabyab, B.F., Pangga, I.B., Ebuenga, M.D., Dorado, M.A., Ballaran, V.G., Jr., Bato, V.A., Altoveros, N.C.** *TR-1833.*

MAIZE; ZEA MAYS; RICE; ORYZA SATIVA; BANANAS; MUSA (BANANAS); COCONUTS; COFFEE; THEOBROMA CACAO; FERTILIZER APPLICATION; SOIL ANALYSIS; AGRICULTURE; CROP MANAGEMENT; WEATHER DATA; SENSORS; MEASURING INSTRUMENTS; PHILIPPINES

Will rambutan [Nepheleum lappaceum] bear fruit in Ilocos Norte [Philippines]. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 14 (Nov 2019).*

NEPHELIUM LAPPACEUM; VARIETIES; CROP MANAGEMENT; PLANTING; PLANT ESTABLISHMENT; FERTILIZER APPLICATION; FRUITING; PHILIPPINES

Youth power for agriculture. **Madriaga, J., Ancheta, A.** *Agriculture (Philippines) v. 28(10) p. 30-31 (Oct 2019).*

FARMS; FLOWERS; GARDENS; INCOME; FARMING SYSTEMS; AGRICULTURAL DEVELOPMENT; YOUTH

F03 Seed production and processing

Meristem tip culture for producing virus-free plant in garlic (allium sativum L.). **Perez, E.A., Aspuria, E.T., Espino, M.R.M., Plaza, R.U., Sanchez, F.M.M., Espino, R.R.C.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 98-99 (Sep 2019).*

The garlic (Allium sativum L.) can be naturally infected by complex viruses belonging to the genera Potyvirus, Carlavirus, and Allexivirus. The infection of viruses tend to accumulate over time leading to yield reduction and degeneration. Three viruses namely, Allexvirus, Garlic Virus D, and Potyvirus Onion Yellow Dwarf Virus (OYDV) were detected in cloves of three garlic varieties Batanes White, Batanes Red, and Ilocos White (NSIC Ilocos Gr 01) through Reverse Transcription - Polymerase Chain Reaction (RT-PCR) technology. The elimination of viruses was achieved using meristem-tip culture. Shoots were included from excised meristem tips (0.3-0.5mm in size) on Murashige and Skoog (1965) basal media supplemented with 0.1 mg/L NAA + 1 mg/L kinetin. These were then transferred to MS medium with 0.179 mg/L IAA + 0.225 mg/L BA after 30 days. One to seven shoots were produced directly from the meristem without intervening callus formation. After one to two months in culture, 10 cm leaves of meristem derived shoots were cut and tested for the presence of these viruses. Virus-free plants were subjected for multiplication of MS basal media supplemented with 1 mg/L NAA + 2.2 mg/L BA. About four meristem derived shoots of Batanes Red from a total of 117 shoots and 2 of Batanes White from 82 shoots tested were identified negative for the three viruses. Identification of additional virus-free plants is still on-going for the three garlic varieties and to other collected materials coming from Ilocos Region and Occidental Mindoro.

ALLIUM SATIVUM; GARLIC; MERISTEM CULTURE; MERISTEMS; IDENTIFICATION; PLANT VIRUSES

F04 Fertilizing

1.6-hectare farmland amply feeds family of 14. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 28(10) p. 40-42 (Oct 2019).*

ORYZA SATIVA; VEGETABLES; TILAPIA; ORGANIC AGRICULTURE; ORGANIC FERTILIZERS; COMPOSTING; OLIGOCHAETA; FARMING SYSTEMS; FARMS

Beyond CPAR [Community-based Participatory Action Research]: organic farmer continues to expand horizons. **Hermoso, R.S.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(5) p. 10 (May 2018).*

ORGANIC AGRICULTURE; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMS; FARMERS; ORGANIC FERTILIZERS; FERTILIZER APPLICATION

Fruit yield and quality of tomato (Lycopersicon esculentum (L. Mill.)) varieties in response to different fertilizer recommendation rates. **Cuizon, A.J.V., Cantinprate, S.C., Aquino, A.M., Reyes, M.E.C., Quidilla, A.B., Pajinag, G.A.I., Utrera, R.T., Alibayog, N.A., Makahiya, H.A.F.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 92 (Sep 2019).*

Varying amount of fertilizer in tomato significantly affects yield. Previous studies showed that tomato requires high amount of fertilizer to maximize yield. Field experiment was conducted at Batac, Ilocos Norte [Philippines] to determine the effect of varying fertilizer recommendation on fruit yield and quality of selected tomato varieties. The treatments were 1) Control or no fertilizer, 2) Organic fertilizer or vermicompost at 10 tons/ha, 3) Northern Foods Corporation (NFC) recommendation at 116-40-120 kg/ha and 4) Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) recommendation at 165-95-215 kg/ha. Tomato varieties tested were open-pollinated variety, 1)Rosanna and two hybrid varieties, 2)Diamante max and 3)Ilocos Red. Results showed that application of fertilizer significantly increases the marketable yield. Similar trend was observed in the number of fruits per square meter and fruit dry weight. The average marketable yield were 40.5 tons/ha in vermicompost application, 43.5 tons/ha in NFC fertilizer rate and 46.8 tons/ha in PCAARRD fertilizer rate, while 32.4 tons/ha in the control. Across varieties, Ilocos Red had the highest fruit dry weight and locule count. It also had the highest total soluble solids (TSS) value of 4.3 deg Brix. Across treatments, PCAARRD fertilizer rate had the lowest TSS of 3.71 deg Brix. This was lower than the required TSS value for processing tomatoes. These suggest that increasing the fertilizer rate increased the marketable yield, but high fertilizer rate reduced the TSS in tomato.

LYCOPERSICON ESCULENTUM; TOMATOES; VARIETIES; ORGANIC FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; FRUITS; CROP YIELD; QUALITY

Growth response of Cavendish (Musa AAA) and saba (Musa ABB) banana to Fertigroe R, N, P and K nanofertilizers. **Angeles, D.A., Limbaga, C.A.Jr., Caballero, G.L., Ruzgal, J.J.C., Flores, G.B., Crodua, A.P.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 93-94 (Sep 2019).*

Plants' growth can be significantly improved using slow-release or controlled-release nanofertilizers. Nanotechnology enables the nutrients to be released at a slower rate. This increases the effective duration of nutrient availability and improves nutrient-use efficiency of plants. FertiGroe sup R is a zeolite-encapsulated single-nutrient nanofertilizers developed by UPLB. Initial kinetics studies had shown that it can release nutrients at a slower rate. Two field experiments were established in Mindanao [Philippines] to determine the response of Cavendish and Saba banana to FertiGroe sup R N, P and K nanofertilizers on June 2018. Two-month old Cavendish and three-month old Saba banana followers were applied with graduated levels of conventional fertilizers and FertiGroe sup R(0%, 25%, 50%, 75%, 100% and 125% of the recommended rate, RR). Timing of application for all the treatment was constant and was based from the prevailing fertilization schedule in the area. Plants' psuedostem girth, pseudostem height and number of leaves were measured and monitored monthly. Towards the end of the vegetative stage of the plants, the effect of FertiGroe sup R nanofertilizer on the growth of Cavendish and Saba banana was evaluated. For both cultivars, fertilizer treatment had no significant effect on the development of the psuedostem. This can be attributed to the dry spell that was prevalent during the early vegetative stage of the plants. In Saba banana, fertilizer treatment had a significant effect on the plant's leaf production and shooting time. Plants that received FertiGroe sup R at 50RR and 75RR produced leaves at a rate comparable with those plants that received conventional fertilizer at higher rate. In Cavendish banana, fertilizer treatment shortened the days needed for shooting. Plant that received with 75 FertiGroe sup R shoot two weeks earlier that the other plants. The results were suggestive that FertiGroe sup R nanofertilizers may improve leaf production and shorten days needed for shooting in Cavendish and Saba banana.

MUSA (BANANAS); VARIETIES; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; TIMING; GROWTH; NUTRIENT AVAILABILITY; NUTRIENT UPTAKE

Growth, yield and nutrient requirement of adlay (Coix lacryma-jobi L.) applied with different levels of nitrogen. **Planas, J.Y., Minoza, M.M.R.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 94 (Sep 2019).*

A study was conducted at the Agricultural Experiment Center, Central Mindanao University, Musuan, Maramag, Bukidnon [Philippines] from August 2018 to January 2019 to (1)evaluate the effects of different rates of N on the soil chemical properties at harvest; (2)evaluate the effects of different rates of N on the growth and yield of adlay; and (3)determine the cost and return analysis of adlay applied with different rates of nitrogen. The treatments were as follows: treatment 1: 0-50-20 kg of N-P sub 2 O sub 5-K sub 2 O/ha, Treatment 2: 30-50-20 kg of N-P2O5-K2O ha-1, Treatment 3: 60-50-20 kg of N-P sub 2 O sub 5-K sub 2 0/ha, Treatment 4: 80-50-20 kg of N-P sub 2 O sub 5-K sub 2 O/ha, Treatment 5: 100-50-20 kg of N-P sub 2 O sub 5-K sub 2 0/ha and Treatment 6: 120-50-20 kg of N-P sub 2 O sub 5-K sub 2 0/ha. Based on the results, soil properties including pH and extractable P at harvest were noted to be not significantly affected by the application of different treatments; however, organic matter and exchangeable K shows significant result over the treatments applied. Highest yield (1,677.47 kg/ha) was obtained from treatment applied with 80 kg/N. Return on investment was determined to evaluate which among the treatments would be the most cost efficient and results showed that treatment applied with 80 kg/N gave the highest return. Treatment combination of 80-50-20 kg of N-P sub 2 O sub 5-K sub 2 O/ gave the best performance among the treatments.

COIX LACHRYMA JOBI; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; SOIL CHEMICOPHYSICAL PROPERTIES; GROWTH; CROP YIELD; NUTRITIONAL REQUIREMENTS

Growth, yield and postharvest responses of spring onion (Allium fistulosum L.) applied with Trichoderma under organic cultivation. **Dela Cruz, K.G., Bayla, J.A., Galindez, J.L.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 94 (Sep 2019).*

The experiment was to evaluate the growth, yield and postharvest quality of spring onion with Trichoderma under organic cultivation. The following treatments were evaluated 4.5 t/ha Organic fertilizer (OF), 0.25 t/ha Trichoderma (tricho), 2.25 t/ha OF + 0.125 t/ha Tricho and 4.5 t/ha OF + 0.25 t/ha Tricho. Application of 4.5 t/ha + 0.25 t/ha Tricho had significantly produced higher plant height, number of tillers, weight of plant per plot, length of the pseudostem, diameter of the pseudostem, root length and oven dry weight of roots and leaves than the other treatments. Spring onion applied with 4.5 t/ha OF with 0.25 t/ha Tricho can be packed in banana leaves and stored for 6 days at 20 deg C or 4 days at ambient condition.

ALLIUM FISTULOSUM; ORGANIC AGRICULTURE; ORGANIC FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; TRICHODERMA; GROWTH; CROP YIELD; POSTHARVEST TECHNOLOGY

Humic acid characterization of compost derived from animal, farm and industrial wastes. **Pabiona, M.G., Lacaolacao, E.O.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 95 (Sep 2019).*

The study was conducted at the rainout shelter at the College of Agriculture, Central Mindanao University, Musuan, Maramag, Bukidnon [Philippines]. It aimed to: (1)determine the pH, organic carbon, total N, total P and total K of composts and humic acid derived from animal, crop and industrial wastes, and (2)evaluate the humus quality by spectrometric methods and Q sub 4/6 values. The chemical analysis of compost showed that total potassium, pH and percent recovery were significantly different among compost, in which C4 (goat manure + coffee hull + bagasse + mudpress) obtained the highest pH and total potassium value and C3 (goat manure + rice straw + bagasse + mudpress) has the lowest pH value, on the percent recovery the highest value was obtained by C1 (goat manure + rice hull + bagasse + mudpress) and the lowest value was obtained by C3(goat manure + rice straw + baggase + mudpress). Based on the results of the study, in comparison to all the compost treatments, C4 (goat manure + coffee hull + bagasse + mudpress) appeared to be the best recommendable compost due to its promising characteristics such as higher nutrient concentration. Furthermore, C2 (goat manure + corn cob + bagasse + mudpress) obtained the highest value (8.19) in Q sub 4/6 but appeared to be low in quality of humus.

COMPOSTS; FARMYARD MANURE; AGRICULTURAL WASTES; INDUSTRIAL WASTES; HUMIC ACIDS; CHEMICOPHYSICAL PROPERTIES

Increasing productivity of coffee (Coffea arabica L.) using Mokusoko as organic fertilizer. **Golonan, A.S., Andiso, E.C., Teotilo, L.B., Wanawan, M.T.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 96 (Sep 2019).*

Arabica Coffee (Coffee Arabica L.) which is known as 'kapeng tagalog' thrives in tropical areas with temperature ranging from 130C to 240C average. This is the best coffee rated because of its aroma and superior taste. The demand for coffee is increasing and considered as good business venture. To increase production intervention in fertilizer application using organic fertilizer is highly recommended. Mokusako is

mature technology tested in CAR for other crops. This is a pyroligineous acid, liquid substance obtained when organic materials such as wood, coconut shell, bamboo, and other plants are placed in a heating chamber. This was used in the study to boost coffee production in the Cordillera. This study is on-going implementation. First year is organic fertilizer application using Mokusako with 75 sample coffee trees. Then irrigation scheme using drip technology after which results will be used through scaling-up with fertigation for application of coffee trees. Initial data on soil analysis identifies which is the area most suitable for coffee production. Mokusako will be submitted for laboratory by June 2019 for future comparison and validation.

COFFEA ARABICA; COFFEE; ORGANIC FERTILIZERS; FERTILIZER APPLICATION; FERTIGATION; FERTILIZERS; TECHNOLOGY

Vermicompost worth more than P300,000 monthly from horse, goat manure. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(12) p. 58-59 (Dec 2019).*

FARMYARD MANURE; HORSES; GOATS; COMPOSTING; OLIGOCHAETA

F08 Cropping patterns and systems

1.6-hectare farmland amply feeds family of 14. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 28(10) p. 40-42 (Oct 2019).*

ORYZA SATIVA; VEGETABLES; TILAPIA; ORGANIC AGRICULTURE; ORGANIC FERTILIZERS; COMPOSTING; OLIGOCHAETA; FARMING SYSTEMS; FARMS

Interplot competition in cassava (Manihot esculenta Crantz) variety trials. **Carpena, A.L.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 180-185. (Jun 2019).*

Interplot competition for root yield in three-row plot variety trials in cassava (Manihot esculenta Crantz) was determined using data from six and 14 varieties evaluated in two cropping years in two sets of trials each (one with unbordered three-row plots and another with bordered three-row plots) and comparing yield performance of each entry in unbordered and bordered plots. In spite of significant differences among the varietal entries in plant height, a trait that could cause competition between adjacent cassava varieties in a trial, analyses of variance showed no significant differences between the two plot types in both crop years in terms of root yield, indicating the absence of intergenotypic competition for root yield in these experiments. The rank correlation of varietal rankings between bordered and unbordered plot trials was highly significant in the crop year with 14 entries, supporting the result of the analysis of variance. Thus, at least for three-row plot trials that usually involve several varieties, this study has indicated that the extra or guard row on each side of the effective plot can be done away with without affecting varietal comparisons.

MANIHOT ESCULENTA; CASSAVA; VARIETY TRIALS; FIELDS; FIELD SIZE; PLOT DESIGN; SPACING; ROOT SYSTEMS

Bayer and Department of Agriculture RFO [Regional Field Office] 12 L. accelerate hybrid adoption in Mindanao [Philippines]. **Anon.** *Agriculture (Philippines) v. 23(10) p. 32-35 (Oct 2019).*

ORYZA SATIVA; HYBRIDS; HYBRIDIZATION; TECHNOLOGY; TECHNOLOGY TRANSFER; DIFFUSION OF INFORMATION; FARMERS; PRODUCTIVITY; PROFITABILITY; LOCAL GOVERNMENT; RESEARCH INSTITUTIONS; PHILIPPINES

Biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance in hybrid rice against bacterial leaf blight. **Bayots, R.G.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 9-39.*

Mestizo 19 and Mestizo 20 hybrids have induced resistance trait and are responsive to radiation-modified kappa carrageenan (RMKC) at optimum concentration of 50-200 ppm. These hybrids have gained resistance against bacterial leaf blight (BLB) just six hours after spraying with the inducer and the induced resistant state can last for about 15 days. Mestizo 20 hybrid seems to be more responsive to RMKC treatment than the Mestizo 19 hybrid, in general. Plant height of Mestizo 19 and Mestizo 20 hybrid varieties was increased significantly by 100 ppm RMKC sprayed three times at 30, 45 and 60 DAT. The 100 ppm RMKC applied at 30, 45 and 60 DAT increased grain yield of Mestizo 20 hybrid by 23%, but did not increase yield in Mestizo 19 hybrid. Meanwhile, 200 ppm RMKC reduced bacterial leaf streak severity of Mestizo 19 hybrid by 34% and 50 ppm RMKC reduced bacterial leaf streak severity of Mestizo 20 hybrid by 48%. Mestizo 19 hybrid was observed to be more susceptible to bacterial leaf streak with 24.82% severity than the Mestizo hybrid 20 hybrid with only 10.43% severity in untreated plants. On the other hand, the response of rice plants to root soaking as means of inducing resistance is influenced by the rice cultivar and the kind of inducers used. In Mestizo 20 hybrid, soaking roots for 5 min in 100 ppm of RMKC produced significantly shorter blight lesions than the untreated plants but the use of chitosan has no effect on blight severity while in Mestizo 19 hybrid, the same treatment using 150 and 200 ppm chitosan reduced blight lesions significantly but RMKC has no effect on blight severity.

ORYZA SATIVA; HYBRIDS; CARRAGEENANS; CHITOSAN; BLIGHT; DISEASE RESISTANCE; RADIATION; ORYZA SATIVA

Biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance to rice tungro. **Sta. Cruz, F.C.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 40-67.*

The treatment with RMKC [radiation-modified kappa carrageenan] did not induce tungro resistance in rice varieties NSIC RC 216, TN1 and PSB RC 82 regardless of RMKC concentration and induction time. However, the slight reduction in tungro severity with treatment of 150 ppm at induction time of 9 days before inoculation which was consistent in both NSIC RC 216 and TN1 varieties in greenhouse experiments, indicated some potential effect of RMKC in inducing virus resistance. Earlier studies showed that RMKC

applied at low concentration of 50 ppm at 5, 10 or 15 days before virus inoculation can reduce the severity of leaf curl disease in two tomato varieties, 'Apollo White' and 'Marimar' under screenhouse conditions (Ong et al., 2016). The potential effect of RMKC for inducing tomato leaf curl resistance was more apparent, and the efficacy has to be evaluated under field conditions. Although the effect of RMKC in inducing tungro resistance was not observed in this project, the effect may be seen for virus diseases of vegetable where it is expected to be more responsive to RMKC treatment in tomato.

ORYZA SATIVA; RICE; TUNGRO DISEASE; DISEASE RESISTANCE; CARRAGEENANS; CHITOSAN; RADIATION

Charming Snow, a new cauliflower variety **Ancheta, A.** *Agriculture (Philippines) v. 23(12) p. 20-21 (Dec 2019).*

BRASSICA OLERACEA BOTRYTIS; CAULIFLOWERS; VARIETIES; CROP MANAGEMENT; PRICES; WEIGHT

DNA profiling of Philippine cacao (Theobroma cacao L.) varieties using microsatellite markers. **Tonogbanua, K.A., Espino, R.R.C., Espino, M.R.M., Ramos, J.V.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 155-162. (Jun 2019).*

Fifteen SSR markers were used to construct a DNA profile of Philippine cacao varieties to assess the genetic similarity, genetic diversity and elucidate relationships between varieties and clones. A total of 50 accessions of cacao were collected, composed of 13 varieties and 7 criollo clones, from 10 provinces in the Philippines. Of the 13 varieties, 6 are National Seed Industry Council (NSIC)-registered. Unweighted pair group method with arithmetic mean (UPGMA) similarity coefficients observed from the cluster analysis of the standard varieties ranged from 0.09 to 0.72, indicating that standard varieties are distinct from one another. The varieties with the highest similarity (72%) were the criollo clones Criollo Green and Criollo Red. At 22% similarity, trinitarios composed the majority in one group. The mixing of other criollos with the trinitario group could be due to their genetic relationship where trinitarios are hybrids between criollo and forastero. All the characterized primers were highly polymorphic with polymorphism information content (PIC) values ranging from 0.6341 to 0.8702. The markers used were repeatable, sufficient and effective in detecting genetic similarities and establishing genetic profiles of the collection.

THEOBROMA CACAO; VARIETIES; DNA; MICROSATELLITES; GENETIC VARIATION; GENETIC MARKERS; BREEDING METHODS; PHILIPPINES

East-West Seed brings 'Mucho' success to farmers with its new eggplant variety. **Anon.** *Agriculture (Philippines) v. 23(12) p. 16-18 (Dec 2019).*

SOLANUM MELONGENA; HIGH YIELDING VARIETIES; COST BENEFIT ANALYSIS; FARMERS; INCOME

Enriched mini-genomic library for the development and characterization of simple sequence repeat (SSR) markers in sugarcane (Saccharum sp. hybrids). **Sanguillosa, J.B., Rasco, J.L.S., Laurena, A.C., Lalusin, A.G.** *Philippine Agricultural Scientist (Philippines). v. 102 (2) p. 95-106. (Jun 2019).*

Enriched mini-genomic libraries of sugarcane variety VMC 87-599 were constructed using AatII and PstI restriction enzymes. A total of 517 sequences were obtained from the combined libraries. BLASTn homology revealed the majority (49%) of the sequences had no significant similarity whereas 22% had

similarity with Saccharum officinarum, 12% with both Sorghum bicolor and Zea mays, 2% with Setaria italic, 1 % with Oryza Sativa, and 2% with other grass species. Also, 3.6% of the sequences had similar gene identity that is organellar and 12.7% nuclear. Of the total sequences, 54 (4.64%) had SSRs and 63 primers were developed with 11 primers mined from genic sequences. SSR repeat motifs were predominantly tetranucleotide (51%) and trinucleotide (30%). The primer sets were used to screen 20 sugarcane accessions of which 46 primers were amplified fragments. A total of 326 alleles were detected with the mean value of 7 alleles per locus. The average PIC value of the 46 optimized primers ranged from 0 to 0.94 with a mean value of 0.73. Cluster analysis of genotypic data of 20 accessions from 46 primers revealed 5 clusters at a dissimilarity coefficient of 0.5. SSR markers designed from the enriched library. These are highly informative and can be utilized for sugarcane genetics and breeding.

SACCHARUM OFFICINARUM; SUGARCANE; HYBRIDIZATION; GENOMES; GENETIC VARIATION; GENETIC MARKERS

Environmental event broadens cultivation of indigenous Palawan cherry [Philippines]. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23(12) p. 30-32*
Dec 2019).

ENVIRONMENT; NATURE CONSERVATION; TOURISM; BIODIVERSITY; INDIGENOUS ORGANISMS; PHILIPPINES

Field evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance in rice insect pest and its influence on the population density of beneficial arthropods. **Magsino, G.L.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 68-120.*

The three (3) – year project (August 2013 to June 2016) at CES, U.P. Los Baños research station (six cropping seasons) and Year 3 Season Trials on Farmer's Field at Victoria, Laguna [Philippines](August to December 2015 and February to June 2016 cropping seasons) established and validated the use of carrageenan as plant food supplement in lowland transplanted rice. Foliar spraying to rice plants of Carrageenan at 200 ppm (3.2 li/ha) 3x(14, 30 and 45 DAT) per season promoted better crop stand, more productive tillers and better quality grain yields especially if supplemented to 1/2 RRG (4 bags NPK/ha) or RRG (8 bags NPK/ha). Across six cropping seasons at CES, U.P. Los Baños, Carrageenan at 3.2 li/ha or 9.6 li/ha/season + 1/2 RRG treated plants (4 bags NPK/ha) produce an average of 37.87% better grain yields than 1/2 RRG treated plants (4 bags NPK/ha). On the other hand, foliar application of Carrageenan at 9.6 li/ha/season + RRG (8 bags NPK/ha) provided an average of 11.06% higher yields than plants treated only with RRG (8 bags NPK/ha). The farmer's field trials (Year 3 cropping season) in Victoria, Laguna showed an average higher grain yields of 30.39% from 1/2 RRG + Carrageenan at 3.2 li/ha/application or 9.6 li/ha/season than 1/2 RRG rice plants and 19.03% from RRG + Carrageenan versus RRG treated plants. The three-year study in rice showed the potential Carrageenan as plant food supplement within the range of 100-300 ppm while 400-1,000 ppm provided moderate growth stunting but the plants maintained the green appearance. The study showed consistent presence of beneficial such as coccinellids and spiders on carrageenan treated plants. Carrageenan treated plants enhanced the presence of natural enemies which were able to manage the pest population such as GLH, BPH and stem borers. The results proved the

increasing presence of natural enemies versus insect pests that relates to density dependent relationship of arthropods in the study.

ORYZA SATIVA; ARTHROPODA; CARRAGEENANS; CHITOSAN; PEST RESISTANCE; RADIATION; POPULATION DENSITY; APPLICATION METHODS; APPLICATION RATES; NATURAL ENEMIES; PHILIPPINES

Field testing of transgenic papaya with delayed ripening trait and papaya ringspot virus (PRSV) resistance towards commercialization (R1109): field testing of transgenic papaya with long shelf and papaya ringspot virus (PRSV) resistance. **Tecson-Mendoza, E.M., Garcia, N.N., Lit, M.C., Ocampo, E.T.M., Serrano, E.P., Laurena, A.C.** *Department of Agriculture, 2nd Floor BSWM Bldg., Elliptical Rd. Cor., Diliman, Quezon City (Philippines). Biotechnology Program Office. TR-1836.*

The researchers project 2011-2014) funded by the DA [Department of Agriculture] Biotechnology Program aimed primarily to conduct the testing of the transgenic papaya hybrid with both long shelf life and PRSV-resistance traits. The following are the highlights of this project: The biosafety permit for the field testing was obtained from Department of Agriculture Bureau of Plant Industry (DA BPI) in June 2012 and papaya seedlings planted on September 4, 2012. The field test of the transgenic papaya was successfully conducted on a 896-sq m lot under the supervision of the DA-BPI Biosafety Team and the UPLB Institutional Safety Committee. All plants in the field were infected with PRSV but the F1 hybrids were able to recover from the disease and produce fruits. The control Davao Solo plants were able to recover from the disease and produce fruits. The control Davao Solo plants was heavily infested with PRSV and majority were unable to recover; those which are less infected bore fruits which had the oil ringspots and deformities typical of fruits from PRSV infected trees. The F1 hybrids took an average of 134 days fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids took an average of 134 days for fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids papaya fruits had an average of 8 days from color break to full yellow and another 5.7 days to ripen for total of about 13.7 days. Control papaya fruits had a total of about 10.7 days total from color break to ripe stage. All transgenic plants in the field were found to be positive for the transgene (anti-ACC synthase 2) by PCR screening. Using specific primers for sex determination, the seedlings planted in the field were about 1:1 female and hermaphrodite. Using relative PCR ACS2 expression was found to be lower in the transgenic papaya, both the F1 hybrid and T4 01-6-48 line, compared with the non-transgenic control papaya, at 80% yellow fruit stage, indicating lower ethylene production in the transgenic papayas. Findings in the field trial revealed the spiders and ants were abundant in the site in November 2012 to May 2013. The eggs of spiders were mostly observed under the surface of the leaves. Diverse arthropods were counted and collected from the papaya hybrid and control plants. These arthropods can be classified according to their functional guilds, namely, predators, parasites, pollinators, neutrals chewing pest and sucking pests. The most abundant were the predators and coccinellids. The arthropod pests that were identified new pest (tentatively a coleopteran) which damaged the young and old fruits of both the hybrids and control plants was observed in the field trial site. The pest was also observed in other papaya growing areas in Laguna [Philippines]. The study of the storage behavior of the papaya fruits showed the fruits harvested at 115, 120, and 122, color break stage, DAF, had similar physico-chemical qualities and sensory attributes. The peak of athylene production was observed to be at 6 to 7 days after harvest of fruits at 120 and 122 DAF and this was already at about 80% yellow. Harvesting at different maturity also did not have any appreciable difference in physico-chemical characteristics of the fruits as well as its sensory attributes. The project team undertook IEC activities firstly in the vicinityof the field test, in Bay and Los Baños, Laguna, with municipal councils of said towns, and in the two barangays [villages] in Bay. The team also briefed the municipal

agricultural officers of the province of Laguna and officials of the provincial government office in Santa Cruz, Laguna. A training workshop on regularity rules and practices was conducted for the members of the project. The team likewise discussed with officials and research and faculty personnel of the Cavite State University and Adventist University of the Philippines for possible collaboration on the second field trial of the transgenic papaya F1 hybrid. Briefings on the transgenic papaya were conducted with the Provincial Agriculturist of Cavite and his technical staff and the Municipal Agriculturist of Silang, Cavite. The researchers obtained information on the NSIC, registration and Application for Plant Variety Protection of the transgenic papaya with delayed repining trait and its F1 hybrid with the introgressed trait of PRSV resistance from the Bureau of Plan Industry. Various IECs on transgenic papaya technology were undertaken in various schools, at IPB, and during talks before different gatherings in workshops on biotechnology.

CARICA PAPAYA; HYBRIDIZATION; DISEASE CONTROL; PLANT DISEASES; TRANSGENIC PLANTS; KEEPING QUALITY; POSTHARVEST PHYSIOLOGY; RIPENING

He [Mr. Florencio Sudoy of Barangay, [village] Mabini, Sto. Domingo, Nueva Ecija, Philippines] produced 14 tons of palay in one hectare. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 16; 18 (Nov 2019).*

ORYZA SATIVA; HYBRIDS; CROP YIELD; PEST RESISTANCE; DISEASE RESISTANCE; FERTILIZER APPLICATION; PRODUCTION COSTS; COST BENEFIT ANALYSIS; PHILIPPINES; FARMERS

Improving productivity and local utilization of mungbean: Project 1: development of mungbean varieties for drought and partial shade tolerance. **Maghirang, R.G., Angeles, L.O., Del Rosario, L.A., Rodriguez, M.C.P.B., Sabanal, A.Q.C., Reyes, D.H., Torillos, R.M.S., Ocampo, J.A.O., delos Reyes, A.M.M., Reyes, E.L., de Mesa, S., Delfin, E.F., Alip, R.C.G., Deseo, N., Dalisay, E.A., Lalap, C.M., Makiling, A.T., Punzalan, F.V., Welgas, J.N.** *TR-1886.*

The development of mungbean populations for drought and shade tolerance was achieved through rigorous evaluation from observational and yield trials, drought, partial shade screenings, and on-farm verification trials. Root characteristics, leaf physiology and foliar spray responses that are essential for the adaptation of mungbean under stress were studied. Identified potential varieties were further improved through hybridization and selection. The same tests were done to identify and recommend a variety adapted under drought (post rice) and partial shade (cassava or coconut intercropping) conditions. Results suggests that Pagasa 5 thrive well under both upland and post-rice conditions. With estimated yield of 0.86 – 1.10 t/ha, it has performed better as compared to other Pagasa varieties. It also performed better in coconut intercropping during the dry season. Notable genotypes in the replicated yield trials were 163113 (2.31t/ha, 53.8 %YA) and 163190 (2.13 t/ha, 42 %YA). Entries comparable with the check were 163136 (Iloilo yellow selection), 163334 and Mgc15-13 (1.8 t/ha). The versatility of Pagasa 7 for partial shade was exhibited by both in coconut and cassava intercropping. Advanced mungbean lines, Mgc15-13, Mgc15- 5, Mgc15-6, Mgc 15-10 and Mgc 16-37 were identified as the most drought tolerant populations having the better yield under drought conditions in the field yielding from about 0.71 to 0.91 t/ha. Mgc15-13, yielded better than the Pag-asa checks (Pag-asa 1, 3, 5, 7) but less than Taiwan Green during wet season. In terms of taste Mgc15-13, had the most preferred texture among the entries. Mgc15-10 also showed good sensory quality in terms of appearance, aroma, taste and 'sabaw'. 12 primers were identified for the genetic diversity analysis. A dendrogram with the 100 mungbean accessions showed 20 distinct clusters at 0.90 similarity coefficient. Pagasa 5, Pagasa 7 and Pagasa 19 was grouped in the Largest cluster, Cluster 1.

This cluster also constitutes most of the variable accessions, in terms of drought tolerance rating, with average to high estimated yield. Pagasa 3 and seven other accessions constitute their own clusters, Cluster 6, 8, 9, 13, 16, 17, 18, 19. Cluster 11 shows a group of highly tolerant accessions with above average yield while cluster 10 constitutes a group of less tolerant individuals with average estimated yield. It was also observed that most of the accessions with yellow seed color tends to be closer together in based on the dendrogram which suggest a specific relationship between them.

VIGNA RADIATA; MUNG BEANS; VARIETIES; BREEDING METHODS; DROUGHT RESISTANCE; PLANT PRODUCTION; SHADING; CROP YIELD; ADAPTATION; ON-FARM RESEARCH; PLANT ESTABLISHMENT

Interplot competition in cassava (Manihot esculenta Crantz) variety trials. **Carpena, A.L.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 180-185. (Jun 2019).*

Interplot competition for root yield in three-row plot variety trials in cassava (Manihot esculenta Crantz) was determined using data from six and 14 varieties evaluated in two cropping years in two sets of trials each (one with unbordered three-row plots and another with bordered three-row plots) and comparing yield performance of each entry in unbordered and bordered plots. In spite of significant differences among the varietal entries in plant height, a trait that could cause competition between adjacent cassava varieties in a trial, analyses of variance showed no significant differences between the two plot types in both crop years in terms of root yield, indicating the absence of intergenotypic competition for root yield in these experiments. The rank correlation of varietal rankings between bordered and unbordered plot trials was highly significant in the crop year with 14 entries, supporting the result of the analysis of variance. Thus, at least for three-row plot trials that usually involve several varieties, this study has indicated that the extra or guard row on each side of the effective plot can be done away with without affecting varietal comparisons.

MANIHOT ESCULENTA; CASSAVA; VARIETY TRIALS; FIELDS; FIELD SIZE; PLOT DESIGN; SPACING; ROOT SYSTEMS

Newly released PhilSCAT [Philippine-Sino Center for Agricultural Technology] hybrid rice variety for irrigated lowland ecosystem. **Cabaniang, R.T.S., Fulgencio, R.A., Meña, F.E., Frediles, E.C., Abon, C.C.Jr.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 99-100 (Sep 2019).*

Hybrid rice technology is intensively promoted by the Department of Agriculture is ensure sufficient rice supply in the Philippines. This government effort is supported by the Philippine-Sino Center for Agricultural Technology (PhilSCAT) through hybrid rice seed production. PhilSCAT as one of the research centers in producing quality hybrid rice seeds in the Philippines bred new hybrid rice variety which is the PhilSCAT 9 and tested in the National Cooperative Test (NCT) in 2017. The NCT results have shown that PhilSCAT 9 was observed to be an early maturing hybrid rice variety at 114 days. It passed yield criterion for a regional recommendation in Luzon and Visayas with a mean yield advantage of 14.4% in Dry Season (DS), 21.9% in Wet Season (WS); and 132% DS, 17.6% WS in Visayas as compared to Mestizo 1 (check variety). Results further indicated that it did not pass national yield criterion but recorded a maximum yield of 11.88 tons/ha in DA-Tabuk. The result also showed that in some selected sites, PhilSCAT 9 exhibited and intermediate to resistant reaction to major pests and diseases such as bacterial leaf blight, sheath blight, yellow stemborer, rice tungro virus, and green leafhopper. Furthermore, PhilSCAT 9 passed grain quality standards with milling recovery of 70.7% (Premium); head rice recovery of 50.5% (Grade 1); with long (7.1

mm) and slender grain (3.4); and higher percentage acceptability especially in the cooked from as compared to IR64, the eating quality check and Mestizo 1. PhilSCAT 9 was given a name of NSIC 2017 Rc490H or Mestiso 82. This new hybrid rice variety was regionally recommended in irrigated lowland areas in Luzon particularly in the provinces of Nueva Ecija, Isabela, Cagayan, and Ilocos Norte; and in the provinces of Leyte and Bohol in Visayas.

RYZA SATIVA; HYBRIDS; LOWLAND; IRRIGATED LAND; PEST RESISTANCE; DISEASE RESISTANCE; QUALITY

Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice. **Magsino, G.L.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. TR-1810.*

ORYZA SATIVA; CARRAGEENANS; CHITOSAN; PEST RESISTANCE; DISEASE RESISTANCE; TUNGRO DISEASE; BLIGHT; RADIATION

Rey Pimentel's [plant breeder, UP Los Baños, Laguna, Philippines] exciting Hoya crosses. **Sarian, Z.B.** *Agriculture (Philippines) v. 28(10) p. 22-23 (Oct 2019).*

INDIGENOUS ORGANISMS; ORNAMENTAL CLIMBERS; FLOWERS; COLOUR; CROSSBREDS; BREEDING METHODS

Ricebusiness cravings. **Frediles, C.** *Agriculture (Philippines) v. 23(11) p. 20; 22 (Nov 2019).*

ORYZA SATIVA; VARIETIES; CROP YIELD; CROP PERFORMANCE; PEST RESISTANCE; DISEASE RESISTANCE; SEEDS; QUALITY; BREEDING METHODS

F40 Plant ecology

Long term monitoring of plant community changes in Mt. Makiling Forest Reserve [Laguna, Philippines]. **Maldia, L.S.J., Aguilon, D.J.D., Luna, A.C., Cruz, R.V.O.** *TR-1867.*

To date, an estimated 875 studies have been conducted in the Mt. Makiling Forest Reserve (MMFR) [Laguna, Philippines] but most were either short term in nature or without follow up studies. In this study, a 4-ha long term monitoring plot established in 1992 through the collaboration of the College of Forestry and Natural Resources and the Japan International Research Center for Agricultural Sciences (JIRCAS) was re-surveyed for trees tagged in 1992 and those that recruited beyond (10 cm diameter at breast height), including current regenerations. This is in order to determine community dynamics of component tree species d assess recruitment strategies of forest trees in MMFR. The three most occurring taxonomic families were Cannabaceae, Meliaceae, and Rubiaceae, while Celtis luzonica (Cannabaceae), the most dominant species recorded in 1992, was consistently the dominant species present in the standing canopy vegetation and regeneration. Over time, the composition of the MMFR was consistently formed by numerous non-dipterocarp tree species, maintaining a species-rich secondary tropical rainforest of MMFR. The present study is useful in understanding the dynamics of a particular forest ecosystem over time.

HIGHLANDS; CANNABIDACEAE; MELIACEAE; RUBIACEAE; FOREST RESERVES; REGENERATION; MONITORING; BIODIVERSITY; PHILIPPINES

Species listing of macrofungi found in the Ifugao indigenous community in Ifugao Province, Philippines. **De Leon, A.M., Cruz, A.S., Evangelista, A.B.B., Miguel, C.M., Pagoso, E.J.A., Dela Cruz, T.E.E., Nelsen, D.J., Stephenson, S.L.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 118-131. (Jun 2019).*

The Philippines is known as one of the megadiverse countries in the world. One of its important biological resources are macrofungi which play an active role in wood decomposition, thereby contributing to nutrient recycling in the forest ecosystem. However, in spite of the important ecological role of macrofungi, little is known about their biodiversity in the Philippines. Investigations on the taxonomy and diversity of macrofungi are also gaining importance, as many macrofungi species are on the brink of extinction due to environmental destruction. Therefore, this study was conducted to document the different species of macrofungi in Ifugao Province, Philippines to come up with a species list of macrofungi in areas inhabited by the Ifugao indigenous community. Purposive sampling method was done to scan the nine barangay [village] study sites: Bangaan, Poitan and Viewpoint in the municipality of Banaue, Bokiawan, Hapao and Poblacion in the municipality of Hungduan, and Chaya, Chumang and Mapawoy in the municipality of Mayoyao. Collected macrofungal samples were identified using both morphological and molecular methods. A total of 144 macrofungal samples were collected; out of these, 109 species were identified: 74 morphologically and 35 molecularly. Of these samples, 71 macrofungi were identified up to the species level while 34 could only be indentified up to the genus level. The identified macrofungi belonged to 30 families, 47 genera and 47species. Sixteen identified species of macrofungi were utilized as food as declared by the community and these are Agaricus sp., Auricularia auricular, Coprinellus disseminates, Coprinus comatus, Lentinus sajorcaju. Lenzites elegans, Mycena sp., Oudemansiella canarii, Phellinus sp., Pleurotus djamor, Pleurotus ostreatus, Pleurotus sp., Schizophyllum commune, Trametes elegans, termitomyces sp. and Vascellum pratense. This study is the first report on macrofungal diversity in the area inhabited by the Ifugao community in Ifugao Province.

EDIBLE FUNGI; SPECIES; AGARICUS; AURICULARIA (FUNGI); COPRINUS; LENTINUS; LENZITES; PHELLINUS; PLEUROTUS; SCHIZOPHYLLUM; TERMITOMYCES; FOREST ECOLOGY; BIODIVERSITY; ETHNIC GROUPS; RURAL COMMUNITIES; PHILIPPINES

F60 Plant physiology and biochemistry

Effects of drought stress on leaf gas exchange, chlorophyll content and dry matter allocation of Phragmites australis in the Heihe River Basin. **Ya Juan Zhang, Yi Hua Li, Hong Gao, Li Wang, Dong Sheng Kong, Yan Wu Wang, Kai Lu, Jiang Wen Tian, Yuan Lin Lu.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 141-148. (Jun 2019).*

Phragmites australis is considered the dominant species of wetlands, especially in Northwest China. It plays a very important role in wetland regulation, but little is known about its photosynthetic capacity. Here, we investigated gas exchange parameters, chlorophyll content and dry matter allocation under different watering regimes along the West Lake Wetland of the Hexi Corridor in China. Drought stress significantly decreased P sub N, E, g sub s, chlorophyll content (Chl a, Chl b, Chl (a + b), Chl a/b) and augmented Ci, but it also decreased the root, shoot, leaf and total dry matter of P. australis. According to Farquhar and Sharkey (1982), there are both stomatal and nonstomatal limitations to photosynthesis. Stomatal limitation

dominates when water stress first occurs, whereas nonstomatal limitation dominates during severe drought. Drought stress lowered Chl a, Chl b, and Chl (a + b), and also the Chl a/b) ratio, showing that water stress seriously damages the PSII reaction center in P. australis. Water stress also lowered relative water content (RWC) and water use efficiency (WUE) at 75% water treatment, indicating that P. australis. was sensitive under drought stress. The threshold for P. australis. at which seedling growth was reduced or even terminated was decline in RWC to less than 57.58%.

PHRAGMITES AUSTRALIS; WATERSHEDS; DROUGHT STRESS; WATER USE; LEAVES; GAS EXCHANGE; CHLOROPHYLLS; DRY MATTER CONTENT; TRANSPIRATION; STOMATA; TRANSLOCATION; PLANT WATER RELATIONS

Laboratory and greenhouse screening for drought tolerance among Iranian cumin (Cuminum cyminum L.) ecotypes under controlled conditions. **Arshad, M., Alizadeh, K., Adeli, E., Teixeira Da Silva, J.A.** *Philippine Agricultural Scientist (Philippines). v. 102 (2) p. 149-154. (Jun 2019).*

Among different environmental stresses, drought is the abiotic factor that limits crop productivity the most. Cumin (Cuminum cyminum L.) is the second most popular spice in the world and an important medicinal plant in Iran. Drought-tolerant cumin cultivars could serve as an alternative spring sown crop in semi-arid areas. In this study, 20 local Iranian cumin ecotypes originating from Azarbaijan, Fars, Isfahan, Kerman, Semnan, Yazd, Northern, Razavi and Southern Khorasan provinces were grown under controlled (laboratory and pot) conditions at the Dryland Agricultural Research Institute (DARI) of Iran. Seed germination and seedling growth were assessed under controlled conditions. Drought stress was simulated by using polyethylene glycol (PEG). Relative drought tolerance of seedlings was evaluated in a greenhouse by controlling the moisture content in pots. PEG-induced osmotic stress resulted in significant differences in germination between ecotypes. There was considerable variation in some morpho-physiological growth parameters in the greenhouse. Ecotypes from Kerman, Razavi Khorasan and Semnan provinces were more drought-tolerant than the remaining 17 ecotypes, and may be suitable for cultivation in drought-stressed areas. This data set will be useful for the development of drought-tolerant cumin cultivars.

CUMINUM CYMINUM; DROUGHT STRESS; DROUGHT RESISTANCE; DROUGHT; DRUG PLANTS; LABORATORY EXPERIMENTATION; POT EXPERIMENTATION; MEDICINAL PROPERTIES; IRAN ISLAMIC REPUBLIC

Negros Occidental [Philippines] farm advocates the use of medicinal plants. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(12) p. 34-36 (Dec 2019).*

DRUG PLANTS; MEDICINAL PROPERTIES; INDIGENOUS ORGANISMS; FARMS; GARDENS; TOURISM; RURAL AREAS; PHILIPPINES

F62 Plant physiology - Growth and development

Interference of weedy rice on yield and yield components of cultivated rice under replacement series method. **Sandoval, F.R., Martin, E.C., Donayre, D.K.M.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 96-97 (Sep 2019).*

Weedy rice are becoming a major threat to rice production in the Philippines. Reports had shown that it affect the quality and quantity of cultivated rice. Information about its negative effect on yield of rice under

Philippine condition is very limited. An experiment was conducted from August-November 2018 at PhilRice CES [Philippine Rice Inst. Central Experiment Station, Science City of Munoz, Nueva Ecija, Philippines]to determine the effect of weedy rice on yield and yield component of cultivated rice using replacement series method. The treatments involved were 100:0, 75:25, 50:50, 25:75 and 0:100% rice:weedy rice or weedy rice:rice ratios. The experiment was arranged in RCBD [randomized complete block design] with 4 replications. Data were subjected to ANOVA replacement method analysis. Results showed that plant height of NSIC Rc 222 was not affected by the presence of weedy rice. However, number of leaves, tillers and panicles were significantly reduced at 50:50 and 25:75 rice to weedy rice ratio. Tillers and panicle number of weedy rice were higher at 75:25 ratio. When the population of weedy rice was lower, the number of tillers increased. Yield components of rice at 25:75 ratio were significantly reduced particularly the panicle length (24cm), total number of grains (107) and biomass (22.15g).

ORYZA SATIVA; WEEDS; RICE; GROWTH; CROP YIELD; YIELD INCREASES; CROP PERFORMANCE

F63 Plant physiology - Reproduction

Enumeration of pollinators and floral visitors of some common weeds with notes on pollen characteristics. **Barrion-Dupo, A.L.A.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (1) p. 63-70. (Apr 2018).*

Inflorescences of six common weeds each representing its plant family, namely: Amaranthus spinosus L. (Amaranthaceae), Tridax procumbens L. (Asteraceae), Coccinia grandis (L.) Voigt (Cucurbitaceae), Euphorbia hirta L. (Euphorbiaceae), Oxalis corniculata L. (Oxalidaceae), and Lantana camara L. (Verbenaceae), were sampled. Data on the morphology of these flowers were compiled and pollen grains were extracted through the Feagri and Iversen's Acetolysis Procedure. In addition, floral visitors and pollinators were identified. Arthropod visitors and pollinators of these common weeds were mostly managed pollinators like Apis mellifera L. and Tetragonula biroi (Friese). Meanwhile, pierid and hesperiid butterflies comprised the lepidopteran floral visitors. New host plant records for these butterflies are reported from among these weeds.

AMARANTHUS SPINOSUS; AMARANTHACEAE; TRIDAX PROCUMBENS; ASTERACEAE; CUCURBITACEAE; EUPHORBIA; OXALIS; OXALIDACEAE; LANTANA CAMARA; APIS MELLIFERA; POLLEN; WEEDS; POLLINATION; POLLINATORS

Review of pollination biology research in selected Asian countries. **Cervancia, C.R.** *Philippine Entomologists (Philippines). 0048-3753. v. 32 (1) p. 3-36. Apr 2018.*

The Asian region, with the southern part being mostly in the tropics, is high in pollinator diversity. Its rich vegetation and mild climate supports the population of pollinators. Solitary and social bees are among the important pollinator species. Other insect pollinators are butterflies, moths, beetles and flies. Birds and mammals pollinate bigger flowers. However, honey bees are the most widely studied species of pollinators. Of the 12 species of honeybees, 11 are native to Asia, namely: dwarf honey bees (Apis andreniformis and Apis florae), giant honey bees (Apis dorsata, Apis laboriosa, Apis dorsata binghami, and Apis breviligula) and cave nesting honey bees (Apis koschevnikovi, Apis cerana, Apisnigrocincta, Apis nuluensis and Apis indica). The European honey bee, Apis mellifera, is not native to Asia. Most pollination studies were focused on high value agricultural and plantation crops. Threats to pollinators are monoculture, pesticide use, pests and diseases, land use change, natural calamities and climate change. This review on the status

of pollination research covers countries in Southeast Asia (Indonesia, Thailand, Vietnam, Singapore, Malaysia and Philippines), east Asia (China, Korea and Japan) and South Asia (Pakistan, India and Nepal).

APIS; HONEY BEES; SPECIES; POLLINATION; POLLINATORS; INDONESIA; THAILAND; VIET NAM; SINGAPORE; MALAYSIA; PHILIPPINES; CHINA; KOREA DEMOCRATIC PEOPLE'S REPUBLIC; PAKISTAN; INDIA; NEPAL

H PLANT PROTECTION

H10 Pests of plants

Additional contributions to the knowledge of Philippine predatory mites mainly of the subfamilies Cunaxinae and Cunaxoidinae (Acari: Prostigmata: Cunaxidae). **Corpuz-Raros, L.A., Naredo, J.C.B., Garcia, R.C.** *Additional taxonomic studies on predatory mites of the family Cunaxidae (acari) from the Philippines, Corpuz-Raros, L.A..- College, Laguna (Philippines), 2018. TR-1838.- p. 40-68.*

A new species of cunaxid mite belonging to the subfamily Cunaxinae, Cunaxa minidiscondyla is described from the Philippines. This species is distinctive by the presence of a small disc-shaped adophysis dorsodistally on palp telofermur, two spine-like setae on palp genu, a long spine-like data on palp tibiotarsus, ill-defined prodosomal shield, absence of hysterosomal shield long hysterosomal setae, and basifemoral and telofemoral chaetotaxy of 4-4-3-1 and 5-5-4-4, respectively. The previously unknown male of Dactolyloscirus trifidus Corpuz-Raros, 2008 (Cunaxinae) and female of Lupaeus longisetus (Corpuz-Raros, 1996) (Cunaxoidinae) are described. A supplementary description is provided for Scutopalus clavatus (Shiba, 1976) (Cunaxoidinae) wich is recorded for the first time in the Philippines on coconut leaves infested with the scale insect, Aspiotus rigidus Reyne. New locality and habitat data are given for some species of the aftermentioned subfamilies, as well as the subfamilies Bonzinae and Orangescirulinae.

ACARINA; PROSTIGMATA; PREDATORS; NEW SPECIES; PHILIPPINES

Additional taxonomic studies on predatory mites of the family Cunaxidae (acari) from the Philippines. **Corpuz-Raros, L.A.** *TR-1838.*

Taxonomic studies were conducted to identify and officially document cunaxid species that were collected mainly in 2016 from Mt. Makiling and vicinity in Laguna, University of the Philippines Land Grant area within the boundaries of Laguna and Quezon and several localities in Northern Luzon provinces of Isabela, Nueva Viscaya and Pangasinan. Samples of litter and other organic debris, as well as nests of ants and termites, were bagged in the field and subjected to Tullgren extraction in the laboratory. Mites trapped in the jar beneath each funnel were sorted out from other arthropods, cleared in lactic acid and mounted on glass slides for microscopic examination and identification and preparation of illustrations for species that were found to new to science or previously not known to exist in the Philippines. A total of 185 specimens were collected and prepared; these belong to 5 subfamilies, 11 genera and 24 species. Addition of new species discovered in the study brings the total diversity of Philippine Cunaxidae to 80, the highest on record worldwide at present. New habitat records were also found for 19 other species that were previously reported from the country. Two forml reports were published, the first dealing with the subfamily Coleoscirinae, and the second mainly with the subfamilies Cunaxinae and Cunaxoidinae. Four new coleocirine species were described as new to science- Neobozia ermilovi Corpuz-Raros, Naredo and Garcia; Corpuz-Raros, Naredo and Garcia; and Neoscirula lambatina Corpuz-Raros, Naredo and Garcia. In

the second paper, one new species, Cunaxia minidiscondyla Corpuz-Raros Naredo and Garcia (subfamily Cunaxoidinae) was recorded for the first time in a country outsite its original or type locality in Peninsular Malaysia. The last species is a significant discovery as it was collected along with other predatory mites associated with the Cocolisap scale insect (Aspidiotus rigidus Reyne) in Batangas where there were then outbreak infestations by this pest on coconut. The previously unknown female of Lupaeus longisetosus (Corpuz Raros, 1996) and male of Dactyloscirus trifidus Corpuz-Raros, 2007 were also discovered and described for the first time.

ACARINA; SPECIES; PREDATORS; TAXONOMY; NEW SPECIES; PHILIPPINES

Field evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance in rice insect pest and its influence on the population density of beneficial arthropods. **Magsino, G.L.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 68-120.*

The three (3) – year project (August 2013 to June 2016) at CES, U.P. Los Baños research station (six cropping seasons) and Year 3 Season Trials on Farmer's Field at Victoria, Laguna [Philippines](August to December 2015 and February to June 2016 cropping seasons) established and validated the use of carrageenan as plant food supplement in lowland transplanted rice. Foliar spraying to rice plants of Carrageenan at 200 ppm (3.2 li/ha) 3x(14, 30 and 45 DAT) per season promoted better crop stand, more productive tillers and better quality grain yields especially if supplemented to 1/2 RRG (4 bags NPK/ha) or RRG (8 bags NPK/ha). Across six cropping seasons at CES, U.P. Los Baños, Carrageenan at 3.2 li/ha or 9.6 li/ha/season + 1/2 RRG treated plants (4 bags NPK/ha) produce an average of 37.87% better grain yields than 1/2 RRG treated plants (4 bags NPK/ha). On the other hand, foliar application of Carrageenan at 9.6 li/ha/season + RRG (8 bags NPK/ha) provided an average of 11.06% higher yields than plants treated only with RRG (8 bags NPK/ha). The farmer's field trials (Year 3 cropping season) in Victoria, Laguna showed an average higher grain yields of 30.39% from 1/2 RRG + Carrageenan at 3.2 li/ha/application or 9.6 li/ha/season than 1/2 RRG rice plants and 19.03% from RRG + Carrageenan versus RRG treated plants. The three-year study in rice showed the potential Carrageenan as plant food supplement within the range of 100-300 ppm while 400-1,000 ppm provided moderate growth stunting but the plants maintained the green appearance. The study showed consistent presence of beneficial such as coccinellids and spiders on carrageenan treated plants. Carrageenan treated plants enhanced the presence of natural enemies which were able to manage the pest population such as GLH, BPH and stem borers. The results proved the increasing presence of natural enemies versus insect pests that relates to density dependent relationship of arthropods in the study.

ORYZA SATIVA; ARTHROPODA; CARRAGEENANS; CHITOSAN; PEST RESISTANCE; RADIATION; POPULATION DENSITY; APPLICATION METHODS; APPLICATION RATES; NATURAL ENEMIES; PHILIPPINES

First record of the dynastid beetle, Xylatrupes gideon L., on field corn. **Abenis, K.O., Lit, I.L., Jr., Cassi-Lit, M.T., Naredo, J.C.B.** *Philippine Entomologists (Philippines). 0048-3753. v.32 (2) p. 147-150. (Oct 2018).*

The occurrence of the dynastid beetle, Xylotrupes Gideon L. on corn (Zea mays L.) in the field is reported for the first time based on specimens collected from Laoac, Pangasinan, and Bay, Laguna [Philippines] during a series of sampling of corn associated insects. This species, more commonly known in the

Philippines as the elephant beetle, is better known as a minor pest of the coconut and other palms. The adult males and females were observed feeding on nodes of corn plants in the late vegetable and early reproductive stages, regardless of cultivar and whether they are conventional or Bt hybrids. There was no coconut trees in the host range of the said species, as well as in lists or compendia of documented destructive insects in corn. The nature of damage included chewed portions of the nodes and some broken tassels and/or panicles of the inflorescences.

ZEA MAYS; MAIZE; COLEOPTERA; PESTS OF PLANTS; CROP LOSSES

Insecticidal activity of five ethanolic extracts against common cutworm, Spodoptera litura (Fabricius) (Lepidoptera: Noctuidae). **Javier, A.M.V., Ocampo, V.R., Caballo, F.A., Javier, P.A.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (2) p. 117-132. (Oct 2018).*

Ethanolic extracts from five Philippine plants, namely: Alpinia pyramidata Blume, Lantana camara L., Plectranthus amboinicus (Lour.) Spreng. (=Coleus amboinicus Lour.), Curcuma longa L. andCatharanthus roseus (L.) G. Don were evaluated in the laboratory for their insecticidal activities against third larval instar of common cutworm, Spofoptera litura (Fabricus) (Lepidoptera: Noctuidae). All the five ethnolic extracts were toxic against cutworm (LD sub 50 = 48.44-80.19 mug/mL acetone) when applied topically at 72th after treatment, while L. camara extract was the most toxic (LC sub 50 =126.01 mug/g larval body weight) when applied trough leaf residue film method. Ethanolic extract from P. ambolinicus provided the highest antifeedant activity at 250 mug/g. At 1000 mug/g, all ethanolic extracts showed repellency comportable with Cybopogan nardus. Ethanolic extracts from A. pyramidata and Cu. Longa showed remarkable insect growth regulatory activities against cutworm expressed by a high number of abnormal pupae, and adults, respectively. Meanwhile, ethanolic extracts from L. camara, P. amboinicus, Ca. roseus and A. pyramidata provided short life span of 7-8 days when applied on the cutworm larvae ; a normal adult lived for about nine days when provided with 100% honey solution as food. In view of their overall pesticidal properties, crude ethanolic extracts from the five plants could be studied further and develop formulation for control of cutworm.

SPODOPTERA LITURA; LEPIDOPTERA; LARVAE; ALPINIA; LANTANA CAMARA; PLECTRANTHUS; COLEUS AMBOINICUS; CURCUMA LONGA; CATHARANTHUS ROSEUS; ANTIFEEDANTS; PESTICIDAL PROPERTIES; BOTANICAL PESTICIDES; PESTICIDAL PROPERTIES; LEAVES; PLANT EXTRACTS

Intra-tree distribution of age structure of the coffee berry borrer Hypothenemus hampic Ferrari, in relation to the phenology of Arabica coffee berry in Benguet, Philippines. **Das-ilen, G.S., Medina, C.Jr.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 97 (Sep 2019).*

The location of infested coffee berries within the tree and the age structure of the coffee berry borer (CBB) were observed to generate basic information for preemptive management of adult CBB. To determine if there is an intra-tree pattern of infestation at different stages of berry development, the branches of the tree were arbitrarily divided into sections as follows: lower and upper canopy, referring to the branches in the lower half and upper half of the trunk; and base, middle and apex referring to the tree equal sections of each branch. The development and distribution of the berries in these various sections of the tree were monitored and samples were regularly taken to determine the infestation level and the developmental stage of the CBB. There was no significant difference in the infestation of the branches at the upper and lower canopy. Infestation started at the clusters of berry in the middle and apex sections of the branches.

The analysis of the age structure of the population indicates that invading adult CBB could start as early as 72 days after flowering (DAF) or perisperm development stage but egg laying occurred from 166 DAF or endosperm development stage until endosperm maturation stage when berries were ready for harvesting. At harvest, the lower canopy had 12.46% infestation while the upper canopy had 7.34%. This pattern of field infestation was consistent with the field biology studies where CBB was able to complete its development from egg to adult in either green berries for a period of 72 days or red berries for a period of 54 days. This study show that in monitoring population of CBB, sampling should be done from the cluster of berries in the middle section of the branch regardless of its position in the canopy. Preemptive management of adult CBB could be done by manipulating the adult through trapping during the perisperm and endosperm maturation stage of coffee berries.

COFFEA ARABICA; HYPOTHENEMUS HAMPEI; PHENOLOGY; AGE STRUCTURE; POPULATION; DISTRIBUTION; MONITORING; PHILIPPINES

Laboratory mass rearing of Asian corn borer and other lepidopteran pests of corn for core-funded and externally-funded projects from 2011-2016. **Caasi-Lit, M.T., de Leus, E., Mantala, J.P.** *TR-1828.*

OSTRINIA FURNACALIS; MAIZE; ZEA MAYS; HELICOVERPA ARMIGERA; SPODOPTERA LITURA; CHRYSODEIXIS; MYTHIMNA; MASS REARING; PESTS OF PLANTS; LABORATORIES; LABORATORY EQUIPMENT; INFESTATION

Management of eggplant and shoot borer, Leucinodes orbonalis Gueene (Lepidoptera: Pyralidae) and other major insect pests of organically grown eggplant with emphasis on biological control agents and botanical insecticides in Quezon, Laguna and Batangas [Philippines]. **Javier, P.A., Punzalan, E.G.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1898.*

The effectiveness of different component non-chemical control methods (mulching release of earwigs, spraying of langkuas + oregano crude water extracts, planting of lemon grass as repellent and sanitation) that were previously reported to be effective against eggplant fruit and shoot borer (EPSB) was determined in two consecutive trials in the Central Experiment Station, UPLB [University of the Philippines Los Baños] from February to June 2015. The effectiveness of the non-chemical control methods was compared with the spraying of methomyl, the conventional method of controlling EPSB. On the other hand, the release of earwigs in combination with the release of Trichogramma chilonsis against EPSB was conducted in San Pablo City (SPC), Laguna [Philippines]. Each component control method that was found effective against eggplant fruit and shoot borer (EFSB) in year the author was investigated and integrated and evaluated in two experiments in an organic farm in Brgy. [village] Bautista, San Pablo City (October 2015 to February 2016 and June to October 2016). In Experiment 1, the following treatments were evaluated: integration of rice straw mulching + earwig + Trichogramma (T1); rice staw mulching + earwig + Trichogramma + botanical insecticide (T2); rice straw mulching + earwig + Trichogramma + botanical insecticide + sanitation (T3); and rice straw mulching+ release of Trichogramma (T4). The EFSB fruit damage in the different treatments ranged from 41.61 to 48.49% while marketable yield ranged from 3.19 - 3.84 tons/ha which do not significantly differ among treatments and the control. This suggests that the integration of the different control methods is not sufficient to reduce EFSB damage. In Experiment 2, the following treatments were evaluated: rice straw mulching + earwig (20,000) earwigs/release/ha) (T1); rice straw mulching + earwig (40,000 earwigs/release/ha) (T2); rice straw mulching + botanical insecticide (T3); rice straw mulching + earwig (20,000 earwigs/release/ha) + botanical insecticide + sanitation (T5); and Control (T6). The EFSB

damage in all treatments was very high (63.40 - 68.79%) and does not significantly differ among treatments (8.70-11.40 tons/ha) and the control, more than 20% increase in marketable yield was obtained in rice straw mulching + earwig (20,000 earwigs/release/ha) + botanical insecticide + sanitation (T5) followed by rice straw mulching + earwig (20,000 earwigs/release/ha) (T1). Observations in the Experiment 2, showed that plants sprayed with neem leaf extracts had a very low insect infestation and reduced. Therefore, the effectiveness of neem in combination with langkuas was verified in the field in Brgy. Bautista, San Pablo City, Brgy. Santissima, Sta. Cruz, Laguna, Brgy. Behia, Tiaong Quezon and Brgy. Bocohan, Lucena City. Among the Trials conducted, the highest net income was obtained in Trials 1 and 2 (SPC) followed by Trial 5 (Sta. Cruz). The highest Return of Investment (ROI) of 423.90% was obtained in Trial 5 followed by Trial 6 (Lucena City) of 365.74% (Table 43). The lower marketable yield in Trial 6 as compared to other Trials was due to the limited number of harvesting. Trials 1 and 2 was harvested 20 times. Trial 3 and 4 was harvested 14 times, Trial 5 was harvested 12 times while Trial 6 was harvested only 8 times. Results of Trials 1 to 6, suggested that the implementation of the OPM technology (integration of the field releases of earwig + mulching, regular removal of infested shoots and fruits, and the spraying of the 1:1 langkuas - neem crude extract combinations) provided an average of 24.52% EFSB infestation by and 46.84% reduction in EFSB damage compared with FP of controlling the pest. Meanwhile, the weekly spraying of OPM technology provided 13.36% EFSB infestation while 15.75% for FP. The OPM technology provided an average of 50% increment in marketable yield and about 65% increase in net income in comparisons with the untreated plants and FP of controlling the insect pests of eggplant.

AUBERGINES; CROP PERFORMANCE; PLANT PROTECTION; LEUCINODES ORBONALIS; LEPIDOPTERA; PYRALIDAE; PEST INSECTS; BIOLOGICAL CONTROL AGENTS; BOTANICAL PESTICIDES; PEST CONTROL

Modelling the development of resistance to Bt corn in the Asian corn borer, Ostrinia furnacalis (Guenee) (Lepidoptera: Crambidae), in the Philippines. **Benigno, E.A., Lit, M.C.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (2) p.83-106. (Oct 2018).*

Fifteen years of planning Bt corn in the Philippines resulted to greater economic gain among corn farmers and better insect pest management system against the target pest, the Asian corn borer, Ostrinia furcalis (Guenee). However, the development of insect resistance is inevitable and monitoring is crucial to predict its onset and prepare for mitigating measures. This paper aimed to develop a model for the Asian corn borer incorporating the basic features of other models that are applicable to Philippine conditions. A simulation model was developed using Stella B software with spatial and temporal refuge, and movements among areas Bt/non – Bt cornand non-crop alternate host areas. Based on our simulations, the following can be taken as danger signs for resistance development; high initial proportion of resistant alleles (5%), high temperature development and rainfall, and continuous and asynchronous cropping. Comparative simulations of two contrasting major corn-growing areas showed the resistance development in Cagayan, near Isabela in northern Luzon with higher rainfall and temperature, could be faster and at a higher level than in General Santos City, Southern Mindanao.

ZEA MAYS; MAIZE; VARIETIES; BACILLUS THURINGIENSIS; OSTRINIA FURNACALIS; LEPIDOPTERA; PEST RESISTANCE; PEST CONTROL; SIMULATION; SIMULATION MODELS; PHILIPPINES

Phosphine resistance in the Philippines. **Acda, M.A., Mangoba, M.A., Mesa, V.G., Dela Cruz, M.V.** *Philippine Entomologist (Philippines). 0048-3753. V. 32 (2) p. 133-146. Oct 2018.*

Resistance to phosphine is a threat to its continued use as a grain fumigant. Reports of increasing frequency of fumigation failures in the industry make it necessary to look into the possible development of phosphine resistance in major stored product pests. Seventeen strains of Rhyzopertha dominica (Fabricius). 40 of Sitophilus spp., 28 of Tribolium castaneum (Herbst), 38 of Oryzaephilus surinamensis (L.), and nine of Cryptolestes ferrugenius Stephens were collected from 29 provinces nationwide and tested for phosphine resistance following the recommended method by the Food and Agriculture Organization. Results were validated in full assay tests and insect responses were analysed by probit-generating concentration-mortality curves. Resistance factors were established using the LC sub 99 of susceptible and resistant strains. Results showed that phosphine resistance is already widespread in the Philippines, with very high level of resistance detected in a strain of R.dominica (x1138). Phosphine resistance was also detected in O. surinamensis and C. ferrugenius. Meanwhile, low levels of resistance were observed in T. castaneum while Sitophilus spp. remains susceptible.

RHYZOPERTHA DOMINICA; SITOPHILUS; TRIBOLIUM CASTANEUM; ORYZAEPHILUS SURINAMENSIS; CRYPTOLESTES FERRUGINEUS; PHOSPHINE; GRAIN; FUMIGATION; PEST RESISTANCE; STORED PRODUCTS PESTS; PHOSPHINE; PHILIPPINES

Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice. **Magsino, G.L.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. 2017 TR-1810.*

ORYZA SATIVA; CARRAGEENANS; CHITOSAN; PEST RESISTANCE; DISEASE RESISTANCE; TUNGRO DISEASE; BLIGHT; RADIATION

Response of second instar Asian corn borer, Ostrinia furnacalis (Guenee) Crambidae: Lepidotera) to Bt transgenic maize, MON89034. **Caasi-Lit, M.T., Manalo, N.A.Q., Suyat, E.A., Dacuba, R.H., Benigno, E.A.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (2) p. 107-115. Oct 2018.*

Response of the Asian corn borer (ACB) to the Bt corn hybrid, MON89034, was determined using leaf disc and whole plat bio-assays at the vegetative stage against second instars of Isabela and Laguna [Philippines] ACB populations. Survival of ACB larvae was low on Bt corn while survival was consistently higher on non-Bt corn, NK603. No significant difference was observed between Laguna and Isabela ACB populations. Results showed that the transgenic corn hybrid, MON890034, may provide protection against the second instars of the ACB.

ZEA MAYS; MAIZE; HYBRIDS; OSTRINIA FURNACALIS; LARVAE; BIOASSAYS; PEST RESISTANCE; BACILLUS THURINGIENSIS; TRANSGENIC PLANTS; PHILIPPINES

Studies on alternate hosts of the Asian corn borer, Ostrinia furnacalis (Guenee). **Caasi-Lit, M.T., de Leus, E., Mantala, J., Punzalan, K.B.** *2016 TR-1829.*

ACB alternate hosts studies from 2011-2016 were conducted at the IPB [Inst. of Plant Breeding] Experimental Station, Tranca, Bay, Laguna [Philippines] and in greenhouses inside the IPB Complex. A total of 21 weed species were surveyed from quadrants and patches. Bermuda grass (Cynodon dactulon), Cogon

grass (Imperata cylindrica) and Guinea grass (Panicum maximum) were the most dominant weed species in the area. Arthopod taxa surveyed on weeds consisted of 32 families under 9 orders. Monitoring of the presence of ACB on alternate hosts showed that the most of the collected ACB were collected from the observed dominant weeds-Paragrass (Brachiaria multica), Guinea grass, Bermuda grass, and Itch grass (Rattboelia cochinchinensis). ACB was also presented in observed on alternate hosts during the dry season in the absence of the corn plant. Collection of egg masses on corn sampling. More than 700 egg masses were collected. Collection of egg masses during the dry season was relatively low since very few corn were planted at that time. Dry and wet season production of Maramias (Tripsacum laxum) showed that during the wet season planting, the plants reached an average height of 147.955 cm at 120 DAP. An average of four tillers per plant were produced. Observations from the two previous seasons showed that T. laxum do not produce seeds during dry season and only flowers when planting during wet season. ACB larval survival on Maramias showed that there was almost 100% survival of 4-day old larvae when infested on leaves and stalk. Active feeding was also observed resulting to a relative high percent damage. These observations indicate that T. laxum is a potential alternate host of the Asian corn borer.

OSTRINIA FURNACALIS; ZEA MAYS; VARIETIES; ALTERNATIVE HOSTS; PEST CONTROL; CYNODON DACTYLON; IMPERATA CYLINDRICA; PANICUM MAXIMUM; PEST CONTROL

Utilization of Sargassum seaweed against Asian corn borer, Ostrinia furnacalis (Guenee) (Lepidoptera:Crambidae) for increased corn productivity. **Calumpang, S.M.F.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1854.*

Anecdotal claims reveal that brown or Sargassum seaweed has long been used by farmers to reduce insect pest populations in cacao and various vegetables. A study was conducted at the National Crop Protection Center, College of Agriculture and Food Science, University of the Philippines Los Baños from 2015-2017 to validate farmer knowledge on reduced Asian corn borer populations when brown seaweed, Sargassum cinctum J. Agardh is placed on plot borders. Prominent volatile organic chemicals (VOCs) emitted by seaweed under sunlight and room conditions were identified by GCMS and differences in emission patterns were observed. In general, the fresh seaweed extract showed a higher percent repellency as compared to the dried seaweed extract. We identified for the first time the nature of the compounds emitted by S. cinctum and repelling the Asian corn borer. Some VOCs presented in combination did not produce synergistic effect. The behavioral responses of Asian corn borer (ACB) larvae and adult oviposition, effect on development, fecundity, hatchability of eggs and longevity to the brown seaweed, S. cinctum, was studied to elucidate the mechanism for reduced ACB populations in corn (Zea mays L.) with brown seaweed hanged on the plant as practiced by farmers. The methods included rearing pan and Petri plate bioassays to determine possible effects of volatile organic chemicals (VOCs) emitted by brown seaweed. Our results demonstrated that neonates and second instar larvae were apparently repelled by VOCs emitted by S. cinctum. VOCs did not affect significantly larval development, developmental periods, fecundity and longevity of adult male and female, O. furnacalis. Egg hatchability and larval survival were likewise not significantly affected by VOCs from the brown seaweed. The number of egg masses and number of eggs laid by female moths was reduced when brown seaweed was applied on corn under field cage conditions. Sargassum seaweed can be used together with other effective IPM strategies, especially in coastal areas, to reduce corn borer population. Brown seaweed can be an effective pest management strategy tool for low input and/or organic green corn production.

ZEA MAYS; SARGASSUM; SEAWEEDS; MAIZE; OSTRINIA FURNACALIS; LEPIDOPTERA; PEST CONTROL; PESTICIDAL PROPERTIES; PESTICIDE PERSISTENCE; INTEGRATED PEST MANAGEMENT

H20 Plant diseases

Addressing jackfruit's lead destroyer. **Lesaca, P.R.A.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(5) p. 12-13 (May 2018).*

ARTOCARPUS HETEROPHYLLUS; PHYTOPHTHORA PALMIVORA; SYMPTOMS; CHITIN; CHITOSAN; CRUSTACEA; EXOSKELETON

Biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance in hybrid rice against bacterial leaf blight. **Bayots, R.G.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 9-39.*

Mestizo 19 and Mestizo 20 hybrids have induced resistance trait and are responsive to radiation-modified kappa carrageenan (RMKC) at optimum concentration of 50-200 ppm. These hybrids have gained resistance against bacterial leaf blight (BLB) just six hours after spraying with the inducer and the induced resistant state can last for about 15 days. Mestizo 20 hybrid seems to be more responsive to RMKC treatment than the Mestizo 19 hybrid, in general. Plant height of Mestizo 19 and Mestizo 20 hybrid varieties was increased significantly by 100 ppm RMKC sprayed three times at 30, 45 and 60 DAT. The 100 ppm RMKC applied at 30, 45 and 60 DAT increased grain yield of Mestizo 20 hybrid by 23%, but did not increase yield in Mestizo 19 hybrid. Meanwhile, 200 ppm RMKC reduced bacterial leaf streak severity of Mestizo 19 hybrid by 34% and 50 ppm RMKC reduced bacterial leaf streak severity of Mestizo 20 hybrid by 48%. Mestizo 19 hybrid was observed to be more susceptible to bacterial leaf streak with 24.82% severity than the Mestizo hybrid 20 hybrid with only 10.43% severity in untreated plants. On the other hand, the response of rice plants to root soaking as means of inducing resistance is influenced by the rice cultivar and the kind of inducers used. In Mestizo 20 hybrid, soaking roots for 5 min in 100 ppm of RMKC produced significantly shorter blight lesions than the untreated plants but the use of chitosan has no effect on blight severity while in Mestizo 19 hybrid, the same treatment using 150 and 200 ppm chitosan reduced blight lesions significantly but RMKC has no effect on blight severity.

ORYZA SATIVA; HYBRIDS; CARRAGEENANS; CHITOSAN; BLIGHT; DISEASE RESISTANCE; RADIATION; ORYZA SATIVA

Biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance to rice tungro. **Sta. Cruz, F.C.** *Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice, Magsino, G.L..- College, Laguna (Philippines), May 2017. TR-1810.- p. 40-67.*

The treatment with RMKC [radiation-modified kappa carrageenan] did not induce tungro resistance in rice varieties NSIC RC 216, TN1 and PSB RC 82 regardless of RMKC concentration and induction time. However, the slight reduction in tungro severity with treatment of 150 ppm at induction time of 9 days before

inoculation which was consistent in both NSIC RC 216 and TN1 varieties in greenhouse experiments, indicated some potential effect of RMKC in inducing virus resistance. Earlier studies showed that RMKC applied at low concentration of 50 ppm at 5, 10 or 15 days before virus inoculation can reduce the severity of leaf curl disease in two tomato varieties, 'Apollo White' and 'Marimar' under screenhouse conditions (Ong et al., 2016). The potential effect of RMKC for inducing tomato leaf curl resistance was more apparent, and the efficacy has to be evaluated under field conditions. Although the effect of RMKC in inducing tungro resistance was not observed in this project, the effect may be seen for virus diseases of vegetable where it is expected to be more responsive to RMKC treatment in tomato.

ORYZA SATIVA; RICE; TUNGRO DISEASE; DISEASE RESISTANCE; CARRAGEENANS; CHITOSAN; RADIATION

Field testing of transgenic papaya with delayed ripening trait and papaya ringspot virus (PRSV) resistance towards commercialization (R1109): field testing of transgenic papaya with long shelf and papaya ringspot virus (PRSV) resistance. **Tecson-Mendoza, E.M., Garcia, N.N., Lit, M.C., Ocampo, E.T.M., Serrano, E.P., Laurena, A.C.** *Department of Agriculture, 2nd Floor BSWM Bldg., Elliptical Rd. Cor., Diliman, Quezon City (Philippines). Biotechnology Program Office. TR-1836.*

The researchers project 2011-2014) funded by the DA [Department of Agriculture] Biotechnology Program aimed primarily to conduct the testing of the transgenic papaya hybrid with both long shelf life and PRSV-resistance traits. The following are the highlights of this project: The biosafety permit for the field testing was obtained from Department of Agriculture Bureau of Plant Industry (DA BPI) in June 2012 and papaya seedlings planted on September 4, 2012. The field test of the transgenic papaya was successfully conducted on a 896-sq m lot under the supervision of the DA-BPI Biosafety Team and the UPLB Institutional Safety Committee. All plants in the field were infected with PRSV but the F1 hybrids were able to recover from the disease and produce fruits. The control Davao Solo plants were able to recover from the disease and produce fruits. The control Davao Solo plants was heavily infested with PRSV and majority were unable to recover; those which are less infected bore fruits which had the oil ringspots and deformities typical of fruits from PRSV infected trees. The F1 hybrids took an average of 134 days fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids took an average of 134 days for fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids papaya fruits had an average of 8 days from color break to full yellow and another 5.7 days to ripen for total of about 13.7 days. Control papaya fruits had a total of about 10.7 days total from color break to ripe stage. All transgenic plants in the field were found to be positive for the transgene (anti-ACC synthase 2) by PCR screening. Using specific primers for sex determination, the seedlings planted in the field were about 1:1 female and hermaphrodite. Using relative PCR ACS2 expression was found to be lower in the transgenic papaya, both the F1 hybrid and T4 01-6-48 line, compared with the non-transgenic control papaya, at 80% yellow fruit stage, indicating lower ethylene production in the transgenic papayas. Findings in the field trial revealed the spiders and ants were abundant in the site in November 2012 to May 2013. The eggs of spiders were mostly observed under the surface of the leaves. Diverse arthropods were counted and collected from the papaya hybrid and control plants. These arthropods can be classified according to their functional guilds, namely, predators, parasites, pollinators, neutrals chewing pest and sucking pests. The most abundant were the predators and coccinellids. The arthropod pests that were identified new pest (tentatively a coleopteran) which damaged the young and old fruits of both the hybrids and control plants was observed in the field trial site. The pest was also observed in other papaya growing areas in Laguna [Philippines]. The study of the storage behavior of the papaya fruits showed the fruits harvested at 115, 120, and 122, color break stage, DAF, had similar physico-chemical qualities and sensory attributes. The peak of athylene

production was observed to be at 6 to 7 days after harvest of fruits at 120 and 122 DAF and this was already at about 80% yellow. Harvesting at different maturity also did not have any appreciable difference in physico-chemical characteristics of the fruits as well as its sensory attributes. The project team undertook IEC activities firstly in the vicinityof the field test, in Bay and Los Baños, Laguna, with municipal councils of said towns, and in the two barangays [villages] in Bay. The team also briefed the municipal agricultural officers of the province of Laguna and officials of the provincial government office in Santa Cruz, Laguna. A training workshop on regularity rules and practices was conducted for the members of the project. The team likewise discussed with officials and research and faculty personnel of the Cavite State University and Adventist University of the Philippines for possible collaboration on the second field trial of the transgenic papaya F1 hybrid. Briefings on the transgenic papaya were conducted with the Provincial Agriculturist of Cavite and his technical staff and the Municipal Agriculturist of Silang, Cavite. The researchers obtained information on the NSIC, registration and Application for Plant Variety Protection of the transgenic papaya with delayed repining trait and its F1 hybrid with the introgressed trait of PRSV resistance from the Bureau of Plan Industry. Various IECs on transgenic papaya technology were undertaken in various schools, at IPB, and during talks before different gatherings in workshops on biotechnology.

CARICA PAPAYA; HYBRIDIZATION; DISEASE CONTROL; PLANT DISEASES; TRANSGENIC PLANTS; KEEPING QUALITY; POSTHARVEST PHYSIOLOGY; RIPENING

Fighting disease the natural way with yeast. **Gestupa, E.J.J.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(5) p. 11; 16*
(May 2018).

VEGETABLE CROPS; FRUITS; PLANT DISEASES; BIOLOGICAL CONTROL; MICROBIAL PESTICIDES; YEASTS

Habitat manipulation for biological pest management in hybrid rice seed production. **Garcia, V.C., Santiago, R.S., Abon, C.C.Jr., Sicat, E.V.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 95 (Sep 2019).*

The role of ecological engineering as a component in pest management is new in rice and its benefits are given little attention. Ecological engineering modifies the environment according to ecological principles (Gurr et al., 2004). It is a useful conceptual framework for considering the practice of habitat manipulation for arthropod pest management. Habitat manipulation, which involves altering the cropping system, is another form of conservation biological control. This study was conducted during the 2019 Dry Season at Philippine-Sino Center for Agricultural Technology (PhilSCAT) farm and experiment areas to determine the effect of planting flowering plants near rice field on the population of beneficial organisms in the hybrid rice ecosystem. Collected beneficial organisms using sweeping net showed that the rice fields planted with flowering plants had higher population than fields without flowering plants. During flowering, population of beneficial organisms collected was generally higher in the fields with flowering plants (14%) than fields without flowering plants (6%). The difference was statistically significant. Habitat manipulation, which include cultivating flower plants as source of nectar and pollen, can help sustain Integrated Pest Management in areas with large rice monoculture. It also serves as refuge to beneficial arthropod. Thus, farmers would spend less in rice production and their health would be protected. The environment is also being guarded as chemical use in the farms is greatly reduced (Arida et al., 2016).

ORYZA SATIVA; HYBRIDS; SEED PRODUCTION; INTEGRATED PEST MANAGEMENT; BIOLOGICAL CONTROL; HABITATS; BENEFICIAL ORGANISMS; ORYZA SATIVA; HYBRIDS; SEED PRODUCTION; INTEGRATED PEST MANAGEMENT; BIOLOGICAL CONTROL; HABITATS; BENEFICIAL ORGANISMS

Identification and mapping of the occurrence of begomoviruses infecting squash (Cucurbita moschata Duch.) in the Philippines. **Relevante, C.A., Balatero, C.H., Sta. Cruz, F.C.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 163-173. (Jun 2019).*

Squash leaf curl disease in the Philippines caused by the bipartite begomovirus species, Squash leaf curl Philippines virus (SLCuPV or SLCPHV), formerly named as Squash leaf curl China virus-Philippines (SLCCNV-PH), has been identified in virus isolate from Muñoz, Nueva Ecija in central Luzon. Later, SLCuPV isolates from Laguna and Batangas in southern Luzon and Benguet in Cordillera Autonomous Region (CAR) have been identified. This study aimed to identify and map the occurrence of squash-infecting begomovirus species in the country. Begomovirus was detected by indirect ELISA in 59% (145/245) samples from plants with symptons of leaf curling, puckering, enation, mosaic and/or yellowing. Single or mixed infections of begomovirus with ZYMV, PRSV-W or CMV were detected in very few samples. Presence of begomovirus was confirmed by PCR and the virus was efficiently detected using primer pairs, TYRepF/TYRepR and TYBF/TYBR that amplify the viral DNA-A or DNA-B component, respectively. BLAST analysis of partial REP gene sequence (744-887 nucleotides) showed that most isolates detected in this study have 93-99% identity with SLCuPV (SLCuPV-PH, Accession no. EU487041 or EU487033.1) and SLCuPV-TW (DQ866135 or EF19974). Virus isolates with highest identity (96-99%) to SLCuPV-PH were found in Ilocos Norte (P180) (MK850838) and Occidental Mindoro (P173) (MK850839) in Luzon, and from Davao (P247) (MK850840) in Mindanao. Isolates from Batangas (P37) (MK850841) and Bulacan (P210) (MK850842) in Luzon were closets to both SLCuPV-PH ans SLCuPV-TW with 95% and 94% identity, respectively. Isolates from Cavite (P131) (MK850843) in Luzon and from Cebu (P215) (MK850844) in the Visayas have the highest identity (95-96%) with SLCuPV. On the other hand, isolate with highest identity (94%) to SLCCNV-CN (AM260206), SLCCNV-PH (EU487031) and SLCCNV—IN (AY184487) was found in Cebu (P211) (MK850845) while isolate P156 (MK850846) from Zamboanga in Mindanao was closest (97%) to SLCCNV-IN. Phylogenetic analysis of partial Rep sequences showed that five isolates from Luzon, one from the Visayas and one from Mindanao clustered with SLCuPV, while the other Visayas and Mindanao isolates clustered with SLCCNV. The identity of the squash-infecting begomoviruses will be fully identified by nucleotide sequence analysis using the full-length DNA-A component. Knowledge of the identity of the virus species and their occurrence in the country are important information in developing strategies for breeding squash with begomovirus resistance.

CUCURBITA MOSCHATA; SQUASHES; LEAF CURLS; PLANT DISEASES; PLANT VIRUSES; DISEASE SURVEILLANCE; CUCURBIT VEGETABLES; DISEASE RESISTANCE

Identification of allexivirus and potyvirus from the different garlic varieties of the three major grousing regions in the Philippines using RT-PCR [reverse transcription polymerase chain reaction]. **Plaza, R.U., Espino, M.R.M., Espino, R.R.C.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 96 (Sep 2019).*

Garlic (Allium sativum) is an economically important crop in the Philippines. Region 1 [Ilocos Region], Region 2 [Cagayan Valley] and Region 4-B [Mindoro, Marinduque, Romblon, and Palawan] are the three major growing regions crop in the country. All varieties of garlic had been found to be infected by different

viruses. This had resulted in small bulb formation resulting to low yield. In this study, eight garlic varieties from the different farm areas of the 3 regions were assessed for the presence of Allexvirus and Potyvirus specifically Onion Yellowing Dwarf Virus (OYDV) using gene specific primer from the coat protein and untranslated region of viral RNA through transcription polymerase chain reaction or RT-PCR. The product for allexi and OYDV was observed at approximately 200 bp and 318 bp, respectively confirming the positive isolation of the viral RNA. In addition, incident rate of virus infection of allexivirus and OYDV varies from the different farm areas on each region. Garlic varieties form Batanes and Occidental Mindoro showed the highest incident rate on allexivirus infection, while varieties from Pangasinan and Occidental Mindoro were the highest for OYDV. Further collection are being undertaken in other garlic growing areas to determine the presence and extent of infection of these viruses. This will provide useful information as to areas where sourcing of planting materials of garlic can be obtained for future planting.

ALLIUM SATIVUM; GARLIC; VARIETIES; IDENTIFICATION; POTYVIRUSES; MORBIDITY; REVERSE TRANSCRIPTION; PCR; PHILIPPINES

Meristem tip culture for producing virus-free plant in garlic (allium sativum L.). **Perez, E.A., Aspuria, E.T., Espino, M.R.M., Plaza, R.U., Sanchez, F.M.M., Espino, R.R.C.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 98-99 (Sep 2019).*

The garlic (Allium sativum L.) can be naturally infected by complex viruses belonging to the genera Potyvirus, Carlavirus, and Allexivirus. The infection of viruses tend to accumulate over time leading to yield reduction and degeneration. Three viruses namely, Allexvirus, Garlic Virus D, and Potyvirus Onion Yellow Dwarf Virus (OYDV) were detected in cloves of three garlic varieties Batanes White, Batanes Red, and Ilocos White (NSIC Ilocos Gr 01) through Reverse Transcription - Polymerase Chain Reaction (RT-PCR) technology. The elimination of viruses was achieved using meristem-tip culture. Shoots were included from excised meristem tips (0.3-0.5mm in size) on Murashige and Skoog (1965) basal media supplemented with 0.1 mg/L NAA + 1 mg/L kinetin. These were then transferred to MS medium with 0.179 mg/L IAA + 0.225 mg/L BA after 30 days. One to seven shoots were produced directly from the meristem without intervening callus formation. After one to two months in culture, 10 cm leaves of meristem derived shoots were cut and tested for the presence of these viruses. Virus-free plants were subjected for multiplication of MS basal media supplemented with 1 mg/L NAA + 2.2 mg/L BA. About four meristem derived shoots of Batanes Red from a total of 117 shoots and 2 of Batanes White from 82 shoots tested were identified negative for the three viruses. Identification of additional virus-free plants is still on-going for the three garlic varieties and to other collected materials coming from Ilocos Region and Occidental Mindoro.

ALLIUM SATIVUM; GARLIC; MERISTEM CULTURE; MERISTEMS; IDENTIFICATION; PLANT VIRUSES

Plant bio-stimulants and elicitor from radiation-modified natural polymers: biological efficacy evaluation of radiation-modified kappa carrageenan and chitosan as inducers of resistance against major pests and diseases in rice. **Magsino, G.L.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. TR-1810.*

ORYZA SATIVA; CARRAGEENANS; CHITOSAN; PEST RESISTANCE; DISEASE RESISTANCE; TUNGRO DISEASE; BLIGHT; RADIATION

Improving productivity and local utilization of mungbean: Project 1: development of mungbean varieties for drought and partial shade tolerance. **Maghirang, R.G., Angeles, L.O., Del Rosario, L.A., Rodriguez, M.C.P.B., Sabanal, A.Q.C., Reyes, D.H., Torillos, R.M.S., Ocampo, J.A.O., delos Reyes, A.M.M., Reyes, E.L., de Mesa, S., Delfin, E.F., Alip, R.C.G., Deseo, N., Dalisay, E.A., Lalap, C.M., Makiling, A.T., Punzalan, F.V., Welgas, J.N.** *TR-1886.*

The development of mungbean populations for drought and shade tolerance was achieved through rigorous evaluation from observational and yield trials, drought, partial shade screenings, and on-farm verification trials. Root characteristics, leaf physiology and foliar spray responses that are essential for the adaptation of mungbean under stress were studied. Identified potential varieties were further improved through hybridization and selection. The same tests were done to identify and recommend a variety adapted under drought (post rice) and partial shade (cassava or coconut intercropping) conditions. Results suggests that Pagasa 5 thrive well under both upland and post-rice conditions. With estimated yield of 0.86 – 1.10 t/ha, it has performed better as compared to other Pagasa varieties. It also performed better in coconut intercropping during the dry season. Notable genotypes in the replicated yield trials were 163113 (2.31t/ha, 53.8 %YA) and 163190 (2.13 t/ha, 42 %YA). Entries comparable with the check were 163136 (Iloilo yellow selection), 163334 and Mgc15-13 (1.8 t/ha). The versatility of Pagasa 7 for partial shade was exhibited by both in coconut and cassava intercropping. Advanced mungbean lines, Mgc15-13, Mgc15- 5, Mgc15-6, Mgc 15-10 and Mgc 16-37 were identified as the most drought tolerant populations having the better yield under drought conditions in the field yielding from about 0.71 to 0.91 t/ha. Mgc15-13, yielded better than the Pag-asa checks (Pag-asa 1, 3, 5, 7) but less than Taiwan Green during wet season. In terms of taste Mgc15-13, had the most preferred texture among the entries. Mgc15-10 also showed good sensory quality in terms of appearance, aroma, taste and 'sabaw'. 12 primers were identified for the genetic diversity analysis. A dendrogram with the 100 mungbean accessions showed 20 distinct clusters at 0.90 similarity coefficient. Pagasa 5, Pagasa 7 and Pagasa 19 was grouped in the Largest cluster, Cluster 1. This cluster also constitutes most of the variable accessions, in terms of drought tolerance rating, with average to high estimated yield. Pagasa 3 and seven other accessions constitute their own clusters, Cluster 6, 8, 9, 13, 16, 17, 18, 19. Cluster 11 shows a group of highly tolerant accessions with above average yield while cluster 10 constitutes a group of less tolerant individuals with average estimated yield. It was also observed that most of the accessions with yellow seed color tends to be closer together in based on the dendrogram which suggest a specific relationship between them.

VIGNA RADIATA; MUNG BEANS; VARIETIES; BREEDING METHODS; DROUGHT RESISTANCE; PLANT PRODUCTION; SHADING; CROP YIELD; ADAPTATION; ON-FARM RESEARCH; PLANT ESTABLISHMENT

Micromateorological and time-lapsed photography techniques in evaluating the effects of high temperature stress in rice. **Manigbas, N.L., Madrid, L.B.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 99 (Sep 2019).*

High temperature stress is one of the major constraints in rice production due to effects of global warming. One hour exposure of rice plants to 35 deg C temperature during flowering and grain-filling is enough to affect yield and grain quality. Rice yield can be reduced to 15% due to high temperature during flowering stage. Grain weight is decreased while chalky grains are increased as a result of heat stress during grain-filling. To assess the manifestation of high temperature stress and its effects to important agronomic traits,

there is a need to evaluate the microclimate of rice plants under field condition. Three genotypes IR64, N22, and IR52 were planted in 2017 and 2018 dry season under non-stress and stress field conditions. Results showed that above canopy temperature (2m) was higher compared to within canopy. However, relative humidity was higher within canopy. Panicle temperature was higher within canopy during flowering and grain-filling. The number of spikelets increased under stressed condition between 76.2-89%, while spikelet fertility decreased between 63.9-89.2%. Weight of 1000 grain decreased between 29.5-72.4% while grain yield was reduced by 10.8-67%. Chalkiness increased between 29.5-72.4%. High percent sterility of 50% was observed in susceptible check IR52 compared to tolerant check N22 with 17%. Breeding is done to incorporate N22 high temperature tolerance trait to popular varieties for climate smart rice in the future.

ORYZA SATIVA; RICE; HEAT STRESS; HEAT; AGRONOMIC CHARACTERS; CLIMATIC CHANGE

H60 Weeds and weed control

Effects of drought stress on leaf gas exchange, chlorophyll content and dry matter allocation of Phragmites australis in the Heihe River Basin. **Ya Juan Zhang, Yi Hua Li, Hong Gao, Li Wang, Dong Sheng Kong, Yan Wu Wang, Kai Lu, Jiang Wen Tian, Yuan Lin Lu.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 141-148. (Jun 2019).*

Phragmites australis is considered the dominant species of wetlands, especially in Northwest China. It plays a very important role in wetland regulation, but little is known about its photosynthetic capacity. Here, we investigated gas exchange parameters, chlorophyll content and dry matter allocation under different watering regimes along the West Lake Wetland of the Hexi Corridor in China. Drought stress significantly decreased P sub N, E, g sub s, chlorophyll content (Chl a, Chl b, Chl (a + b), Chl a/b) and augmented Ci, but it also decreased the root, shoot, leaf and total dry matter of P. australis. According to Farquhar and Sharkey (1982), there are both stomatal and nonstomatal limitations to photosynthesis. Stomatal limitation dominates when water stress first occurs, whereas nonstomatal limitation dominates during severe drought. Drought stress lowered Chl a, Chl b, and Chl (a + b), and also the Chl a/b) ratio, showing that water stress seriously damages the PSII reaction center in P. australis. Water stress also lowered relative water content (RWC) and water use efficiency (WUE) at 75% water treatment, indicating that P. australis. was sensitive under drought stress. The threshold for P. australis. at which seedling growth was reduced or even terminated was decline in RWC to less than 57.58%.

PHRAGMITES AUSTRALIS; WATERSHEDS; DROUGHT STRESS; WATER USE; LEAVES; GAS EXCHANGE; CHLOROPHYLLS; DRY MATTER CONTENT; TRANSPIRATION; STOMATA; TRANSLOCATION; PLANT WATER RELATIONS

Interference of weedy rice on yield and yield components of cultivated rice under replacement series method. **Sandoval, F.R., Martin, E.C., Donayre, D.K.M.** *Philippine Journal of Crop Science (Philippines) v. 44(Supplement no. 1) p. 96-97 (Sep 2019).*

Weedy rice are becoming a major threat to rice production in the Philippines. Reports had shown that it affect the quality and quantity of cultivated rice. Information about its negative effect on yield of rice under Philippine condition is very limited. An experiment was conducted from August-November 2018 at PhilRice CES [Philippine Rice Inst. Central Experiment Station, Science City of Munoz, Nueva Ecija, Philippines]to

determine the effect of weedy rice on yield and yield component of cultivated rice using replacement series method. The treatments involved were 100:0, 75:25, 50:50, 25:75 and 0:100% rice:weedy rice or weedy rice:rice ratios. The experiment was arranged in RCBD [randomized complete block design] with 4 replications. Data were subjected to ANOVA replacement method analysis. Results showed that plant height of NSIC Rc 222 was not affected by the presence of weedy rice. However, number of leaves, tillers and panicles were significantly reduced at 50:50 and 25:75 rice to weedy rice ratio. Tillers and panicle number of weedy rice were higher at 75:25 ratio. When the population of weedy rice was lower, the number of tillers increased. Yield components of rice at 25:75 ratio were significantly reduced particularly the panicle length (24cm), total number of grains (107) and biomass (22.15g).

ORYZA SATIVA; WEEDS; RICE; GROWTH; CROP YIELD; YIELD INCREASES; CROP PERFORMANCE

Laboratory and greenhouse screening for drought tolerance among Iranian cumin (Cuminum cyminum L.) ecotypes under controlled conditions. **Arshad, M., Alizadeh, K., Adeli, E., Teixeira Da Silva, J.A.** *Philippine Agricultural Scientist (Philippines). v. 102 (2) p. 149-154. (Jun 2019).*

Among different environmental stresses, drought is the abiotic factor that limits crop productivity the most. Cumin (Cuminum cyminum L.) is the second most popular spice in the world and an important medicinal plant in Iran. Drought-tolerant cumin cultivars could serve as an alternative spring sown crop in semi-arid areas. In this study, 20 local Iranian cumin ecotypes originating from Azarbaijan, Fars, Isfahan, Kerman, Semnan, Yazd, Northern, Razavi and Southern Khorasan provinces were grown under controlled (laboratory and pot) conditions at the Dryland Agricultural Research Institute (DARI) of Iran. Seed germination and seedling growth were assessed under controlled conditions. Drought stress was simulated by using polyethylene glycol (PEG). Relative drought tolerance of seedlings was evaluated in a greenhouse by controlling the moisture content in pots. PEG-induced osmotic stress resulted in significant differences in germination between ecotypes. There was considerable variation in some morpho-physiological growth parameters in the greenhouse. Ecotypes from Kerman, Razavi Khorasan and Semnan provinces were more drought-tolerant than the remaining 17 ecotypes, and may be suitable for cultivation in drought-stressed areas. This data set will be useful for the development of drought-tolerant cumin cultivars.

CUMINUM CYMINUM; DROUGHT STRESS; DROUGHT RESISTANCE; DROUGHT; DRUG PLANTS; LABORATORY EXPERIMENTATION; POT EXPERIMENTATION; MEDICINAL PROPERTIES; IRAN ISLAMIC REPUBLIC

J- POSTHARVEST TECHNOLOGY

J10 Handling, transport, storage and protection of agricultural products

Field testing of transgenic papaya with delayed ripening trait and papaya ringspot virus (PRSV) resistance towards commercialization (R1109): field testing of transgenic papaya with long shelf and papaya ringspot virus (PRSV) resistance. **Tecson-Mendoza, E.M., Garcia, N.N., Lit, M.C., Ocampo, E.T.M., Serrano, E.P., Laurena, A.C.** *Department of Agriculture, 2nd Floor BSWM Bldg., Elliptical Rd. Cor., Diliman, Quezon City (Philippines). Biotechnology Program Office. TR-1836.*

The researchers project 2011-2014) funded by the DA [Department of Agriculture] Biotechnology Program aimed primarily to conduct the testing of the transgenic papaya hybrid with both long shelf life and PRSV-resistance traits. The following are the highlights of this project: The biosafety permit for the field testing

was obtained from Department of Agriculture Bureau of Plant Industry (DA BPI) in June 2012 and papaya seedlings planted on September 4, 2012. The field test of the transgenic papaya was successfully conducted on a 896-sq m lot under the supervision of the DA-BPI Biosafety Team and the UPLB Institutional Safety Committee. All plants in the field were infected with PRSV but the F1 hybrids were able to recover from the disease and produce fruits. The control Davao Solo plants were able to recover from the disease and produce fruits. The control Davao Solo plants was heavily infested with PRSV and majority were unable to recover; those which are less infected bore fruits which had the oil ringspots and deformities typical of fruits from PRSV infected trees. The F1 hybrids took an average of 134 days fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids took an average of 134 days for fruits to reach maturity compared to 136 days for control papaya. The F1 hybrids papaya fruits had an average of 8 days from color break to full yellow and another 5.7 days to ripen for total of about 13.7 days. Control papaya fruits had a total of about 10.7 days total from color break to ripe stage. All transgenic plants in the field were found to be positive for the transgene (anti-ACC synthase 2) by PCR screening. Using specific primers for sex determination, the seedlings planted in the field were about 1:1 female and hermaphrodite. Using relative PCR ACS2 expression was found to be lower in the transgenic papaya, both the F1 hybrid and T4 01-6-48 line, compared with the non-transgenic control papaya, at 80% yellow fruit stage, indicating lower ethylene production in the transgenic papayas. Findings in the field trial revealed the spiders and ants were abundant in the site in November 2012 to May 2013. The eggs of spiders were mostly observed under the surface of the leaves. Diverse arthropods were counted and collected from the papaya hybrid and control plants. These arthropods can be classified according to their functional guilds, namely, predators, parasites, pollinators, neutrals chewing pest and sucking pests. The most abundant were the predators and coccinellids. The arthropod pests that were identified new pest (tentatively a coleopteran) which damaged the young and old fruits of both the hybrids and control plants was observed in the field trial site. The pest was also observed in other papaya growing areas in Laguna [Philippines]. The study of the storage behavior of the papaya fruits showed the fruits harvested at 115, 120, and 122, color break stage, DAF, had similar physico-chemical qualities and sensory attributes. The peak of athylene production was observed to be at 6 to 7 days after harvest of fruits at 120 and 122 DAF and this was already at about 80% yellow. Harvesting at different maturity also did not have any appreciable difference in physico-chemical characteristics of the fruits as well as its sensory attributes. The project team undertook IEC activities firstly in the vicinityof the field test, in Bay and Los Baños, Laguna, with municipal councils of said towns, and in the two barangays [villages] in Bay. The team also briefed the municipal agricultural officers of the province of Laguna and officials of the provincial government office in Santa Cruz, Laguna. A training workshop on regularity rules and practices was conducted for the members of the project. The team likewise discussed with officials and research and faculty personnel of the Cavite State University and Adventist University of the Philippines for possible collaboration on the second field trial of the transgenic papaya F1 hybrid. Briefings on the transgenic papaya were conducted with the Provincial Agriculturist of Cavite and his technical staff and the Municipal Agriculturist of Silang, Cavite. The researchers obtained information on the NSIC, registration and Application for Plant Variety Protection of the transgenic papaya with delayed repining trait and its F1 hybrid with the introgressed trait of PRSV resistance from the Bureau of Plan Industry. Various IECs on transgenic papaya technology were undertaken in various schools, at IPB, and during talks before different gatherings in workshops on biotechnology.

CARICA PAPAYA; HYBRIDIZATION; DISEASE CONTROL; PLANT DISEASES; TRANSGENIC PLANTS; KEEPING QUALITY; POSTHARVEST PHYSIOLOGY; RIPENING

Drying and storage characteristics of batuan fruit powder. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 72-108.*

The study evaluated the drying and storage characteristics of the batuan fruit powder including optimization of parameters for powder production, Moisture Sorption Isotherm (MSI), and Accelerated Shelf-life Test (ASLT). The optimum sodium metabisulfite (SMS) concentration and drying temperature were determined where the physicochemical, functional and sensory characteristics of the powder were considered as the responses. The optimum drying temperature and SMS concentration were found to be 50.0001 deg C and 106.249 ppm, respectively, with a desirability of 0.578. The moisture sorption behavior of the powder revealed that the equilibrium moisture content (EMC) increased with water activity (aw) while the EMC values generally decreased when the temperature was increased. The BET Isotherm and Halsey Equation gave the best fit models to describe the MSI of the powder. The monolayer value and water activity, aw, of the batuan powder were calculated to be 0.08499 g water/g solids and 0.36, respectively, at room temperature. During the ASLT of the powder, Maillard browning was predominant and found to be a first-order reaction in terms of whiteness index (WI). The shelf-life of the product at room temperature was predicted to be 202 days (6.73 months).

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; DRYING; STORAGE; TEMPERATURE; KEEPING QUALITY; CHEMICOPHYSICAL PROPERTIES; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Postharvest quality and safety management of organically-grown fruits and vegetables. **del Carmen, D.** *Department of Agriculture, BPI Cmpd. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1754.*

The newly developing organic industry of the country is faced with the challenge of delivering organically-grown fruits and vegetables that have same safety, quality and shelf-life as their conventionally-grown counterparts. The project is thus implemented to develop technologies for maintaining the quality and insuring safety of organically-grown fruits and vegetables during harvesting, postharvest handling, storage and marketing. In general, the supply/value chain for organically-grown fruits and vegetables is very simple, characterized by a short chain with few players. Except for seeds (mostly highland vegetables) and the greenhouse or plastic house supplies which were source-out from commercial input suppliers, the rest of the inputs utilized in organic farming such as bio-fertilizer and bio-pesticides were produced, prepared or concocted by the growers themselves. The cultural management practices were more or less similar in all the project sites. Postharvest and marketing practices are also very simple. Growers and grower-traders do minimal sorting, trimming and packaging, and, marketing is direct to customers or final consumers. The latter is done at the farm or in weekend or organic specialty markets, or channeled to retailers such as in supermarket or wet market stallholders. The weekend organic market usually operates only once a week either half or whole day, and the unsold fresh produce are brought home by the grower-traders. A survey of consumer preferences was the next activity after the supply chain documentation. This was done to ensure that the improvements made would address consumer or market needs and wants. Consumers perceived organic produce as safe to eat, free from pesticides and nutritious too. The qualities looked for when buying fresh produce are freshness, cleanliness and the absence of damage either physical,

mechanical injuries or decay. Postharvest technology researches therefore focused on: 1. determining safety of the produce from microbial contaminants (determination of chemical or pesticide contaminants was not included) along the various points in the supply chain; 2. physico-chemical characterization and determination of quality changes of organically-grown produce, which were also compared with conventionally-grown counterparts; 3. maintaining the freshness of the produce and extending shelf-life (MAP, organic acids for disease control, packaging, ripening); and, 4. minimizing postharvest disease. The results in the form of new information or technology protocol(s) which were generated from the above researches were then translated to information education and communication material (IEC) and disseminated or shared with the actors, both the direct and indirect players of the organic fruit and vegetables supply chain namely, the growers or organic practitioners, agricultural technicians, fellow researchers and other industry players. Four technical papers were presented as oral papers in three scientific conferences, two local and one international. One was published in an international journal as proceedings. Three poster papers were also presented in scientific conference here and abroad. One technical bulletin on postharvest handling techniques for organic fruits and vegetables, and two extension flyers on evaporative cooling were also prepared and printed for dissemination to industry stakeholders. Before the project ended in September, an additional 2 technical papers were prepared and accepted for presentation to the ISAAS International Congress in November 5-7, 2016 to be held in Hanoi, Vietnam. Eight awareness training or capability building program on postharvest handling or organically-grown fruits and vegetables were provided to organic practitioners in response to the need of the industry. Most of these were in cooperation with the municipal LGU's through the agriculture office. One training programs was conducted with Alter Trade Corporation, the project cooperator in the conduct of postharvest research on organic banana. A training manual was also prepared based on the training programs conducted. Evaporative cooler crates and an upscale design were provided by the project to selected vegetable producers and traders, and growers’ association, who also served as co-operators of the project. While there were a number of postharvest researches conducted during the project duration, more researches still need to be done and optimized on organic fresh fruits and vegetables. The changing climate greatly affects organic production and consequently the availability of supply became the limiting factor in the conduct of research during the span of the project. Moreover, other organic production systems in Luzon and outside of Luzon area, and the many other types of fresh fruits and vegetables grown organically have yet to be studied.

FRUITS; VEGETABLES; ORGANIC AGRICULTURE; SAFETY; QUALITY; KEEPING QUALITY; MARKETING; POSTHARVEST TECHNOLOGY; POSTHARVEST CONTROL

Quality and biochemical changes of 'Sukkari' bananas during shelf life as affected by postharvest in dipping in ethanolic extract of propolis. **Awad, M.A., Al-Qurashi, A.D.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 132-140. (Jun 2019).*

The effect of postharvest ethanolic extracts of propolis (EEP) dipping at 2.5%, 3.5% or 4.5% on quality and biochemical changes in 'Sukkari' bananas during 13 d of shelf life at 20 +- 2 deg C and 60-70% RH were evaluated EEP treatments, especially at 4.5%, lowered weight loss, total soluble solids (TSS) concentration and pH, and retained higher peel green color, membrane stability index (MSI), firmness and vitamin C concentration during shelf life compared with the control treatment. EEP treatments maintained higher titratable acidity (TA) and total phenol concentrations than the control only after 6 d of shelf life. Free radical scavenging capacity (FRSC) increased (lowered DPPH IC50 values) during shelf life and was not affected by the treatments. The relations of such biochemical changes with α-amylase, xylanase,

polygalacturonase, peroxidase and polyphenoloxidase activities were discussed. In conclusion, EEP treatments at 4.5% retained quality of 'Sukkari' bananas during shelf life and are suggested as a natural alternative to synthetic chemicals.

MUSA (BANANAS); PROPOLIS; KEEPING QUALITY; EDIBLE FILMS; POSTHARVEST; PHYSIOLOGY; RIPENING; DIPPING; ETHYLENE; MUSA (BANANES)

J12 Handling, transport, storage and protection of forest products

Chocolate brand's search for the 'Prince of Cacao' **Taculao, P.B.S.** *Agriculture (Philippines) v. 28(10) p. 54-55 (Oct 2019).*

THEOBROMA CACAO; VARIETIES; INDIGENOUS ORGANISMS; CROP MANAGEMENT; HARVESTING; POSTHARVEST TECHNOLOGY; THEOBROMA CACAO

J14 Handling, transport, storage and protection of fisheries and aquacultural products

Improving productivity of sea cucumber processing through mechanization and packaging. **Yaptenco, K.F., Pangan, R.S.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Alsons Aquaculture Corp., Alabel, Sarangani (Philippines).; Bureau of Fisheries and Aquatic Resources, Region 3, Masinloc, Zambales (Philippines).; Fishermans' Association of Batingue, Pagbilao Quezon (Philippines).; Orient Pearl Seafood Restaurant , Cal. TR-1871.*

SEA CUCUMBERS; PRODUCTIVITY; PROCESSING; MECHANIZATION; PACKAGING; EQUIPMENT

K- FORESTRY

K01 Forestry - General aspects

Analysis of international guidelines and policies on accreditation of quality and environmental management system bodies for forest certification. **Bugayong, L.A., Capinpin, H.L.L.** *Assessment of drivers of deforestation and forest degradation in Eastern Samar and Davao Oriental [Philippines] REDD-[Reducing Emissions from Deforestation and Forest Degradation] Plus project sites, Bugayong, L.A.Dolom, P.C.Carandang, A.P.Capinpin, H.L.L.Nicmic, J.C..- College, Laguna (Philippines), Sep 2015. TR-1800.- p. 123-144.*

FORESTRY; FOREST MANAGEMENT; FORESTRY POLICIES; ENVIRONMENTAL MANAGEMENT; ENVIRONMENTAL PROTECTION

Analysis of the logging moratorium (EO 23) and related policies in the Philippines. **Bugayong, L.A.** *Assessment of drivers of deforestation and forest degradation in Eastern Samar and Davao Oriental [Philippines] REDD-[Reducing Emissions from Deforestation and Forest Degradation] Plus project sites, Bugayong, L.A.Dolom, P.C.Carandang, A.P.Capinpin, H.L.L..- College, Laguna (Philippines), Sep 2015. TR-1800.- p. 82-122.*

LOGGING; FORESTS; FORESTRY; POLICIES; FOREST MANAGEMENT; PHILIPPINES

Assessment of status and trends of forestry investments in the Philippines. **Bugayong, L.A., Tolentino, N.L.** *TR-1865.*

The demand for forest-based goods and services has shifted in the past decades from mainly timber-based harvesting to the provision of ecosystem-based goods and services. Ecosystem provisioning goods and services include food, timber, fuelwood, non-timber forest products, medicine, resin, and latex, among other things. Among the regulating services are carbon sequestration, soil and water conservation, clean air, watershed services, and biodiversity conservation. Cultural services provide ecotourism, aesthetic value, and education. There is heightened appreciation and demand for these ecosystem goods and services due to globalization of technology and information. Investments in the forestry sector have been declining over the years due to major policy changes such as the 1987 Philippine Constitution where the timber license agreements (TLAs) were replaced by co-production, production sharing, and joint production agreements. The timber harvesting ban in primary forests in the 1990s and the recent logging moratorium in residual natural forests in 2011 significantly shifted wood production from naturally grown timber to plantation wood. These have led to increasing imports for wood to supply the wood processing industry. However, there remain opportunities for investments in the forest-based industry such as the availability of forestlands (about 4M has open access areas) where ecosystem goods and services can be developed and sustainably managed to address the continuously growing demand for such. The areas planted with tree species and high value crops such as rubber, coffee, cacao and rattan under the National Greening Program (NGP) also serve as investment opportunities for development of processing industries. This study discusses the issues and concerns that need to be addressed so that the forestry investments can become attractive and viable to interested entities. Among the recommendations are an investor-friendly policy environment and a forestry investments road map.

FORESTRY; FOREST PRODUCTS; FOREST PRODUCTS INDUSTRY; TRENDS; INVESTMENT; PHILIPPINES

Carbon stock of green spaces in central schools of Santiago City, Isabela, Philippines. **Damance, M.F., Castaneto, Y.T.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Green spaces are those areas planted with trees. These areas are very important especially in sequestering carbon. Thus, this study was conducted to determine the amount of carbon stock in the green spaces of 4 central schools in Santiago City, Isabela, Philippines. The study used the measurement of trees at diameter at breast height (dbh). Above-ground biomass was also computed using allometric equation. Interviews using a structured questionnaire was also conducted for the information on the management of trees within the schools. Results showed that among the 4 central schools, Santiago South has the most number of trees with 260 trees with 10 cm dbh and above and with carbon sequestered of 302,310.65 kg. It was followed by Santiago North with 241 trees and with carbon sequestered of 225,920.27 kg; Santiago East with 240 trees with carbon sequestered of 208,621.23 kg; and Santiago West with 67 trees and with 18,587.22 kg of carbon sequestered. The 4 central schools stored a total of 755,439.37 kg or 755.44 tons of carbon. Trees identified in the schools were mahogany (Swietenia macrophylla) with the highest number of individual trees, followed by yemane (Gmelina arborea), narra (Pterocarpus indicus), talisai (Terminalia catappa), and banaba (Lagerstroemia speciosa). In terms of tree management within the schools, teachers

and utility workers were interviewed. Based on the findings, most of the respondents have limited knowledge on carbon stocks of green spaces in the schools. However, they took care of the trees by watering, application of fertilizers, and placing tree guards during seedlings transplanting operation. As part of the silvicultural treatments, diseased and defective trees were cut to give way for the healthy trees to grow vigorously. Trees were planted within the school because of the shade and the cooling effect they provide. The schools depend on the seedlings provided by the City Environment and Natural Resources Office for their greening program. Results of the study presents the need for the provision of relevant information on the crucial role of trees and green spaces in carbon sequestration.

SWIETENIA MACROPHYLLA; GMELINA ARBOREA; PTEROCARPUS INDICUS; TERMINALIA CATAPPA; LAGERSTROEMIA; EDUCATIONAL INSTITUTIONS; URBAN FORESTRY; CARBON; PHILIPPINES

Consumer for sustainable forest management. **Buot, M.K.M.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 4-5 (Jan-Dec 2017).*

FORESTS; FOREST MANAGEMENT; SUSTAINABILITY; WOOD PRODUCTS; CONSUMER BEHAVIOUR; CONSUMERS; STANDARDS; CERTIFICATION

FDC leads in drafting of EO [executive order] and DAO [Department Administrative Order] on forest certification in the Philippines. **Bugayong, L.A.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 3-4 (Jan-Dec 2017).*

FORESTS; FORESTRY POLICIES; FOREST MANAGEMENT; SUSTAINABILITY; LOCAL GOVERNMENT; PHILIPPINES

Forest Certification Interim National Governing Board: what lies ahead. **Palacpac, A.B.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 5-6 (Jan-Dec 2017).*

FORESTS; CERTIFICATION; FORESTRY POLICIES; FOREST MANAGEMENT; SUSTAINABILITY; LOCAL GOVERNMENT

FRExLS [Forest Resource Extraction from LiDAR Surveys] component. *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines)*, 2017 TR-1835.- p. 147-202

FORESTS; GEOGRAPHICAL INFORMATION SYSTEMS; DATA COLLECTION; INFORMATION STORAGE; DATABASES; INFORMATION MANAGEMENT; INFORMATION TECHNOLOGY; INFORMATION TRANSFER

Learning from the experiences of neighboring ASEAN countries [forest certification]. **Cabrera, R.V.C., Villanueva, M.M.B.** *FDC [Forestry Development Center] Philippine Forestry Policy Forum (Philippines) v. 7(1) p. 1-2 (Jan-Dec 2017).*

FORESTS; CERTIFICATION; FOREST MANAGEMENT; SUSTAINABILITY; FOREST PLANTATIONS; INDONESIA; MALAYSIA

Overview of the forest resources in the Philippines. **Claudio, L.E.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 22-28.*

FOREST RESOURCES; FOREST MANAGEMENT; FOREST RESERVES; ENVIRONMENTAL MANAGEMENT; PHILIPPINES

REDD+ co-benefits: poverty reduction and biodiversity conservation. **Valenzuela, R.B., Yeo-Chang, Y.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

To conserve biodiversity, South Korean government signed the UN Convention on Biological Diversity (CBD) in 1994 and established the 3rd national biodiversity strategies in 2014. Part of the strategy is the implementation of regulation policies that designated protected areas and protected species such as endangered species. These policies can be supported by people's evaluation of biodiversity conservation. However, economic value of biodiversity can be influenced by social conditions such as institutions and regimes as well as ecological conditions such as ecosystem type. In this study, authors aim to analyse the economic value of biodiversity in Korea with respect to social and ecological conditions using meta-analysis. Data was collected by searching keywords related to biodiversity on Research Information Service System (RISS) and National Discovery for Science Library (NDSL) database from 1990 to 2017. After data screening, 31 researches were included in data analysis. Number of researches on biodiversity increased since the Nagoya Protocol in 2010. Result indicates that biodiversity value of urban ecosystem and cultivated land tends to be higher than that of natural ecosystems including river, forest, wetland and ocean.

FORESTS; RESOURCE MANAGEMENT; BIODIVERSITY; CLIMATIC CHANGE; DEFORESTATION; SOCIAL PARTICIPATION; POVERTY; RURAL AREAS

Study on REDD+ project attributions to biodiversity. **Min-Young, P., Yeo-Chang, Y.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

In developing countries, biodiversity is threatened by deforestation, forest degradation, and land-used changes. The indiscriminate use of the biological resources by local people for their livelihood, and activities that are intended for development and industrialization exacerbates the problem. REDD+, a climate change mitigation project, is seen as an alternative in solving the problem as biodiversity conservation is one of its co-benefit. Previous researches, however, shows that REDD+ attributions that can lead to biodiversity promotion. Eight project areas were selected from the VCS database-all projects used VCS and CCB Standards. The Project Implementation Report and Project Design Document of the selected

projects were reviewed. Results of Fs/QCA analysis revealed that the number of participating institutions and organizations and the number of stakeholders' collaborations are the key factors that determine the potential for biodiversity promotion.

FORESTS; CLIMATIC CHANGE; DEFORESTATION; LAND USE; BIODIVERSITY; SOCIAL PARTICIPATION; DEVELOPMENT PROJECTS

K10 Forestry production

Assessment of drivers of deforestation and forest degradation in Eastern Samar and Davao Oriental [Philippines] REDD-[Reducing Emissions from Deforestation and Forest Degradation] Plus project sites. **Bugayong, L.A., Dolom, P.C., Carandang, A.P., Capinpin, H.L.L., Nicmic, J.C.** *TR-1800.*

The Philippines forest cover has been drastically reduced from 10.9 million hectares of land in the 1970sto just 7.7 million ha in 2003 (PFS 2003). NAMRIA [National Mapping and Resources Information Administration] reports that from 2003 to 2010, closed canopy forest declined by 25% in terms of area. Despite government efforts to protect, conserve and rehabilitate forests, forest destruction continues due to such activities as shifting cultivation, timber extraction, mining, and conversion of forest to other land uses. In order to define specific strategies for REDD-plus and related measures, an analysis of drivers of deforestation and forest degradation is required. The basis of this action is the Warsaw REDD-plus framework agreed upon in the UNFCCC's COP-19 [] where parties, organizations, and private sector are encouraged to take action to reduce the driver's of deforestation and forest degradation and to share the results of their work. The assessment of the drivers of deforestation and forest degradation was implemented in the REDD-plus project areas namely, Eastern Samar and Davao Oriental. The study is part of the project 'Preparation of a National REDD-plus Mechanism for Greenhouse Gas Reduction and Conservation of Biodiversity in the Philippines' (National REDD-plus System Philippines) with assistance from the German German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) under its International Climate Initiative (IKI). This study had the objectives: 1)analysis of drivers and courses of deforestation and forest degradation in the project sites; 2)assessment of the importance of various drivers and courses of deforestation and forest degradation; and 3)development of differentiated recommendations to address the various drivers and courses of deforestation and forest degradation. The assessment followed three of the five steps identified in the Decision Support Tool for Identifying and Addressing Drivers prepared by the ASEAN Regional Knowledge Network on Forests (ARKN-FCC 2014). These steps includes: 1)gathering information and assessing drivers, 2)selecting drivers to address, and 3)designing interventions to address prioritized drivers. The other two steps, 4)implementation of selected interventions to address prioritized drivers and 5)monitoring and evaluating success of interventions, are to be undertaken by the respective REDD-plus project partners. The methods used include review of secondary data, information, and literature; key informant interviews (KIIs); focus group discussion (FGDs); analysis of available data sets from NAMRIA and FMB-DENR; descriptive statistics; financial analysis; and qualitative descriptions. The priority identified with the stakeholders in both project sites includes upland agriculture expansion, timber poaching, tree cutting for fuelwood, charcoal, rattan extraction, and mining. Underlying causes of deforestation and forest degradation include socio-demographic factors, such as increasing population and in-migration, cultural factors like changing consumption patterns; economic factors that include poverty, limited livelihood opportunities, and market demand; technological factors such as low productivity, proliferation of chainsaws, and poor access to market; and policy and institutional factors among which are unstable policy environment and weak forest

governance. To address the drivers of deforestations and forest degradation through REDD-plus, the Interventions include forest land use planning, co-management of forests and forestlands with tenture options, improved governance, and improved livelihood options. Addressing the poverty and lock of livelihood options that drive current degradation activities needs to be prioritized such as technical, financial, and marketing assistance on improved upland farming systems. A number of farm-based livelihood options were analyzed that would guide the project implementation and farmers. The options analyzed includes status quo or business as usual (BAU); REDD-plus, without enhancement; REDD-plus with communal tree plantations (Dipterocarps and fast growing trees), agroforestry-based farming (coconut, banana, or citrus based), fuelwood plantation, and rattan plantation. The BAU option involves the current kaingin farming or shifting cultivations with timber poaching/fuelwood tree cutting but this option yields negative net present value (NPV) of benefits. All other interventions with REDD-plus enhancement susch as agroforestry and/or timber plantations resulted to positive NPVs and attractive internal rates of return (IRR).

FORESTS; DEFORESTATION; DEGRADATION; GREENHOUSES; FOREST MANAGEMENT; FOREST PROTECTION; PHILIPPINES

Community livelihood dependence on forest and non-timber forest products. **Soe, K.T., Yeo-Chang, Y.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Poor regulation and unsustainable extraction of fuel wood in Myanmar is affecting millions of hectares of natural forests and this is how they become one of the main drivers of deforestation. Myanmar joined UN-REDD Program (United Nations Reducing Emissions from Deforestation and Forest Degradation) to mitigate climate change and conduct REDD+ activities. To address the drivers effectively, development and implementation of policies and measures (PAMs) under the national REDD+ strategy are crucial. This study focused on how the specific PAMs would be implemented effectively with a better understanding of empirical research findings. The focused priority drivers here are firewood collection and charcoal production examining the Taungoo District as an example case of non-timber forest products (NTFPs) dependency by the forest-dependent communities. Primary objectives are: to explore forest-dependent communities' willingness to keep using the existing woodfuels and to analyze their dependency on NTFPs and perceptions of woodfuels utilization. To meet these objectives, qualitative and quantitative data collection and analyses were conducted by interviewing forest-dependent communities (N=330). The researchers found that charcoal making and the utilization of charcoal for cooking pose higher dependency on NTFPs and prompt the households' willingness to keep using it. The households who are landless, rice insufficient, below the poverty line and who has less income from off-harm activities are more dependent on NTFPs in the area. By integrating those key findings, the authors propose appropriate responses for the effective implementation of targeted PAMs. The findings from this study provide useful information for ascertaining the actions for PAMs at a local scale.

FORESTS; FOREST PRODUCTS; NONWOOD FOREST PRODUCTS; FORESTRY POLICIES
DEFORESTATION; POVERTY; RURAL AREAS; RURAL COMMUNITIES

Enhancement of the forest genetics laboratory of the College of Forestry and 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.

Laboratory mass rearing of the five lepidopteran pests of cornnamely the Asia acorn borer (ACB Ostrini furnacalis), Corn earworn (CEW Helicoverpa armigera). Common cutworm ((CCW Spodoptera litura), Corn semi-looper (CSL Chrysodeixis eriosoma) and True armyworm TAW (MYthimna separata), was done from 2011-2016 with the principal focus on rearing ACB. Field collection of Laguna and Isabela ACB populations were conducted in several sites to cater test insects requirements of the different externally funded and core funded studies. In summary the IPB Entomology Laboratory was able to produce 786, 320 ACB, 1,640 ACB egg masses 363,825 CEW, 28,160 CCW, 27,830 CSL and 343,820 TAW. Several studies were conducted using the IPB modified artificial diet. Study 1 aims to determine the optimal temperature for rearing under laboratory conditions by subjecting CB rearing under different temperatures. Results showed that ACB performed better under normal room condition. In study 2, different techniques for infestation of Asian corn borer were evaluated. Results showed that infestation technique using corn stalk at 25 DAP was more efficient and infestation rate using 50 four-day old ACB larvae showed the most severe damage on the corn plants. Study 3, aims to lessen the cost of the rearing diet by substituting varying amounts of Baker’s yeast and corn oil. The experiment showed promising result but this is yet to be confirmed. An on-going experiment is being conducted to compare this method to the existing standard artificial diet. Study 4 determines the effect of X solution in egg mass production of ACB adult female. Result showed that the addition of the X solution to the honey/sugar solution in the ACB adult diet greatly improved the production of viable eggs by female ACB adults. With the improvement or rearing facilities, rearing methodologies and acquisition of skills by laboratory personnel, the Entomology Laboratory has established itself as the national center for mass rearing of Asian corn bore and other lepidopterous pests of corn.

FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES; PHILIPPINES

Impact assessment of the National Greening Program in Malinao, Aklan, Philippines. **Orpia, Ma.K.P., Florindo, R.M., Tanael, R.L.Jr., Pintor, L.L.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

The National Greening Program (NGP) contributed in the improvement of biological diversity particularly in the plantation established in Osman, Malinao, Aklan [Philippines]. Impact assessment was undertaken in the area in 2016 wherein the results were compared to the baselining data gathered in 2013. Transect line method and opportunistic sampling covering the sampling sites assessed during the baseline activities in 2013 was conducted. Arthropods and other invertebrates were collected using sweep nets and pitfall traps where the baseline study occurred in 2013. Results showed that the diversity of the trees changed from relatively moderate to relatively high from 2013 to 2016 with values ranging from 2.67 to 3.09. The area became more diverse based from the Species Richness which increased from 28 in 2013 to 33 in 2016. The total number of individuals also increased from 134 to 161. The increase may be attributed to natural succession, lesser destructive human intervention, and enhanced protection efforts of the NGP beneficiaries. The calculated Shannon diversity (H') values in 2013 are also higher compared in 2016 which implies that the area becomes less diverse inn species arthropods and invertebrates. Hymenoptera particularly ants was found dominant for ground-dwellers while Family Formicidae still dominates the site for foliage-dwelling arthropods. There was an increase in the species richness of herpeto-fauna particularly Macaca fascicularis Raffles and Paradoxurus hermaphroditus Pallas. Most of the species of herps and

mammals listed during the impact assessment were gathered from ethno biological accounts. The result of impact assessment for avifauna shows high species richness than that of 2013 which recorded 22 species and 17 species, respectively. The relative abundance of 120 is similarly higher than the 51 counted during the baseline survey. The increase in species richness and relative abundance were due to the actual biophysical/environmental conditions of the area, the strategies applied during the assessment activities, and sampling period. Insectivorous birds are the most common in the area. This is considered as one of the reasons to the decrease in the insect population in the area.

SPECIES; BIODIVERSITY; TREES; ARTHROPODA; INVERTEBRATES; RESOURCE MANAGEMENT; IMPACT ASSESSMENT; PHILIPPINES

Long term monitoring of plant community changes in Mt. Makiling Forest Reserve [Laguna, Philippines]. **Maldia, L.S.J., Aguilon, D.J.D., Luna, A.C., Cruz, R.V.O.** *TR-1867.*

To date, an estimated 875 studies have been conducted in the Mt. Makiling Forest Reserve (MMFR) [Laguna, Philippines] but most were either short term in nature or without follow up studies. In this study, a 4-ha long term monitoring plot established in 1992 through the collaboration of the College of Forestry and Natural Resources and the Japan International Research Center for Agricultural Sciences (JIRCAS) was re-surveyed for trees tagged in 1992 and those that recruited beyond (10 cm diameter at breast height), including current regenerations. This is in order to determine community dynamics of component tree species d assess recruitment strategies of forest trees in MMFR. The three most occurring taxonomic families were Cannabaceae, Meliaceae, and Rubiaceae, while Celtis luzonica (Cannabaceae), the most dominant species recorded in 1992, was consistently the dominant species present in the standing canopy vegetation and regeneration. Over time, the composition of the MMFR was consistently formed by numerous non-dipterocarp tree species, maintaining a species-rich secondary tropical rainforest of MMFR. The present study is useful in understanding the dynamics of a particular forest ecosystem over time.

HIGHLANDS; CANNABIDACEAE; MELIACEAE; RUBIACEAE; FOREST RESERVES; REGENERATION; MONITORING; BIODIVERSITY; PHILIPPINES

L- ANIMAL SCIENCE, PRODUCTION AND PROTECTION

L01 Animal husbandry

Batangas [Philippines] egg farm produces antibiotic-free eggs. **Taculao, P.B.S.** *Agribusiness (Philippines) v. 28(10) p. 50-51 (Oct 2019).*

LAYER CHICKENS; BREEDS (ANIMALS); ANIMAL FEEDING; EGGS; EGG PRODUCTION; ANTIBIOTICS; RESIDUES; HYGIENE; PHILIPPINES

Buzzing with fun on a hillside farm. **Urlanda, R.V.** *Agriculture (Philippines) v. 28(10) p. 36-38 (Oct 2019).*

APIS MELLIFERA; APIS CERANA; APICULTURE; POLLINATION; HONEY; FOOD PROCESSING; PROCESSED PRODUCTS

Development of effective management strategies for low-cost/organic production systems through the identification and analysis of the microbial flora and parasite fauna of the Philippine native swine. **Paller, V.G.V., Opulencia, R.B.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1866.*

SWINE; INDIGENOUS ORGANISMS; ORGANIC AGRICULTURE; MICROBIAL FLORA; PARASITES; INTESTINES; 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: project title: ex-ante analysis of PCAARD Industry strategic S and T for livestock (layer). **Valientes, R.M., Diona, D.L.Z., II.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Laguna (Philippines). TR-1868.*

The objective of the PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development]ISP [Industry strategic S and T]for Layer is to increase egg production by 2% and stabilize the supply of eggs by 2016 to 2020 through the following strategic interventions: (1) development of QPM [quality protein maize] cultivar for layer feedings; (2) developing value-added egg products thru processing and packaging; (3) promotion of value-added egg products; (4) technology assessment and audit for potential intellectual property; and (5) provision of non-cash incentives to poultry raisers. Of these interventions, only (1) is on-going while the rest are yet to be proposed and implemented. This study estimated the economic value of the Layer ISP in the livestock sector using ex-ante assessments as well as validated the assumptions related to the baseline indicators and targets set by the ISP, traced the impact pathway by which the Layer S and T interventions and monetized the likely benefits and costs of the interventions for Layer ISP. The ex-ante assessment shows that the interventions cannot deliver the objective targeted for the Layer-ISP and no positive net benefits for layer farms can be derived within the targeted period. As a long-horizon intervention, the impact pathway of the QPM project is packed with technical and adoption constraints that need to be hurdled at different levels, the planned period of intervention is no enough to solicit an impact that is worthy of public investments. The prospect for the rest of the ISP interventions is appealing but is largely dependent on successful private-public partnership in developing the technology, critical infrastructure/facility, business development services, operation and financing. The study suggested that it may be necessary to rethink ad reconfigure the entire ISP for Layer to align industry targets with proposed S and T interventions. Deferring the implementation of the Layer ISP until appropriate alignment of goals and interventions may be optimal. Furthermore, the study recommends that since the layer industry is largely commercial and thriving with large commercial players with own R and D efforts, it may be high time for PCAARRD to focus on developing other industries instead like the native layer where private sector S and T effort are almost absent and let go of the largely commercial layer industries.

LIVESTOCK; LAYER CHICKENS; LAYING PERFORMANCE; EGG PRODUCTION; EX-ANTE IMPACT ASSESSMENT; TECHNOLOGY ASSESSMENT

Ex-ante analysis of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] Industry Strategic S and T [science and technology] Plans (ISP) for crops, livestock (swine). **Catelo, Ma.A.O., Daite, R.B., Evangelista, G.B.** *Philippine Council for Agriculture, Aquatic and*

Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Laguna (Philippines). TR-1870.

This research involved doing a before-the-fact economic appraisal of the likely benefits and costs of executing the Swine ISP. The said ISP [Industry Strategic S and T [science and technology] Plans] contains S and T interventions embodied in two research programs and three stand-alone projects, with a total budget of Php 101 million for implementation from 2011 to 2015. The baselines, benchmarks and targets set by the ISP were generally reasonable and technically feasible. However, the issue of timing of delivery of project outputs in order to reach the 2020 targets is a significant concern. The time horizon involved in the ISP's production of technologies and their adoption along the commodity chain are not in sync with the target dates of industry impact realization. The mapping of impact pathways of the ISP projects showed the difficulty in assuming that S&T outputs can easily deliver the envisioned results. The targeted outcomes of the ISP were found to be too far from project reach. There are many crucial post-project relay activities beyond the control of the interventions, and technology transfer and utilization are subject to the behavior of private actors which cannot be assumed to be favorable. Assuming project success and that the technical, financial and market constraints along the impact pathways are overcome, the cost-benefit analysis showed that the investments on the ISP can bring fair rates of return. However, bottlenecks along the impact pathways affect the economic viability of the R&D investments, and many critical activities related to technology delivery and adoption—which can determine economic success—are beyond the scope of the ISP. It is recommended that future ISPs should consider the temporal dimension of the entire research and development process. Periodic milestones would be useful to track not only technology development, but vital forward activities beyond the project. Also, the ISP designers should already build the impact pathways and understand the important issues along them before the plans are approved. Finally, ex ante studies would stand to benefit when farm-level data such as on production, costs-and returns, market prices, and adoption are compiled and made available. Fresh studies along these areas (especially on adoption) would serve as important inputs in ex ante evaluation of proposed projects.

SWINE; EX-ANTE IMPACT ASSESSMENT; COST BENEFIT ANALYSIS; LIVESTOCK; TECHNOLOGY TRANSFER; ECONOMIC ANALYSIS; MARKET RESEARCH

Ex-ante analysis of PCAARD's [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] ISP [Industry Strategic S and T Plans] for the duck industry. **Baldovino, H.V.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Philippines Univ. Los Baños, College, Laguna (Philippines). Coll. of Economics and Management. TR-1869.*

An ex-ante Benefit-Cost Analysis (BCA) method was used to assess the Industry Strategic S and T Plans (ISP) of PCAARRD [Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development] for the Duck Industry. The main goal of the ISP is to increase duck egg production rate to 70% and improving the uniformity of the eggs produced through selection and breeding of the Philippine Mallard Duck and other complementary projects. The steps I conducting a BCA were followed and both primary and secondary data were used to calculate and project benefits and costs of the Duck ISP from 2013 to 2022. Given a social discount rate of 6%, the study found that positive net benefits may be derived from the Duck ISP with a Net Present Value of Php 213 million and an Internal Rate of Return of 46.7%. However, the

value of the benefits can be significantly affected by the accuracy of the baseline data and the ability of selected breeder farms to supply certified PMD stock to local duck farmers.

DUCKS; LIVESTOCK; POULTRY; EX-ANTE IMPACT ASSESSMENT; COST BENEFIT ANALYSIS

Isozyme and morphometric analyses of natural populations of the Asian honey bee (Apis cerana Fabricius) from different geographical areas in the Philippines. **Montalbo, M.D., Aquino, G.M.B., Tandang, R.N., Laude, R.P.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (1) p. 37-49. (Apr 2018).*

The isozyme and morphological variability in natural populations of the Asian honey bee (Apis cerana Fabbricius) from three different geographical areas in the Philippines (Area I: Batangas, Cavite, and Laguna; Area II: Cagayan de Oro; Area III: Bicol) were detected by starch-gel electrophoresis and morphometric analysis. Isozyme polymorphisms were detected for alkaline phosphatase, acid phosphatase, esterase and malate dehydrogenase, as encoded by 13 presumptive loci. Based on the observed proportion of polymorphic loci and average heterozygosity, genetic variability was highest in the Area II population. The genetic and genotypic variabilities between populations from Areas I and II suggest a possible mechanism of subspeciation. Principal component analysis of 31 morphometric characters yielded 4 possible clusters of bee populations. Areas II and III each formed district clusters, but Area I was divided into the Batangas-Cavite cluster and the Laguna cluster. The Cagayan de Oro (Area II) population had the highest measurements for most of the size-related characters, whereas the Bicol (Area III) population had the lowest. The isozyme and morphometric analyses of Apis cerana consistently showed considerable divergence between the populations from Areas I and III. However, the Area II population was not as distinct from other populations.

APIS CERANA; HONEY BEES; ISOENZYMES; POPULATION GENETICS; GEOGRAPHICAL DISTRIBUTION; POLYMORPHISM

Laying the groundwork for commercial rabbit production. **Veneracion, A.M.** *Agriculture (Philippines) v. 23(11) p. 34-36 (Nov 2019).*

RABBITS; ANIMAL HUSBANDRY; ANIMAL PRODUCTION; PROCESSING; RABBIT MEAT; FARMERS

Review of pollination biology research in selected Asian countries. **Cervancia, C.R.** *Philippine Entomologists (Philippines). 0048-3753. v. 32 (1) p. 3-36. Apr 2018.*

The Asian region, with the southern part being mostly in the tropics, is high in pollinator diversity. Its rich vegetation and mild climate supports the population of pollinators. Solitary and social bees are among the important pollinator species. Other insect pollinators are butterflies, moths, beetles and flies. Birds and mammals pollinate bigger flowers. However, honey bees are the most widely studied species of pollinators. Of the 12 species of honeybees, 11 are native to Asia, namely: dwarf honey bees (Apis andreniformis and Apis florae), giant honey bees (Apis dorsata, Apis laboriosa, Apis dorsata binghami, and Apis breviligula) and cave nesting honey bees (Apis koschevnikovi, Apis cerana, Apisnigrocincta, Apis nuluensis and Apis indica). The European honey bee, Apis mellifera, is not native to Asia. Most pollination studies were focused on high value agricultural and plantation crops. Threats to pollinators are monoculture, pesticide use, pests and diseases, land use change, natural calamities and climate change. This review on the status

of pollination research covers countries in Southeast Asia (Indonesia, Thailand, Vietnam, Singapore, Malaysia and Philippines), east Asia (China, Korea and Japan) and South Asia (Pakistan, India and Nepal).

APIS; HONEY BEES; SPECIES; POLLINATION; POLLINATORS; INDONESIA; THAILAND; VIET NAM; SINGAPORE; MALAYSIA; PHILIPPINES; CHINA; KOREA DEMOCRATIC PEOPLE'S REPUBLIC; PAKISTAN; INDIA; NEPAL

Secrets to raising Iloilo's [Philippines] best chicken. **Gestupa, E.J.J.** *BAR [Bureau of Agricultural Research] Chronicle (Philippines) v. 19(5) p. 9; 13; 15 (May 2018).*

CHICKENS; INDIGENOUS ORGANISMS; ANIMAL FEEDING; DRUG PLANTS; FREE RANGE HUSBANDRY; PHILIPPINES

Technical and economic feasibilities of on-farm and on-station organic chicken production. **Magpantay, V.A., Bejo, M.B., Adiova, C.B., Quimio, J.M.UP.H., Lavega, C.P.** *National Swine and Poultry Research and Development Center Farmer's Association of Dolores, Dolores, Quezon (Philippines). TR-1830.*

Eight independent studies were done to evaluate the technical and economic feasibilities of on-farm and on-station organic commercial broiler and native chicken production. Awareness on organic chicken production by the farmers in Dolores, Quezon [Philippines] was created by seminar-orientation and focus, group discussion. Four farmer-cooperators were selected to raise native chicken on-form based on their willingness to participate in the program. Results of the different studies, both on-station and on-farm trials, indicated the technical feasibility of using commercial broiler and native chicken for organic production. Sensory evaluation of meat showed that native chicken for organic production. Sensory evaluation of meat showed that native chicken had advantage over the commercial meat showed that native chicken for organic production. Sensory evaluation of meat showed that native chicken had advantage over the commercial broiler and native chicken for organic production. Sensory evaluation of meat showed that native chicken had advantage over the commercial meat showed that native chicken had advantage over the commercial meat showed that native chicken for organic production. Sensory evaluation of meat showed that native chicken had advantage over the commercial broiler for aroma, flavor, and general acceptability. Feed resources preferred by chicken include dehydrated coconut, corn grits, rice bran D1. Farmers also supplement other farm by-products like wilted vegetables from the market. Large variation in the growth performance and livability of birds might be a result of the differences in the management of the four farmers. Successful on-farm trials depend heavily on the willingness of the farmers to extend extra effort in taking care of the birds. As for the alternative medicines, in vitro and in-vivo studies indicated the potential of using garlic, oregano, turmeric, and betel nut as natural dewormers. While oregano and guava leaves concoction showed potential in improving respiratory apparatus of the chickens. Gross margin analysis revealed that organic chicken production using commercial broiler and native chicken stocks were both economically feasible.

ORGANIC AGRICULTURE; IN VITRO; IN VIVO EXPERIMENTATION; MORTALITY; FEEDING; PREFERENCES; GROSS MARGINS; ECONOMIC ANALYSIS; ECONOMIC INDICATORS

Understanding the gastrointestinal microbial flora of the Philippine native swine. **Paller, V.G.V., Opulencia, R.B.** *Development of effective management strategies for low-cost/organic production systems through the identification and analysis of the microbial flora and parasite fauna of the Philippine native swine, Paller, V.G.V.Opulencia, R.B..- College, Laguna (Philippines), 2017. TR-1866.- p. 1-107.*

The Philippine Native Swine has been widely accepted as a more robust and more disease-resistant swine breed than the white crossbreeds or hybrid. The microbiota of an animal's intestinal tract has long been shown to play significant functions in the overall health and productivity of swine. However, there is no known study on the microbial diversity in the gut of the Philippine native swine. In this study, the microbial succession in the ileum of Philippine native swine at one-, two-, three-, and four-week- old was determined by 16S rRNA gene analysis using the paired-end Illumina HiSeq platform. A clear succession pattern of microbial colonization was observed where the phyla Chlamydiae and Proteobacteria were predominant in one-week-old swine while Firmicutes dramatically increased as the swine aged. The most dominant bacterial genera at every swine age were potentially pathogenic to both humans and animals. Phenotypic and genotopic analyses of 58 weaning and market age swine from various municipalities in Quezon province revealed the occurrence of bacteria that could cause food poisoning. The shiga toxin-producing Eschirichia coli (STEC) and Salmonella were detected at 91% and 26% of the native swine, respectively.

SWINE; INDIGENOUS ORGANISMS; ESCHERICHIA COLI; SALMONELLA; INTESTINES; MICROBIAL FLORA; FAUNA; PARASITES; DISEASE CONTROL; PHILIPPINES

Urban beekeeper harvests 58 kgs of honey from just two colonies. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(11) p. 48-51 (Nov 2019).*

APIS MELLIFERA; APICULTURE; HONEY; HONEY PRODUCTION; PROCESSED ANIMAL PRODUCTS; ANTIOXIDANTS; ANTIMICROBIAL PROPERTIES

L02 Animal feeding

Effect of adding wheat stalk and molasses to potato leaves and stems on silage chemical composition and fermentation quality. **Zhao, F.F., Al-Marashdeh, O., Zheng, C., Guo, Y.L., Cheng, L.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 174-179. (Jun 2019).*

The study investigated the effects of adding wheat stalk and molasses to potato leaves and stems on silage fermentation quality. Potato leaves and stems were treated (fresh weight basis) for ensiling without additives (control), with 20% wheat stalk (W), and with 1%, 3%, and 5% molasses and 20% wheat stalk (WM1, WM3, and WM5, respectively). The nutritional compositions of raw materials and silage and fermentation quality were analyzed. Adding 20% wheat stalk could significantly reduce the pH value and acetic acid content in comparison with no additives. Adding molasses resulted in lower pH value and NH3-N content, higher lactic acid content, compared with the 20% wheat stalk group and the control group. Addition of 5% molasses could result in the highest level of lactic acid content and the lowest pH value and ratio of lactic to acetic acid. Adding 20% wheat stalk could increase the dry matter (DM) content, neutral detergent fiber (NDF) content and acid detergent fiber (ADF) content, decrease the crude protein (CP) content in comparison with no additives. Adding molasses could significantly improve the CP content and reduce the NDF and ADF content compared with the 20% wheat stalk addition group. Generally, applying wheat stalk and molasses additives improved the fermentation characteristics and silage quality of potato leaves and stem, in which the greatest improvement was achieved by adding molasses at 5% to forage mixture containing 80% potato leaves and stems + 20% wheat stalk on a fresh weight basis.

POTATOES; LEAVES; STEMS; WHEATS; MOLASSES; CHEMICAL COMPOSITION; FERMENTATION; SILAGE

L20 Animal ecology

Ecological implications of domestic cat ranges on the Calayan rail in the forest sanctuary of Calayan Island, Cagayan, Philippines. **Lastica-Tennura, E.A., Afuang, L.F., Balatibat, J.B., Masangkay, J.S.** *Sylvatrop (Philippines) The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 17-30 (Jan-Jun 2018).*

Studies show that domestic cats are considered as one of the biggest threats to wildlife. They have been implicated in species decline on islands and on continents, and affect mammals, birds, reptiles, and amphibians. A preliminary assessment of the threats to the Calayan rail (Gallirallus calayanensis) showed that introduced domestic cats have effects on its conservation status from being vulnerable to being extinct. This study aims to determine domestic cat diet and ranges on Calayan Island; confirm if there is an overlap between cat and G. calayanensis habitat range; identify human perceptions on the possible impact of domestic cats on G. calayanensis; and provide basis for future management options. Results showed that cats traveled an average distance of 112.38 m and overlapped with the habitat of the G. calayanensis. Although cats were not perceived to be threats to local wildlife by the respondents, the cats sampled in the study were able to cross buffer areas into the wildlife sanctuary, implying a possible impact on species vulnerable to predation. Calayan Island, because of its size and importance to biodiversity, can be a possible model for island conservation through the control of introduced predators and management of pet ownership.

CATS; DOMESTIC ANIMALS; DIET; FORESTS; HABITATS; BIODIVERSITY; RESOURCE MANAGEMENT; PHILIPPINES

Enumeration of pollinators and floral visitors of some common weeds with notes on pollen characteristics. **Barrion-Dupo, A.L.A.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (1) p. 63-70. (Apr 2018).*

Inflorescences of six common weeds each representing its plant family, namely: Amaranthus spinosus L. (Amaranthaceae), Tridax procumbens L. (Asteraceae), Coccinia grandis (L.) Voigt (Cucurbitaceae), Euphorbia hirta L. (Euphorbiaceae), Oxalis corniculata L. (Oxalidaceae), and Lantana camara L. (Verbenaceae), were sampled. Data on the morphology of these flowers were compiled and pollen grains were extracted through the Feagri and Iversen's Acetolysis Procedure. In addition, floral visitors and pollinators were identified. Arthropod visitors and pollinators of these common weeds were mostly managed pollinators like Apis mellifera L. and Tetragonula biroi (Friese). Meanwhile, pierid and hesperiid butterflies comprised the lepidopteran floral visitors. New host plant records for these butterflies are reported from among these weeds.

AMARANTHUS SPINOSUS; AMARANTHACEAE; TRIDAX PROCUMBENS; ASTERACEAE; CUCURBITACEAE; EUPHORBIA; OXALIS; OXALIDACEAE; LANTANA CAMARA; APIS MELLIFERA; POLLEN; WEEDS; POLLINATION; POLLINATORS

Environmental factors affecting arthropods faunal diversity in brgy. [Barangay, village] San Miguel, Butacan [Philippines]. **Recto, K.S.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

In many ecosystems, arthropods have the greatest species diversity and biomass. They are critical to nutrient cycling and play important roles in natural ecosystems. Understanding terrestrial arthropods diversity and abundance is essential to prioritize areas for conservation actions and to eradicate activities such as conversion of forest areas to agricultural lands. Barangay [village] San Juan, San Miguel, Bulacan [Philippines] serves as habitat for terrestrial arthropods due to its climate. Application of agrochemicals, agro-practices, changes in atmospheric conditions, and vegetation contributes to the distribution of the insects in area. Certain modifications in the land influence the declamation of arthropod diversity, therefore, assessing arthropod distribution is relevant in determining the overall well-being of the area. Assessment of arthropod diversity in relation to environmental factors such as ambient air temperature, humidity, soil quality, and anthropogenic activities were conducted in July to November 2016 in three areas in the barangay with different land uses. The soil samples were collected using SWMB guidelines while anthropogenic activities were determined by conducting survey during sampling periods. The study found that distribution and abundance of arthropod species depends in the changes of environmental variables relevant to their survival and habitat. There are 906 individuals from 57 different families collected in the 3 sampling stations. The most abundant species is from Formicidae family from order Hymenoptera which is considered as a bio-indicator of habitat degredation followed by Pieridae and Acrididae. Erebidae, Nymphalidae, Lycanidae, Pyalidae, and Pieridae are also good bio-indicators of changing landscape and habitat. Moreover, Barangay San Juan's agricultural lands have the highest nitrogen and phosphorus content, exceeding the standard level due to the residents' activity such as application of fertilizer and pesticides, and agricultural land practices.

ARTHROPODA; BIODIVERSITY; STORAGE; INDIGENOUS ORGANISMS; ENVIRONMENTAL FACTORS; PHILIPPINES

Isozyme and morphometric analyses of natural populations of the Asian honey bee (Apis cerana Fabricius) from different geographical areas in the Philippines. **Montalbo, M.D., Aquino, G.M.B., Tandang, R.N., Laude, R.P.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (1) p. 37-49. (Apr 2018).*

The isozyme and morphological variability in natural populations of the Asian honey bee (Apis cerana Fabbricius) from three different geographical areas in the Philippines (Area I: Batangas, Cavite, and Laguna; Area II: Cagayan de Oro; Area III: Bicol) were detected by starch-gel electrophoresis and morphometric analysis. Isozyme polymorphisms were detected for alkaline phosphatase, acid phosphatase, esterase and malate dehydrogenase, as encoded by 13 presumptive loci. Based on the observed proportion of polymorphic loci and average heterozygosity, genetic variability was highest in the Area II population. The genetic and genotypic variabilities between populations from Areas I and II suggest a possible mechanism of subspeciation. Principal component analysis of 31 morphometric characters yielded 4 possible clusters of bee populations. Areas II and III each formed district clusters, but Area I was divided into the Batangas-Cavite cluster and the Laguna cluster. The Cagayan de Oro (Area II) population had the highest measurements for most of the size-related characters, whereas the Bicol (Area III) population had the lowest. The isozyme and morphometric analyses of Apis cerana consistently showed considerable divergence between the populations from Areas I and III. However, the Area II population was not as distinct from other populations.

APIS CERANA; HONEY BEES; ISOENZYMES; POPULATION GENETICS; GEOGRAPHICAL DISTRIBUTION; POLYMORPHISM

Records of floral visitation by dipterans on Malaboo, Rafflesia lagascae Blanco (RAFFLESIACEAE), mainly in Mount Makiling, Laguna, Philippines. **Lit, I.L.** *Philippine Entomologist (Philippines). 0048-3753. v. 32 (1) p. 51-61. (Apr 2018).*

Floral visitors of Rafflesia lagascae Blanco are identified and recorded as actual or potential pollinators. The most commonly observed was the metallic blue blow fly, Chrysomya megacephala (Faricius), while two other blow flies, observed but not collected include a dull-colored, bristly species that probably belongs to Bengalia, and the greenish-blue species Lucilia fumicosta Malloch. The red-eyed flesh fly, Sarcophaga sp., was also observed to visit and possibly larviposts some of its tiny maggots into the perigone. The common housefly, Musca domestica L., vinegar flies Drosophila spp., and undetermined dolichopodids and phorids were also observed. The phorids probably play a greater role towards the decay of the more matured flowers. Video-documentation and other field studies are recommended for this threatened Rafflesia species in a forest reserve that has witnessed a recent rise in tourist visits.

RAFFLESIACEAE; CALLIPHORIDAE; SARCOPHAGIDAE; MUSCIDAE; POLLINATORS; PARASITIC PLANTS; BEHAVIOUR; PHILIPPINES

Spatial ecology of a male and a female leopard cat (Prionailurus bengalensis heaneyi Groves 1997) in Aborlan, Palawan, Philippines. **Fernandez, D.A.P., de Guia, A.P.O., Dimalibot, J.C., Bantayan, N.C.** *Sylvatrop (Philippines) The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 1-16 (Jan-Jun 2018).*

The spatial ecology of Palawan leopard cats (Prionailurus bengalensis heaneyi) was studied using live trapping, radio telemetry, and small mammal trapping from May 2013 to July 2014 in Aborlan, Palawan, Philippines. One adult female and 3 adult male P. b. heaneyi were captured. Radio-collars were attached to one adult male and one adult female individual then released in their respective capture sites. Radio telemetry was conducted for 32 days per season. Non-volant small mammals were captured using box traps and released to determine prey species availability. Results showed that the habitat types utilized by the 2 P. b. heaneyi include: forest (71.09%), mixed brushlands (25.78%), coconut plantations (2.60%), and built-up areas (0.52%). The mean 95% minimum convex polygon (MCP) home range of the male (6.2917 sq km) was larger than that of the female (3.9236 sq km). An increase in mean home range size from dry season (3.5658 sq km) to wet season (4.0611 sq km) for both sexes could be related to the decrease in small mammal abundance during wet season. Small mammal species captured in the area included Rattus exulans, Rattus tanezumi, Sundasciurus steerii, Maxomys panglima, and Tupaia palawanensis. When prey availability decreases, leopard cats may be driven to occupy larger ranges in search of food.

LEOPARDS; MALES; FEMALES; ANIMAL ECOLOGY; HABITATS; TRAPPING; PHILIPPINES

L60 Animal taxonomy and geography

Additional contributions to the knowledge of Philippine predatory mites mainly of the subfamilies Cunaxinae and Cunaxoidinae (Acari: Prostigmata: Cunaxidae). **Corpuz-Raros, L.A., Naredo, J.C.B., Garcia, R.C.** *Additional taxonomic studies on predatory mites of the family Cunaxidae (acari) from the Philippines, Corpuz-Raros, L.A..- College, Laguna (Philippines), 2018. TR-1838.- p. 40-68.*

A new species of cunaxid mite belonging to the subfamily Cunaxinae, Cunaxa minidiscondyla is described from the Philippines. This species is distinctive by the presence of a small disc-shaped adophysis dorsodistally on palp telofermur, two spine-like setae on palp genu, a long spine-like data on palp tibiotarsus, ill-defined prodosomal shield, absence of hysterosomal shield long hysterosomal setae, and basifemoral and telofemoral chaetotaxy of 4-4-3-1 and 5-5-4-4, respectively. The previously unknown male of Dactolyloscirus trifidus Corpuz-Raros, 2008 (Cunaxinae) and female of Lupaeus longisetus (Corpuz-Raros, 1996) (Cunaxoidinae) are described. A supplementary description is provided for Scutopalus clavatus (Shiba, 1976) (Cunaxoidinae) wich is recorded for the first time in the Philippines on coconut leaves infested with the scale insect, Aspiotus rigidus Reyne. New locality and habitat data are given for some species of the aftermentioned subfamilies, as well as the subfamilies Bonzinae and Orangescirulinae.

ACARINA; PROSTIGMATA; PREDATORS; NEW SPECIES; PHILIPPINES

Additional taxonomic studies on predatory mites of the family Cunaxidae (acari) from the Philippines. **Corpuz-Raros, L.A.** *TR-1838.*

Taxonomic studies were conducted to identify and officially document cunaxid species that were collected mainly in 2016 from Mt. Makiling and vicinity in Laguna, University of the Philippines Land Grant area within the boundaries of Laguna and Quezon and several localities in Northern Luzon provinces of Isabela, Nueva Viscaya and Pangasinan. Samples of litter and other organic debris, as well as nests of ants and termites, were bagged in the field and subjected to Tullgren extraction in the laboratory. Mites trapped in the jar beneath each funnel were sorted out from other arthropods, cleared in lactic acid and mounted on glass slides for microscopic examination and identification and preparation of illustrations for species that were found to new to science or previously not known to exist in the Philippines. A total of 185 specimens were collected and prepared; these belong to 5 subfamilies, 11 genera and 24 species. Addition of new species discovered in the study brings the total diversity of Philippine Cunaxidae to 80, the highest on record worldwide at present. New habitat records were also found for 19 other species that were previously reported from the country. Two forml reports were published, the first dealing with the subfamily Coleoscirinae, and the second mainly with the subfamilies Cunaxinae and Cunaxoidinae. Four new coleocirine species were described as new to science- Neobozia ermilovi Corpuz-Raros, Naredo and Garcia; Corpuz-Raros, Naredo and Garcia; and Neoscirula lambatina Corpuz-Raros, Naredo and Garcia. In the second paper, one new species, Cunaxia minidiscondyla Corpuz-Raros Naredo and Garcia (subfamily Cunaxoidinae) was recorded for the first time in a country outsite its original or type locality in Peninsular Malaysia. The last species is a significant discovery as it was collected along with other predatory mites associated with the Cocolisap scale insect (Aspidiotus rigidus Reyne) in Batangas where there were then outbreak infestations by this pest on coconut. The previously unknown female of Lupaeus longisetosus (Corpuz Raros, 1996) and male of Dactyloscirus trifidus Corpuz-Raros, 2007 were also discovered and described for the first time.

ACARINA; SPECIES; PREDATORS; TAXONOMY; NEW SPECIES; PHILIPPINES

Catalogue of oribatid mites (acari) of Southeast Asia. **Corpuz-Raros, L.A.** *TR-1916.*

A catalouge of the oribatid fauna of Southeast Asia (SEA) as presented, covering a period of 113 years, from 1905 when the first nine species were reported by the Italian zoologist.Antonio Berlese, from the island of Java, to the end of 2018. For each species, information on the reference to the original description and

subsequent recombinations with their genera are given, type locality and habitat from where it was first collected, other localities and habitats recorded later, and its geographic distribution within the outside SEA. These data were gathered from over 600 different publications containing original species descriptions, rediscriptions and new species records, as well as world catalouges, checklists and keys for identification of taxa including those originality described from SEA. Other references to original descriptions and type locality of species that were originally described outside SEA but later found to exist also in the region were also consulted. Europeans have led explorations in the region in the 1960s to early 1990s, and taxonomic accounts of collections deposited in European museums are mainly due to acarologists from Hungary, Poland, Japan and Russia, the last especially on the Vietnamese fauna. Except for the Philippine and Vietnam, contributions from nationals of these countries are minimal, although some acarologists from Thailand have recently taken oribatids as subjects of research. Southeast Asia lies within the tropics and comprises countries located above the equator up to approximately 20 sup 0 N, and parts of Indonesia below the equator up to 10 sup O S, and it longitudes between 90 sup O W to 150 sup O E. It includes 11 countries squeezed between the Indian Ocean and Pacific Ocean-Myanmar, Thailand, Laos, Cambodia and Vietnam on the Southeastern edge of the Asian continent were most of them share their northern boarder with China; and the Malay Archipelago composed of a group of islands politically belonging to Malaysia, Brunei, Singapore, Indonesia, East Timor and the Philippines. All of these countries belong to the Oriental Region except for the Indonesian Moluccas Islands and Iran on the western half of New Guinea Island which are zoogeographically part of the Australian region. Among the various component countries, Vietnam has the highest number of recorded species at 623, followed by the Philippines (511), Indonesia including Kalimantan located in Borneo Island (406), Malaysia including Sabah and Sarawak in Borneo Island (255), Thailand (116), Brunei in Boromeo Island (66), Cambodia (32), Singapore (25), Myanmar (11), while not a single species is currently known from East Timor and Laos. Most of the species known from the Malaysia come from its two provinces (Sabah and Sarawak)which compromise East (Malaysian) in Boromeo Island with 194, or more than twice that on Peninsular or West Malaysia with 77 species. On the whole, Boromeo Island which is home for three countries, has 246 recorded species with Sabah and Sarawak, having 194, Brunei, 66 and Kalimantan only 20species. A greater portion of the recorded species, that is, 945 or 61.9% of the total (1,526) occur only in or are endemic to Southeast Asia as delimited here. Endemism to the individual countries ranges from 33.2 and Brunei (56.1%). The relatively better known and bigger countries have lower rates of endemism - 28.7% for Vietnam, Philippines 46.8%, Malaysia 42.3%, Thailand 37.1%, and Indonesia 33.0%. Oribitads are found in extremely diverse habitats not only in the soil-litter system but many are aboreal and a few are aquatic. In terrestrial ecosystem,, they exist in biomes from the coast of marine and freshwater bodies to the highest elevations where forest habitats become mossy and foggy. The original vegetation of tropical rain forests primary dipterocarp forests, although much diminished in modern times, still exist in many parts of Southeast Asia. There are also monsoon forests, dry tropical forests, natural re-growths of mixed secondary forests, man-made tree plantation forests, mangrove swamps and marshy peat forests along coasts of islands, freshwater swamp forests, agricultural areas from lowlands to uplands, and patches of savanna and grasslands inland. Within these broad biomes, numerous habitats or microhabitats are as limitless as the vegetation and environmental conditions therein. Foremost of these are plant debris fallen to the ground inside caves or in water, mosses on dry or wet ground, or actually submerged in freshwater or marine waters; and on orboreal parts of living trees and understory shrubs. Less frequently, they inhabit the nests of social insects like ants, termites, bees and wasps and vertebrates mainly birds, and their droppings, or on the bodies of these animals themselves. Orbatid species reported from the most diverse habitats are usually also the most widely distibuted geographically with a given country or across the world zoogeographic regions. Scheloribates praeniscus appears to have the most diveres habitats in SEA,

including most of those mentioned earlier. Other, widespread species are Peragalumma margaritata, Lamellobates molecula, Peloribates kaszabi, Trachyoribates ovulum, Opiella nova, Zetorchestes saltator, Tectocepheus velatus, Trichyoribates ovuum, Opiella nova, Zetorchestes saltator, Tectocepheus velatus, Trichogalumma nipponica, Ermobelba bellicosa, Suctobelbella variosetosa, Lamellobates (Paralamellobates) misella, Mesoplophora plantotrema, and Eremelus avenfer.

ACARINA; SPECIES; FAUNA; HABITATS; DENSITY; SOUTH EAST ASIA

L72 Pests of animals

Development of effective management strategies for low-cost/organic production systems through the identification and analysis of the microbial flora and parasite fauna of the Philippine native swine. **Paller, V.G.V., Opulencia, R.B.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1866.*

SWINE; INDIGENOUS ORGANISMS; ORGANIC AGRICULTURE; MICROBIAL FLORA; PARASITES; INTESTINES; PHILIPPINES

Study 2: understanding the parasite fauna of the Philippine native swine. **Paller, V.G.V., Opulencia, R.B.** *Development of effective management strategies for low-cost/organic production systems through the identification and analysis of the microbial flora and parasite fauna of the Philippine native swine, Paller, V.G.V.Opulencia, R.B..- College, Laguna (Philippines), 2017. TR-1866.- p. 108-228.*

Philippine native swine industry has increased in the past recent years in the country and common in smallholder ares where it is kept under low-cost farming system. At present, there is an increasing demand for native swine meat due to its nutraceutical value of palatability. However, there is a dearth of information regarding the potential threats, such as parasites, in low-cost native swine farming. Hence, this study aimed to determine the parasite fauna of the Phil. native swine among smallholder farms and assess the extent of contamination in the environment. Examination of native swine samples from municipalities of Quezon Province [Philippines] identified 14 parasites, all of which have adverse effects on animal health and are potential zoonotic agents, thus, have implications to public health. Morphological and molecular identification revealed the presence of the five nematode species namely, Ascaris suum, Metastrongylus apri, two species of Oesophagostomum (O. dendatum and O. quadrispinulatum), Strongyloides ransomi, and Trichur suis; and nine protozoan species namely, Balantidum coli, Blastocystis sp. Crytosporidium sp., Eimeria sp. Endolimax nana, Entamoeba spp., Giardia sp., Iodamoeba butschlii, and Isospora sp. Two subtypes of Blastocystis were also identified namely subtype 1 associated with human and subtype 3 associated with swine and ruminants. Parasites' eggs/larvae were also found contaminating soils from farm vicinities such as Ascaris sp., Trichuris sp., Toxocara sp. and Hymenolepis nana, strongylids, and coccidian oocysts. Cryptoporidium oocysts and Giardia cysts were also recovered from water samples. Univariate analysis showed significant associations of the occurrence of parasite with the sex of swine, farming experience, raising other livestock in the farm , provision of mixed raw roughage to animals, administration of medication to sick pigs, routine deworming of pigs, and farmers' knowledge on the impact of manure to the environment. The current data will be useful in improving agricultural practices in marginalized sectors and facilitate effort from various stakeholders to mitigate the adverse effects of parasitic infections in native swine.

SWINE; INDIGENOUS ORGANISMS; FAUNA; PARASITES; PEST CONTROL; NEMATODA; PHILIPPINES

Understanding the gastrointestinal microbial flora of the Philippine native swine. **Paller, V.G.V., Opulencia, R.B.** *Development of effective management strategies for low-cost/organic production systems through the identification and analysis of the microbial flora and parasite fauna of the Philippine native swine, Paller, V.G.V.Opulencia, R.B..- College, Laguna (Philippines), 2017. TR-1866.- p. 1-107.*

The Philippine Native Swine has been widely accepted as a more robust and more disease-resistant swine breed than the white crossbreeds or hybrid. The microbiota of an animal's intestinal tract has long been shown to play significant functions in the overall health and productivity of swine. However, there is no known study on the microbial diversity in the gut of the Philippine native swine. In this study, the microbial succession in the ileum of Philippine native swine at one-, two-, three-, and four-week- old was determined by 16S rRNA gene analysis using the paired-end Illumina HiSeq platform. A clear succession pattern of microbial colonization was observed where the phyla Chlamydiae and Proteobacteria were predominant in one-week-old swine while Firmicutes dramatically increased as the swine aged. The most dominant bacterial genera at every swine age were potentially pathogenic to both humans and animals. Phenotypic and genotopic analyses of 58 weaning and market age swine from various municipalities in Quezon province revealed the occurrence of bacteria that could cause food poisoning. The shiga toxin-producing Eschirichia coli (STEC) and Salmonella were detected at 91% and 26% of the native swine, respectively.

SWINE; INDIGENOUS ORGANISMS; ESCHERICHIA COLI; SALMONELLA; INTESTINES; MICROBIAL FLORA; FAUNA; PARASITES; DISEASE CONTROL; PHILIPPINES

M. FISHERIES AND AQUACULTURE

M01 Fisheries and aquaculture - General aspects

Improving productivity of sea cucumber processing through mechanization and packaging. **Yaptenco, K.F., Pangan, R.S.** *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, Paseo de Valmayor, Economic Garden, Los Baños (Philippines).; Alsons Aquaculture Corp., Alabel, Sarangani (Philippines).; Bureau of Fisheries and Aquatic Resources, Region 3, Masinloc, Zambales (Philippines).; Fishermans' Association of Batingue, Pagbilao Quezon (Philippines).; Orient Pearl Seafood Restaurant , Cal. TR-1871.*

SEA CUCUMBERS; PRODUCTIVITY; PROCESSING; MECHANIZATION; PACKAGING; EQUIPMENT

M11 Fisheries production

Cage culture of rabbitfish in La Union [Philippines]. **Guerrero, R.D. III.** *Agriculture (Philippines) v. 23(11) p. 24 (Nov 2019).*

SIGANUS; CHIMAERIFORMES; CAGE CULTURE; ANIMAL FEEDING; GRACILARIA; SEAWEEDS; INCOME; MARKET PRICES; PHILIPPINES

M12 Aquaculture production

New findings from the 12th Asian Fisheries and Aquaculture Forum. **Guerrero, R.D. III.** *Agriculture (Philippines) v. 28(10) p. 24-25 (Oct 2019).*

PRAWNS AND SHRIMPS; TILAPIA; CRABS; AQUACULTURE; TECHNOLOGY; ANIMAL FEEDING; WASTEWATER TREATMENT; BIOREMEDIATION; PROBIOTICS

M40 Aquatic ecology

Initial assessment of plant community structure using point-centered quarter method in a 15 year old reforested mangrove forest in Brgy [barangay, village] Gulod Calatagan, Batangas, Philippines. **Amante, Q.B., Bariring, A.A.T., Fuentecilla, S.R., Husana, D.V.P., Larida, N.J.A., Nicolas, M.G., Pancho, U.Z., Taguinod, J.J.P., Tambaon, F.G.S., Luna, D.A., Adorador, J.T., Meneses, Z.D., Rabena, M.A.F.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

The structure of the reforested mangrove community in Brgy. [village] Gulod, Calatagan, Batangas [Philippines] was determined through assessment of physico-chemical parameters such as dissolved oxygen (DO), pH, salinity, and electrical conductivity and species composition and diversity using Point-Centered Quarter Method (PCQM). The mangrove area was divided into two sites, namely, edge and interior. Results showed that the mangrove forest is exposed to low DO level and high pH, salinity, and conductivity. A total of five species were recorded from the whole area. Edge site is more diverse with species richness of (S=5) and Simpson Index of Diversity (SID) of 0.23 compared to the interior site (S=3; SID=0.41) which was dominated by Avicenia oepata showing higher tree density (193 trees/ha). PCQM is subjective sampling thus the use of other sampling techniques and increasing the sampling size are recommended to determine the density and diversity of the mangrove ecosystem.

MANGROVES; ECOSYSTEMS; VEGETATION, DENSITY, BIODIVERSITY, BOTANICAL COMPOSITION, PHILIPPINES

N- AGRICULTURAL MACHINERY AND ENGINEERING

N20 Agricultural machinery and equipment

Enhancement of the forest genetics laboratory of the College of Forestry and 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.*

Laboratory mass rearing of the five lepidopteran pests of cornnamely the Asia acorn borer (ACB Ostrini furnacalis), Corn earworn (CEW Helicoverpa armigera). Common cutworm ((CCW Spodoptera litura), Corn semi-looper (CSL Chrysodeixis eriosoma) and True armyworm TAW (MYthimna separata), was done from 2011-2016 with the principal focus on rearing ACB. Field collection of Laguna and Isabela ACB populations were conducted in several sites to cater test insects requirements of the different externally funded and core funded studies. In summary the IPB Entomology Laboratory was able to produce 786, 320 ACB, 1,640

ACB egg masses 363,825 CEW, 28,160 CCW, 27,830 CSL and 343,820 TAW. Several studies were conducted using the IPB modified artificial diet. Study 1 aims to determine the optimal temperature for rearing under laboratory conditions by subjecting CB rearing under different temperatures. Results showed that ACB performed better under normal room condition. In study 2, different techniques for infestation of Asian corn borer were evaluated. Results showed that infestation technique using corn stalk at 25 DAP was more efficient and infestation rate using 50 four-day old ACB larvae showed the most severe damage on the corn plants. Study 3, aims to lessen the cost of the rearing diet by substituting varying amounts of Baker’s yeast and corn oil. The experiment showed promising result but this is yet to be confirmed. An on-going experiment is being conducted to compare this method to the existing standard artificial diet. Study 4 determines the effect of X solution in egg mass production of ACB adult female. Result showed that the addition of the X solution to the honey/sugar solution in the ACB adult diet greatly improved the production of viable eggs by female ACB adults. With the improvement or rearing facilities, rearing methodologies and acquisition of skills by laboratory personnel, the Entomology Laboratory has established itself as the national center for mass rearing of Asian corn bore and other lepidopterous pests of corn.

FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES; PHILIPPINES

Laboratory mass rearing of Asian corn borer and other lepidopteran pests of corn for core-funded and externally-funded projects from 2011-2016. **Caasi-Lit, M.T., de Leus, E., Mantala, J.P.** *TR-1828.*

OSTRINIA FURNACALIS; MAIZE; ZEA MAYS; HELICOVERPA ARMIGERA; SPODOPTERA LITURA; CHRYSODEIXIS; MYTHIMNA; MASS REARING; PESTS OF PLANTS; LABORATORIES; LABORATORY EQUIPMENT; INFESTATION

Performance evaluation of single-cylinder diesel engine using different microemulsions of N-Butyl alchohol, coconut oil and diesel fuel. **Magmanlac, A.R.R., Eusebio, R.E., Fajardo, A.L., Suministrado, D.C., Zubia, O.F.** *Philippine Agricultural Scientist (Philippines). 0031-7454. v. 102 (2) p. 107-117. (Jun 2019).*

The use of n-butanol as surfactant allows the mixing of coconut oil and diesel fuel through microemulsification without any additional significant energy input compared with transesterification. This study evaluated the performance of a single-cylinder compression-ignition engine using different blends of n-butanol, coconut oil, and diesel. Four blends of fuel (D90-nB5-CO5, D80-nB10-CO10, D70-nB15-CO15, and D60-nB20-CO20 were formulated based on the available literature regarding the miscibility of the three fuel components. Each blend was evaluated at the engine’s maximum rated output speed and maximum torque speed and compared with commercially available diesel (B5) through the varying load tests. Statistical analysis revealed that there were no significant differences in the power output, torque, fuel consumption, and oil and water temperatures between the blends and D100. Significant differences were observed among the blends at maximum output speed (6.18 kW) which were attributed to the higher oxygen content of blend D60. Significant differences were also observed between D100 (534.33 deg C) and the blends (420.67 deg C, 361.33 deg C, 356.00 deg C, and 435.67 deg C) in terms of exhaust gas temperatures which were attributed to the higher latent heat of vaporization of n-butanol which contributed to a cool-burn effect. Therefore, blends of up to 40% of 1:1 ratio of n-butanol and coconut oil mixed with diesel fuel can perform at par with the commercially available diesel fuel.

DIESEL ENGINES; EQUIPMENT; EQUIPMENT PERFORMANCE; BUTANOL; SURFACTANTS; EMULSIONS; CHEMICAL REACTIONS; FUELS; DIESEL OIL; COCONUT OIL; ALCOHOLS

Policy study in support to the local assembly and manufacture of single cylinder engine for the Philippine Agri-Fisheries sector. **Rudulfo,V.A. Jr., Fajardo, A.L., Martinez, R.C., Santiago, M.R., Reyes, M.J.B., Llarena, A.E.** *TR-1777.*

In the Philippines, small agricultural engines are the major sources of power in the agri-fisheries sector. All agricultural engines currently available in the Philippines are imported units from Japan, China, India, Vietnam and other countries. Many of these engines are of good quality and imported by reputable local agricultural machinery distributors that provide after sales service nationwide. There were reports that small but significant volumes of used engines with fake brand names managed to reach the Philippines. These engines were less expensive than legitimately imported units. The quality, reliability and the after sales support of these engines are not fully guaranteed. Consistently, efforts have been made by the Philippine government and the private sector towards local prototyping and manufacturing of agricultural engines. Unfortunately, previous efforts did not prosper for various reasons such as low demand, technical problems, political situation, foreign partners, etc. and there is yet no locally manufactures agricultural engine in the market. The enactment and signing into law of Republic Act No. 10601 known as 'An Act Promoting Agricultural and Fisheries Mechanization Development in the Country' made it imperative to step up the efforts towards the local manufacture of agricultural engines. The Act stipulates that the local assembly and manufacture of agricultural engines shall be promoted and encouraged by the Department of Agriculture in partnership with the private sector and through joint venture agreements. In light of these need, the Center for Agri-Fisheries and Biosystems Mechanization (BIOMECH) of UPLB, funded by the Philippine Council for Agriculture and Fisheries of the Department of Agriculture (DA-PCAF) implemented the project on 'Policy Study in Support to the Local Assembly and Manufacturing of Single Cylinder Engine for the Philippine Agri-Fisheries Sector'. The general objective of the project is to create the enabling technical, operational and investment environments that will attract local investor and foreign partner to a joint venture agreement for the local assembly of small agricultural engine. This policy study is composed of six studies which require extensive research that involve the cooperation of government agencies, private individuals and various stakeholders. In Study 1, past and continuing efforts to locally assemble and manufacture single cylinder engines in the country were assessed. In Study 2, an overview of the current and projected demand single cylinder engines in the country was provided. In Study 3, factors considered in the viability of engine assembly/manufacturing in the country vis-a-vis imported engines were evaluated. In Study 4, a benchmarking study on manufacturing in China and Vietnam was presented. In Study 5, existing policies on joint ventures, investment priority plans and incentives in the country were reviewed and evaluated. Policy recommendations to (support the assembly/manufacture and commercialization of the locally-made single cylinder engine were presented.

AGRICULTURAL SECTOR; ENGINES; POLICIES; MARKETING; FARM EQUIPMENT; EQUIPMENT PERFORMANCE; EQUIPMENT CHARACTERISTICS

Upgrading of vegetable breeding facilities. **Maghirang, R.G.** *TR-1825.*

EQUIPMENT; MODERNIZATION; VEGETABLES; PLANT BREEDING; IRRIGATION SYSTEMS; SOIL STERILIZATION

P- NATURAL RESOURCES AND ENVIRONMENT

P01 Nature conservation and land resources

Conservation milestone of the critically endangered Philippine crocodile (Crocodylus mindorensis Schmidt 1935). **Manalo, R.I., Tabayag, E.A., Baltazar, P.C.** *Sylvatrop (Philippines) The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 31-48 (Jan-Jun 2018).*

Conservation efforts to save the rarest crocodile species in the world, the Philippine crocodile (Crocodylus mindorensis), were exerted through the years from 1891 to 2016. This study aimed to provide insights for the conservation management of the species by documenting the milestones that could form part of future conservation programs. The review of historical accounts and published scientific articles identified species milestones in a timeline format. Results showed that C. mindorensis became known to science as early as 1891, based on specimens collected from the island of Mindoro (FMNH 11135), and was originally described by Karl Schmidt as Crocodylus mindorensis in 1935. It was later considered as a subspecies of the New Guinea crocodile (Crocodylus novaeguineae mindorensis) until Philip M. Hall provided new evidence for its designation as a totally separate species in 1989. Wild populations severely declined in the early 1940s to 1980s due to human persecution and indiscriminate hunting for skin trade. This triggered distribution studies to locate and estimate the abundance of extant wild populations. Upon the conclusion of these studies in the early 1990s, the International Union for Conservation of Nature (IUCN) declared the species as critically endangered in 1996. Ex-situ conservation breeding program was deemed the only hope for the species in the late 1990s to early 2000s. The successful initiation and continuous development of the collaborative breeding programs have resulted into a restocking of the species to form nucleus populations in its natural habitat from 2009 to 2016. Over the course of 125 years, wild populations have been unearthed and the species was finally released in protected sanctuaries starting in the year 2009.

CROCODILES; RESOURCE CONSERVATION; ENDANGERED SPECIES; PHILIPPINES

Ecological implications of domestic cat ranges on the Calayan rail in the forest sanctuary of Calayan Island, Cagayan, Philippines. **Lastica-Tennura, E.A., Afuang, L.F., Balatibat, J.B., Masangkay, J.S.** *Sylvatrop (Philippines) The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 17-30 (Jan-Jun 2018).*

Studies show that domestic cats are considered as one of the biggest threats to wildlife. They have been implicated in species decline on islands and on continents, and affect mammals, birds, reptiles, and amphibians. A preliminary assessment of the threats to the Calayan rail (Gallirallus calayanensis) showed that introduced domestic cats have effects on its conservation status from being vulnerable to being extinct. This study aims to determine domestic cat diet and ranges on Calayan Island; confirm if there is an overlap between cat and G. calayanensis habitat range; identify human perceptions on the possible impact of domestic cats on G. calayanensis; and provide basis for future management options. Results showed that cats traveled an average distance of 112.38 m and overlapped with the habitat of the G. calayanensis. Although cats were not perceived to be threats to local wildlife by the respondents, the cats sampled in the study were able to cross buffer areas into the wildlife sanctuary, implying a possible impact on species vulnerable to predation. Calayan Island, because of its size and importance to biodiversity, can be a possible model for island conservation through the control of introduced predators and management of pet ownership.

CATS; DOMESTIC ANIMALS; DIET; FORESTS; HABITATS; BIODIVERSITY; RESOURCE MANAGEMENT; PHILIPPINES

Economic value of biodiversity in Korea with respect to social and ecological conditions. **So-Hee, P., Yeo-Chang, Y., Minkyung, K.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

To conserve biodiversity, South Korean government signed the UN Convention on Biological Diversity (CBD) in 1994 and established the 3rd national biodiversity strategies in 2014. Part of the strategy is the implementation of regulation policies that designated protected areas and protected species such as endangered species. These policies can be supported by people's evaluation of biodiversity conservation. However, economic value of biodiversity can be influenced by social conditions such as institutions and regimes as well as ecological conditions such as ecosystem type. In this study, the researchers aim to analyse the economic value of biodiversity in Korea with respect to social and ecological conditions using meta-analysis. Data was collected by searching keywords related to biodiversity on Research Information Service System (RISS) and National Discovery for Science Library (NDSL) database from 1990 to 2017. After data screening, 31 researches were included in data analysis. Number of researches on biodiversity increased since the Nagoya Protocol in 2010. Result indicates that biodiversity value of urban ecosystem and cultivated land tends to be higher than that of natural ecosystems including river, forest, wetland and ocean.

BIODIVERSITY; RESOURCE MANAGEMENT; ECONOMIC POLICIES; PROTECTED FORESTS; ENDANGERED SPECIES; EVALUATION; ECONOMIC VALUE; KOREA REPUBLIC

Environmental event broadens cultivation of indigenous Palawan cherry [Philippines]. **Yap, J.P.Jr.** *Agriculture (Philippines) v. 23(12) p. 30-32*
Dec 2019).

ENVIRONMENT; NATURE CONSERVATION; TOURISM; BIODIVERSITY; INDIGENOUS ORGANISMS; PHILIPPINES

Impact assessment of the National Greening Program in Malinao, Aklan, Philippines. **Orpia, Ma.K.P., Florindo, R.M., Tanael, R.L.Jr., Pintor, L.L.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

The National Greening Program (NGP) contributed in the improvement of biological diversity particularly in the plantation established in Osman, Malinao, Aklan [Philippines]. Impact assessment was undertaken in the area in 2016 wherein the results were compared to the baselining data gathered in 2013. Transect line method and opportunistic sampling covering the sampling sites assessed during the baseline activities in 2013 was conducted. Arthropods and other invertebrates were collected using sweep nets and pitfall traps where the baseline study occurred in 2013. Results showed that the diversity of the trees changed from relatively moderate to relatively high from 2013 to 2016 with values ranging from 2.67 to 3.09. The area became more diverse based from the Species Richness which increased from 28 in 2013 to 33 in 2016. The total number of individuals also increased from 134 to 161. The increase may be attributed to natural succession, lesser destructive human intervention, and enhanced protection efforts of the NGP

beneficiaries. The calculated Shannon diversity (H') values in 2013 are also higher compared in 2016 which implies that the area becomes less diverse inn species arthropods and invertebrates. Hymenoptera particularly ants was found dominant for ground-dwellers while Family Formicidae still dominates the site for foliage-dwelling arthropods. There was an increase in the species richness of herpeto-fauna particularly Macaca fascicularis Raffles and Paradoxurus hermaphroditus Pallas. Most of the species of herps and mammals listed during the impact assessment were gathered from ethno biological accounts. The result of impact assessment for avifauna shows high species richness than that of 2013 which recorded 22 species and 17 species, respectively. The relative abundance of 120 is similarly higher than the 51 counted during the baseline survey. The increase in species richness and relative abundance were due to the actual biophysical/environmental conditions of the area, the strategies applied during the assessment activities, and sampling period. Insectivorous birds are the most common in the area. This is considered as one of the reasons to the decrease in the insect population in the area.

SPECIES; BIODIVERSITY; TREES; ARTHROPODA; INVERTEBRATES; RESOURCE MANAGEMENT; IMPACT ASSESSMENT; PHILIPPINES

Institutionalizing cooperation and sustaining collective action: the case of the Binulasan [village in Infanta, Quezon, Philippines] Fisheries and Aquatic Resource Management Association, Inc. (BFARMA). **Bariuan-Elea, J.**

Buncag, M.J., Canizares, M.A., Capunitan-Abasolo, M.J., Magsanoc, S.L. *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Barangay Binulasan in Infanta, Quezon [Philippines] is known for the court battle that the local community fought contesting a powerful Manila-based politician's application for a Fishpond Lease Agreement (FLA). The case was instrument in inspiring the establishment of BFARMA, which then led to the group's entitlement of a Community-Based Forest Management Agreement (CBFMA). This study contributes to existing work that aims to better understand the issues that surround and affect the effectiveness and resilience of NRM institutions at the grassroots level. Researchers describe the institutionalization process in the rehabilitation and sustainable management of Binulasan mangroves through BFARMA's development and continued operation. Using a qualitative lens, authors constructed a highly contextualized and textured narrative of this institutionalization process, highlighting participant views, elicited through unstructured, informal interview-conversations. Recognizing the instrumental role played by the court battle in mobilizing collective action, analysis shows the importance of leadership of selected local champions in pushing forward efforts to institutionalize mangrove rehabilitation and sustainable management in Binulasan. This study also highlights BFARMA's catharsis to lead a new social movement (NSM) and transformation of the sporadic and cyclical nature of members' participation in order to contribute towards livelihood sustainability which is vital to the organization's continued ability to carry our its commitments. Three things are necessary to sustain the collective action inspired by BFARMA and achieve natural resource management (NRM) resilience and effectiveness: (a) improve BFARMA's ability to adapt to future shocks through promotion of values appropriate for organizational effectiveness and development of capacities of its members; (b) contribute towards rural poverty alleviation objectives by facilitating local livelihood development so that the undertaking remains attractive to locals; and (c) continue to expand its influence as an NRM agent by working in close partnership with the LGU in enjoining the larger community so that value formation is not confined to members but is shared by the local society it serves.

MANGROVES; RESOURCE MANAGEMENT; SUSTAINABILITY; FOREST REHABILITATION; RURAL COMMUNITIES; SOCIAL PARTICIPATION; PHILIPPINES

Odonata communities and habitat characteristics in Mount Kanlaon Natural Park, Negros Island, Philippines. **Pagal, N.A.G., Dagoc, K.M.F., Warquez, D.A., Paguntalan, L.M.J., Jakosalem, P.G.C., Villanueva, R.J.T.** *Sylvatrop (Philippines) The Technical Journal of Philippine Ecosystems and Natural Resources v. 28(1) p. 49-72 (Jan-Jun 2018).*

A study on the diversity, abundance, and habitat preference of odonates on different habitat types and altitudinal gradients in Mount Kanlaon Natural Park [Philippines] was conducted from May 18 to June 2, 2015 using line transect, visual searching techniques aided by sweep nets, hand catching, and photo documentation. A total of 72 plots with a size of 10 x 10 m each was established in the study area for habitat assessment. Eleven species, in which 8 are Philippine endemics, were recorded. Highest diversity (H1=2.05) and endemicity (70%) were recorded in secondary lowland forest. Areas with low elevation had the highest species richness (S=10). Furthermore, all species found in high elevation were considered endemic. The Philippine endemic Cyrano unicolor was the most abundant species. Canonical Correspondence Analysis showed that height of understory level seems to influence the abundance of Drepanosticta cf. pistor, canopy cover and elevation might influence the abundance of Heteronaias heterodoxa, and stream depth might affect the abundance of Neurobasis subpicta. Multiple Regression Analysis identified water pH as an important factor influencing the occurrence of C. unicolor while occurrence of Risiocnemis rolandmuelleri might be dependent on tree density.

ODONATA; HABITATS; INDICATOR ORGANISMS; NATIONAL PARKS; BIODIVERSITY; PHILIPPINES; INDIGENOUS ORGANISMS

REDD+ co-benefits: poverty reduction and biodiversity conservation. **Valenzuela, R.B., Yeo-Chang, Y.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

To conserve biodiversity, South Korean government signed the UN Convention on Biological Diversity (CBD) in 1994 and established the 3rd national biodiversity strategies in 2014. Part of the strategy is the implementation of regulation policies that designated protected areas and protected species such as endangered species. These policies can be supported by people's evaluation of biodiversity conservation. However, economic value of biodiversity can be influenced by social conditions such as institutions and regimes as well as ecological conditions such as ecosystem type. In this study, authors aim to analyse the economic value of biodiversity in Korea with respect to social and ecological conditions using meta-analysis. Data was collected by searching keywords related to biodiversity on Research Information Service System (RISS) and National Discovery for Science Library (NDSL) database from 1990 to 2017. After data screening, 31 researches were included in data analysis. Number of researches on biodiversity increased since the Nagoya Protocol in 2010. Result indicates that biodiversity value of urban ecosystem and cultivated land tends to be higher than that of natural ecosystems including river, forest, wetland and ocean.

FORESTS; RESOURCE MANAGEMENT; BIODIVERSITY; CLIMATIC CHANGE; DEFORESTATION; SOCIAL PARTICIPATION; POVERTY; RURAL AREAS

Biomass incentives in the Philippines. **Pajarillo, D.S.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 60-63.*

BIOMASS; POLICIES; INVESTMENT; LEGISLATION; PHILIPPINES

Planning-workshop and hosting of the Philippine International Biomass conference. **Briones, M., Movillon, J., Dizon, L.S., Obligado, F., Demafelis, F.A.** Department of Energy, Energy Center, Rizal Drive,Bonifacio Global City, Taguig City (Philippines)., Department of Environment and Natural Resources, Visayas Avenue, Diliman, Quezon City (Philippines)., Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research., 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. *TR-1823.*

Philippines, an agricultural country, has subscribed amount of biomass resources, which could be used for power generation and biofuel production. The government highlighted this when Republic Act 9367, also known as 'The Biofuels Act of 2006, was implemented. In support to this, the University of the Philippines Los Baños-Interdisciplinary Biofuels Research Studies Center (UPLB-IBRSCI). In cooperation with the Department of Agriculture-Bureau of Agricultural Research (DA-BAR). Department of Environment and Natural Resources (DENR) and Department of Energy (DOE), launched the 2015 Philippine International Biomass Conference to address certain issues on biomass resources in the country. A Planning-Workshop for the event was conducted from April 21-24 2015 at the Atlantic Hall, Convention Center of Widus Hotel and Casino, Clark, Pampanga. The conference Director Dr. Myra G. Briones, UPLB-IBRSC Chair Prof. Rex B. Dimafelis. DA-BAR Director Dr. Nicomedes P. Eleazar headed the activities for the workshop. Present were members of UPLB-IBRSC and staff of DA-BAR. Committees were formed and each formulated plans and strategies for the conduct of the conference. Aside from planning, team building and social's night were also held to boost synergy among organizers of this event. The logistics committee also had their ocular inspection of the venue and its surrounding vicinity. The 2015 Philippine International Biomass Conference was held on June 16-18, 2015 at the Convention Center of Widus Hotel. This event aimed to discuss the Philippine roadmap on bioenergy industry, present the recent technological innovations in the bioenergy industry, establish bonds and synergies among the different sectors in the bioenergy industry, promote the use of biomass and increase knowledge with the importance of bioenergy. Speakers were from the academe, local and international biofuels companies, industries, government agencies and banking and financial institutions. Press conference, open forums, cocktail and business matching activities were also conducted on the second day while a plant visit at San Jose City 1 Power, Nueva Ecija was held in the third day. There were a total of 324 people present during the first day while 423 people during the second day. Most attendees are from the industry, government agencies and local government units.

BIOMASS; BIOFUELS; ENERGY GENERATION; BIOENERGY; TRAINING COURSES; PHILIPPINES

Policy incentives and investment barriers to fuelwood plantation development in the Philippines. **Bugayong, L.A.** *TR-1864.*

Woodfuels sush as firewood and charcoal continue to be used by households for cooking and by commercial establishments such as bakeries, restaurants/eateries, barbecue/grilled food vendors, and food processing, industries. Woodfuels are more affordable than electricity, liquefied petroleum gas (LPG), and kerosene are among other energy resources. Likewise, rural households, get fuelwood from the trees in the backyards, farms or nearby forest using damaged wood, branches, trees tops, and other logging wastes and agricultural residues. Estimated average annual per capita consumption is 400-700 kg/capita/year. The 2016 forestry master plan estimates a total of planting area of 372,228 ha is required to supply total consumption by 2031. There are many policies and incentives for investments in to supply total consumption by 2031. There are many policies and incentives for investments in fuelwood and biomass plantation development. Among the barriers to increased or sustained investments are unstable policy environment (conflicting, fragmented, changing different interpretations at field level, etc.), lack of database, lack of information on available areas for plantation development, difficult to access incentives and financing programs, fuelwood prices lower than those of development, difficult to access incentives and financing programs, fuelwood prices lower than those of round wood products, and lack of national strategy for fuelwood development. Recommendations to address these barriers include development of database on fuelwood/biomass plantations, identification of available areas for plantation development, information campaign on available areas and incentives for investors, streaming and harmonization of regulatory policies, deregulation, and strengthening of forest protection thru incentivizing local initiatives.

FUELWOOD; PLANTATIONS; CHARCOAL; HOUSEHOLDS; POLICIES; INCENTIVES; INVESTMENT; PHILIPPINES

P06 Renewable energy resources

Bioenergy direction of Philippines: a global perspective. **Dar, W.D.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 54-56.*

SORGHUM BICOLOR; BIOENERGY; ETHANOL; ENERGY POLICIES; PHILIPPINES

Bioethanol production from the first and second generation feedstocks. **Hong Chee Kean.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 51-54.*

ETHANOL; PRODUCTION; ENERGY SOURCES; BIOMASS; RAW MATERIALS

Biomass-to-energy. **Tadeo, B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p.31-37.*

BIOMASS; BIOFUELS; RENEWABLE ENERGY; CROP RESIDUES; AGRICULTURAL WASTES

Commercial bio-oil production and business model for multi-purpose application. **Ray, A.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 57-60.*

NATURAL GAS; BIOMASS; BIOFUELS; ENERGY GENERATION

Current situation and potential of super sorghum in the Philippines. **Ikeda, R.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 56-57.*

SORGHUM; SPECIES; BIOMASS; BIOFUELS; PHILIPPINES

Financing green projects. **Lledo, J.B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 68-70.*

BANKING; FINANCING; LOANS; BIOMASS; PHILIPPINES

Interdependency of biothermal and sugarcane industry. **Amarra, A.B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International*

Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 44-50.

SUGARS; ETHANOL; MOLASSES; BIOMASS; SUGARCANE; INDUSTRY

LBP [Landbank of the Philippines] bioenergy loan facility. **Ramos, J.A.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 71-72.*

BIOENERGY; COOPERATIVE BANKS; LOANS; RENEWABLE ENERGY; PHILIPPINES

Municipal solid waste and its potential for waste-to-energy. **Cabeso, B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 37-44.*

SOLID WASTES; WASTE MANAGEMENT; WASTE UTILIZATION; ENERGY; LOCAL GOVERNMENT; COMPOSTING; RECYCLING; LANDFILLS

Research and development initiatives of UPLB [University of the Philippines Los Baños]. **Demafelis, R. B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 63-66.*

SORGHUM; JATROPHA; SPECIES; DIESEL ENGINES; BIOFUELS; RESEARCH; EDUCATIONAL INSTITUTIONS; PHILIPPINES

Status and potential of agricultural residues in the Philippines. **Benavidez, P., II.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College,*

Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 28-29.

RICE; MAIZE; COCONUTS; CROP RESIDUES; BIOMASS; PHILIPPINES

P10 Water resources and management

Customer satisfaction survey (CSS) on the LLDA's [Laguna [Philippines] Lake Development Authorities'] overall performance. **Abrigo, C.S.** *Laguna Lake Development Authority, LLDA Bldg., National Ecology Center, East Ave, Diliman, Quezon City (Philippines). TR-1847.*

This report explains the findings of the satisfaction study conducted to determine the perception of the level of satisfaction of stakeholders of the LLDA's [Laguna [Philippines] Lake Development Authority] programs and project implemented in the Laguna de Bay (LDB) region. Specifically, it aimed to: 1. determine the level of stakeholders awareness of the LLDA's mandate vision, mission and objectives; 2. identify issues and concerns about the lake that confront the stakeholders and recommend measures that shall address gaps in the perception and satisfaction of the respondents on the service quality given by the LLDA; 3. identify the programs, projects and activities wherein stakeholders relate with the LLDA; 4. identify specific collaborative approaches/strategies/mechanisms among the stakeholders that would pursue or intensify institutional relationship; and 5. to analyze the factors associated with the overall rating of the respondents. In this study, satisfaction refers to the act of fulfilling the needs and managing expectations of the stakeholders in relation to their mission and mandate of (Market and Opinion Research Institute, 2004). Based on the said research, there are several key drivers that affect the satisfaction of stakeholders and costumers to the service provided by company institution. In this study, four drivers were considered. These are: 1. delivery and quality of services; 2. staff attitude and professionalism; 3. transparency to stakeholders; and 4. office operations and environment guidelines. To measure the stakeholders' satisfaction for driver, several statements were rated by the respondents/key informants (KIs). The samples was derived from the population of 35,930 stakeholders of the LLDA. These stakeholders were categorized into five such as: industries, fisheries and aquatics resources management councils (FARMCs),fishpen/cage operators, local government units (LGUs), non-government organizations (NGOs) and people's organizations (POs). With only a few number of individuals to be interviewed in the national government agencies (NGAs) and the academe, complete enumeration was used. Stratified random sampling was used to determine the samples for the remaining five categories. From the population, a sample of 290 was derived. With the LLDA setting the sample size of 300, the research group decided to add 26 more respondents from various categories of stakeholders to make sample size more representatives of the stakeholders. A Likert-scale was used to measure the ratings of the respondents/KIs for each statement. Results showed that based on the four drivers of satisfaction, the 2015 overall performance of the LLDA is 'Very Good' (4). Only the academe gave them a rating of 'Good' (3). All other stakeholders rated them 'Very Good' (4). This result is consistent with the respondents' perceived overall performance of the LLDA in 2015. The respondents rated them 'Very Satisfactory' (4). This time, only the FARMCS gave them a rating of 'Neutral' (3). All other stakeholders rated the LLDA as 'Good' and 'Neutral', it is important to look closely why such as rating was given. For the awareness, most (88%) of them are aware to the mandate, vision, mission and objectives (MVMO) of the LLDA. As to their awareness level, they claimed to be 'Moderately Aware' (4). For the issues and concerns about the lake that confront the

stakeholders, the following issues were identified: 1. process of accreditation/permitting takes time; 2. communication lapses; 3.inspection and monitoring related problems, 4. environmental/enforcement concerns; 5. service delivery concerns; 6. accessibility of the LLDA office of the stakeholders; 7. honoring agreements with institutional partners; 8. tedious requirements on the LLDA's projects; and livelihood concerns, they suggested the following: 1. improve communication advocacy; 2. be where the actors are; 3. improve service delivery on community development obligations; 4. increase human resources of the LLDA for monitoring and enforcement and partnership buildings; 5. appropriate and prompt response to stakeholder concerns; 6. moratorium of fees after disasters and calamities; and 7. enforce environmental laws. The respondents also identified the programs, projects, and activities that they were involved. Finally, to enhance the LLDA's institutional collaboration among their stakeholder's some approaches were determined. In terms of determining the factors associated with overall rating of the LLDA, Spearman Rank Order Correlation Analysis was done for each stakeholder. While the LLDA stakeholders rated them 'Very Good' (4) and 'Satisfactory' (4) in their 2015 overall performance, it is important that the LLDA should sustain and probably enhance their performance to maintain or even get a higher rating in the future. Beyond the 'Very Good' and 'Satisfactory' ratings, they need to address the issues and concerns that were identified by the stakeholders. It is also important to determine why some stakeholders, like the FARMCs and the academe gave them 'Neutral' and 'Good' ratings. These stakeholders, like the other stakeholders, are equally important partners in the LLDA's quest to become not only on a regulatory agency but a role model of environmental governance in the future.

WATER QUALITY; QUALITY ASSURANCE; PERFORMANCE TESTING; GROWTH RATE; WORK SATISFACTION; MONITORING; COMMUNITY DEVELOPMENT; DEVELOPMENT POLICIES; INNOVATION ADOPTION; POLLUTION CONTROL; CONSUMER BEHAVIOUR; PHILIPPINES

Gender and forest land management: when women take key roles in watershed rehabilitation. **Gendrano, M.M.B., Bator, N.J.B.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Despite the global recognition of the pivotal role of women in the protection and conservation of natural resources as inspired by various environmental movements lead by women (such as the Chipko movement in India and Igorot women struggles against Chico dam project in the Cordilleras, northern Philippines), the forestry sector in the country remains to be male-dominated, often setting women's participation as secondary to that of men. What happens when women claim key roles in watershed rehabilitation? This paper features two women's organizations as partner people's organizations (POs) of the Department of Environment and Natural Resources (DENR) in the development and protection of two critical watershed in the Philippines. The Samahan ng Kababaihang Makakalikasan ng Segium (SKMS) in Segium Subwatershed in Nueva Ecija and Pullaan Women's Organization in Ibulao Subwatershed in Ifugao are primarily involved in the planning and implementation of reforestation and agroforestry activities as well as maintenance and protection activities in their respective subwatersheds. These 2 POs are the only women's groups among the 147 POs engaged in the DENR watershed rehab project (FMP). Through focus group discussions, key informant interviews and life stories, the study (1) explores the rationale and motivation behind the organizations; (2) articulates the successes of the women's groups in terms of implementing watershed rehabilitation activities and contributing to the enhancement of the socio-economic well-being of the women in their communities; and (3) identifies the challenges the women's organizations confront in carrying out their watershed rehabilitation initiatives as well as the factors influential to the presence of these constraints. At the end, it highlights that organizing women upland farmers, whether self-initiated or

project-oriented, and empowering them to formally participate actively in the forestry sector is a vital ingredient for an effective, sustainable and pro-people forest management.

WOMEN; ROLE OF WOMEN; SEX; WATERSHED MANAGEMENT; WATERSHEDS; FORESTS; HIGHLANDS; FARMERS

Land use change and impacts on watersheds of large urban lakes (Project 3). **Bantayan, N.C., Tiburan, C.L., Avellabo, J.A., Carada, C.E.D., Montecillo, E.V.** *TR-1861.*

This project was characterized the biological and physical components of three watersheds of Laguna de Bay [Philippines] with the intention of identifying critical areas within the study area through vulnerability assessment. Major activities included land cover/land use characterization using satellite images covering two decades and six time periods, spatio-temporal land cover/land use change analysis, and assessment of the hydrologic regime through the installation of automatic weather system (AWS) and water level (AWLS) instruments in various sites of the study area. The hydrologic and land use/land cover analysis became the basis for identifying criteria of watershed health, namely: hydrologic response, biodiversity and connectivity, socio-ecological system, hazards assessment, and ecological footprint analysis.All these criteria are anchored on land use/land cover dynamics. This project used the GAME [Geographic Information System-Based Assessment Monitoring and Evaluation] Model gridding system for vegetation assessment, ArcSWAT for modeling the hydrologic response of the watershed to land management practices, and unit hydrographs from storm and heavy rainfall events for vulnerability assessment. Results of the biophysical assessment show that majority of the watershed exhibit Macolod soil (Undifferentiated) series, and the geology is mostly under Pliocene-Quaternary. Analysis of the land cover changes reveal that Tigbi has the largest increase of built-up area from 2003 to 2010, but it also has the largest increase in area for closed forest (387.57 ha to 628.86 ha). In terms of the overall area of the watersheds, only the closed forests and cultivated lands (annual copy) have decreased, while the rest of the other land classes reported in increase in area. The vegetation surveys showed that Family Moraceae has the most number of representatives for each family (26 species), while Fabaceae and Sapindacceae have the lowest number (nine species each). Results from the key information interviews showed that farmers within the boundary of MFR use traditional agroforestry practices. The analysis of vulnerability to landslide showed that in Cambantoc Watershed. only about 7% or 132 ha are found to ave high vulnerability to landslide. Most of these are located in Brgy. [village] Batong Malake (55 ha) in Los Baños and in Brgy Bitin (28 ha) in Bay. For the Molawin-Dampalit Watershed, about 4% or 149 ha are highly vulnerable to landslide. These are situated mostly in Brgy Anos (66 ha), Brgy Bambang (53 ha), and Brgy Batong Malake (22 ha) in Los Baños Large portions of the moderate vulnerable areas are observed in the same barangays with high vulnerabilities in Los Baños including Bagong Silang (128 ha) and in Brgy Santa Cruz (126 ha) in Bay. Meanwhile for Tigbi Watershed, an approximate of 8% or 157 ha are classified as high and most of the barangays affected are Brgy Bambang (76 ha) and Brgy Lalakay (76 ha) in Los Baños. Moderate areas to landslide are situated mostly in Brgy. Puting Lupa (246 ha) in Calamba City and in Brgy Lalakay (275 ha) in Los Baños. Flood-prone areas were identified in In Cambantoc Watershed, about 20% or 395 ha are classified under high vulnerable areas with Brgy Maitim (99 ha) and Santo Domingo (164 ha) having the largest areas prone to flooding in Bay. Meanwhile in Molawin-Dampalit Watershed, approximately 26% or around 1,071 ha have high vulnerabilities. Mostly these are located in Brgy. Maahas (288 ha), Brgy Batong Malake (221 ha), Brgy Putho Tuntungin (170 ha), and Brgy Anos (128 ha in the municipality of Los Baños. As for the Tigbi Watershed,about 20% or 378 ha are vulnerable to flooding and these are mostly located in Brgy Sucol (124 ha). Brgy Bagong Kalsada (47 ha), Brgy Masili (42 ha), and Brgy Pansol (41 ha) in Calamba

City and Lalakay (115 ha) in Los Baños. On the other hand, Cambantoc (approx. 9% or 166 ha) and Molawin-Dampalit (approx 11% or 472 ha) are vulnerable to drought. These are located in barangays Santo Domingo (76 ha), Paciano Rizal (43 ha), and Maitim (35 ha) in Los Baños in Cambantoc. Meanwhile in the Molawin-Dampalit Watershed, affected areas are in Brgy Batong Malake (93 ha), Brgy Mayondon (84 ha), and Brgy Bayog (76 ha) in Los Baños while part of Brgy Paciano Rizal (38 ha) is also classified under high vulnerabilities. However, in Tigbi Watershed, only 5% or roughly 90% ha are affected with high vulnerability to drought. Brgy Sucol (39 ha) has the highest vulnerable areas to drought in Calamba City while Brgy Lalakay (25 ha) in Los Baños. Assessment of the hydrologic behavior of the study areas using SWAT [Soil and Water Assessment Tool] modeling suggest that water yield and surface runoff may be substantial. In other words, the water balance ratios indicate taht majority of the precipitation goes to streamflow while majority of the total flow is composed of surface runoff. Results of this study can be used in the development of a Watershed Vulnerability Index (WVI) that is based to a large extent on land use/land cover change dynamics using the criteria listed earlier. The WVI can be a useful basis for policy actions on a watershed scale.

LAND USE; WATERSHEDS; WATERSHED MANAGEMENT; LAKES; AGROFORESTRY; LANDSLIDES; RISK ASSESSMENT; GEOGRAPHICAL INFORMATION SYSTEMS; MONITORING; MODELS; PHILIPPINES

Sources of drinking water and sanitary practices at Purok [District] 6, San Isidro, San Pablo City [Philippines]. **Luis, K.M.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Purok [District] 6, Barangay [Village] San Isidro, San Pablo City, [Laguna, Philippines] is a rural are located at an elevated part of the city. Inhabitants obtain water from spring and mostly dependent on natural resources. On this site, environmental issues on water such as source, safety, access and availability depend on human inhabitants. In line with this, the study aims to determine the sanitary practices and the sources of drinking water in the area. A validated self-made survey questionnaire based from the World Health Organization was used. A total of 219 individuals from households at Purok 6 were surveyed. Results showed that pipe into dwelling as the common source of drinking water is considered improved, yet a considerable number of residents obtain water from an exposed spring. Inhabitants who obtain water from the spring use a filtering cloth as water treatment, which is unimproved, but some their drinking water in plastic containers with close lids. Septic tank is the sanitation facility commonly used. However, some of the residents still use unimproved facilities, such as open pits. There are also households sharing sanitation facilities such as toilets. Although the spring is maintained by the community as a source of water for human consumption, the management of this natural resource can still be improved to avoid wasting of this resource due to contamination, thus making it unfit for human consumption.

DRINKING WATER; DRINKING WATER SYSTEMS; HYGIENE; RURAL AREAS; PHILIPPINES

P40 Meteorology and climatology

Adaptation pathways for climate-resilient development: lessons from selected local government units in Central Luzon, Philippines. **Elazigue, D.D., Quimbo, M.A.T., De los Santos, S.G.G.** *Adaptation pathways for climate-resilient development: selected cases in Cambodia, Myanmar and the Philippines, Quimbo, M.A.T.Heng, N.Aung, W.H.Elazigue, D.D..- College, Laguna (Philippines), 2016. TR-1796.- p. 30-60.*

This article examines the pathways of selected local government units in the Philippines to adapt to changing climate. With the locality's vulnerability to climate hazards such as typhoon and flooding which are projected to worsen, adaptation strategies should build climate resilience over time. Local adaptation evolved from physical measures such as infrastructure; to knowledge-based measures such as early warning system; and to institutional measures such as land use planning and mainstreaming climate risk reduction in development planning. The progress depended on the capability of the local government unit. With limited resources, e.g., technical, financial, the local government should harness external support and build partnership. Moreover, decisions on adaptation should be based on monitoring and evaluation of strategies over time.

CLIMATIC CHANGE; LOCAL GOVERNMENT; ADAPTATION; CYCLONES; FLOODING; RISK ASSESSMENT; RISK; RISK MANAGEMENT; DISASTER PREPAREDNESS; DISASTER PREVENTION; PHILIPPINES

Adaptation pathways for climate-resilient development: selected cases in Cambodia, Myanmar and the Philippines. **Quimbo, M.A.T., Heng, N., Aung, W.H., Elazigue, D.D.** *TR-1796.*

This study was conducted to provide an understanding of the adaptation decisions of households, communities and local government units frequently affected by climatic related hazards, track and examine their adaptation strategies, and analyse if these are building the community's climate resilience. Primary data were gathered through key informant interviews, focus group discussions, and household survey in each country. Secondary data on climate hazards and impacts, socio-demographic characteristics and development indicators of study areas, climate change adaptation and/or disaster risk management plans, and development plans were gathered from various sources. Cambodia, Myanmar and the Philippines have repeatedly experienced extreme climate events such as typhoons, flood and drought causing severe losses and damages to crop, properties and livelihood. Household adaptation measures implemented across study locations were largely reactive in nature. While there had been expression of adaptation plans, these were mainly focused on short-term measures that aimed to protect the households and livelihood. Rural households need to adopt more proactive ways, with long-term perspective in order to anticipate and manage risks. However, ensuring proactive adaptation strategies requires community-level participation and a strong enabling environment to facilitate collective action. At the institutional level, adaption strategies evolved from structural (e.g., infrastructure/engineering interventions) to non-structural (e.g., knowledge-based technology such as early warning system). In recent years, institutional innovations evolved with mainstreaming climate change and disaster risk reduction and management in local development planning. This places more emphasis on resilience, unlike in the past where the focus was on relief and recovery. For the three countries, the institutional breakthrough around 2011 was the Climate Change Action Plan aiming for more resilience-oriented strategies. This was also an outcome of the countries' commitment to international response to climate change. As climate change projections indicate greater risks in the future, adaptation planning may need to reinforce resilience building. Currently, there is no established mechanism on monitoring and evaluation of adaptation strategies. Based on assessment of the community, experts, and literature review, there are advantages and disadvantages of current adaptation strategies in terms of cost, technical, and other development aspects such as land use that have to be considered in adaptation decisions. Adaptation strategies for agriculture remained over the years to be agronomic (e.g., drought/flood resistant plant cultivars). Such low-cost adaptation measures may not be sufficient to offset the significant climate change damages. With huge losses experience in severe El Niño incidents, drought management solutions must consider a long-term perspective. In terms of infrastructure intervention, flood control structures, may have possible externalities as illustrated in the resulting salt

water intrusion from the construction of a river channel , consequently, leading to conversion of rice to fishponds. Reconstruction and repair structures (e.g., irrigation facilities) damaged from extreme weather events may in the long term encourage development and land uses in vulnerable areas, as owners know that government will help repair any damages caused by a climate-related event. This could disrupt development programs and reinforces a state of underdevelopment.

CLIMATIC CHANGE; ADAPTATION; HOUSEHOLDS; LOCAL GOVERNMENT; DEVELOPMENT PROJECTS; WEATHER HAZARDS; DISASTERS; DISASTER PREPAREDNESS; DISASTER PREVENTION; CAMBODIA; MYANMAR; PHILIPPINES

Beach bloomer : 'balai-lamok' (Crateva religiosa Forst. f, Capparidaceae) along Lobo coast of Verde Island Passage, Batangas, Philippines. **Caringal, A.M., Macatangay, D.T., Bañados, H.G.Jr.** *14. FORESPI International Conference on Biodiversity in a Changing Landscape and Climate, College, Laguna (Philippines) 8-9 Nov 2018.*

Lobo Coast [Batangas, Philippines] has probably the first photographic record of blooming 'balai-lamok' (Crateva rekiliosa Forst. f, Capparidaceae) known by 'Loboanos' as 'santol tamar'. The study is a part of the continuing opportunistic 'plotless canopy density count' (PCDC) for rare and locally-important endemic-indigenous flowering trees growing from ridge to coast of Lobo Batangas. Fourteen mother trees of C. religiosa with dbh of 11-33cm and height of 7-19m were spotted across four coastal villages, 2-14 m above the sea level and 27-780 m from the coast. Mother trees best blooms during summer from April to mid-May following state of deciduousness. Surprise flowering was observed in September to October following rain recession for weeks. The flowering of C. religiosa was a helpful biosignal in locating their abundance and clue to the seasons or anomalous climate in general. The expanding built-up anthropocentric agroecosystems in Lobo coast of Verde Island Passage such as tourism roads and resorts and settlements have buried the abundance due to lack of awareness about the ecological value of the species. The remnant population of 'balai-lamok' is generally far (0.36-3.6km) from Lobo River but very near (3-477m) to expanding settlements and just 0.04-592m away from widening tourism roads. Meanwhile, very few old fisherfolks have traditional ecological knowledge about the species as they observed that during blooming it is visited by many bats, bees and birds; it has great fragrance at early morning; it provide shaded ground during summer for cattle and carabaos; and serve as source of fuelwood.

FLOWERING; TREES; INDIGENOUS ORGANISMS; CANOPY; ECOLOGY; ENVIRONMENTAL FACTORS; PHILIPPINES

Closing the gap between adaptation and climate-resilient development: challenges to developing economics. **Elazigue, D.D., Quimbo, M.A.T., Hang, N., Aung, W.H., De los Santos, S.G.** *Adaptation pathways for climate-resilient development: selected cases in Cambodia, Myanmar and the Philippines, Quimbo, M.A.T.Heng, N.Aung, W.H.Elazigue, D.D..- College, Laguna (Philippines), 2016. TR-1796.- p. 61-87.*

This article examines the pathways of selected local cases in Cambodia, Myanmar, and the Philippines to adapt to changing climate. Adaptation evolved from physical measures such as infrastructure; to knowledge-based measures such as early warning system; and to institutional measures such as mainstreaming climate change in development planning. The progress depended on the capability of the frontline government units. As climate change projections indicate greater risks, resilience building becomes critical. The study indicated that there are advantages and disadvantages of current adaptation

strategies in terms of cost, technical, and other development aspects such as land use that should be considered in adaptation decisions. Resilience has a long-term perspective and poses institutional challenges such as resource limitations and public support. Technology plays an important role in climate challenge adaptation as well as social factors such as human capital and governance structures. Institutional linkages could help address resource these challenges.

CLIMATIC CHANGE; CLIMATIC DATA; INFRASTRUCTURE; DISASTER PREPAREDNESS; DISASTER PREVENTION; DEVELOPING COUNTRIES; ADAPTATION; LAND USE; TECHNOLOGY

Exploring the links of the incidence of teenage pregnancy and natural disaster: the case of Eastern Visayas, Philipiines. **Nelson, G.L.M., Rodriguez, M.V.C.** *TR-1783.*

The survey on the 742 female youth, 12 to 21 years old from Eastern Visayas [Philippines] who have experienced severe typhoon (Yolanda) or moderate typhoon (Ruby) aims to explore the links of natural disaster and the likelihood of increase in teenage pregnancy. The Eastern Visayas youth who reported being pregnant in 2013-2016, was found to be 22% in severely hit areas (Tacloban-Palo) and 15% in moderately hit areas (Dolores and CanAvid). The study identified the differential characteristics (socio-economic, sexual risk behavior, non-sexual risk behaviors and disaster experience characteristics) of the Eastern Visayas youth that were associated with both severity of typhoon experience and incidence of pregnancy. These are the age of the youth, household type (extended family and two or more non-related families), are in a consensual union, living in own permanent housing, out of school but are high school graduate, and have reported monthly income between 5,001 to 10,000 pesos. Furthermore, significant relationship was also found among the youth who had alcohol, had been exposed to pornography and have attempted suicide, had premarital sexual experience between 15 to 19 years old with either their own spouses or partners, have had three or more boyfriends when they were between 15 to 19 years old. The youth that had that experience only 1 move while in the emergency shelter, or had been relocated for 91 to 180 days, had stayed less than 330 days in transitional shelters, and had been staying less than 120 days in donated permanent housing, and had been living in their own houses from 666 to 730 days were also found to be related to incidence of pregnancy and severity of typhoon. Significant difference was also found among the ever-pregnant youth in their age of initiation to premarital sex (PMS). Those in severely hit areas had PMS at age 16.75 and 17.23 for those in the moderately hit typhoon areas.

ADOLESCENTS; PREGNANCY; CYCLONES; STORMS; DISASTERS; PHILIPPINES

Phil-LiDAR [Philippines-Light Detection and Ranging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines]. **Magcale-Macandog, D.** Philippines Univ. Diliman, Diliman, Quezon City (Philippines)., Department of Science and Technology, Bicutan, Taguig City (Philippines)., Occidental Mindoro State Coll., San Jose, Occidental Mindoro (Philippines)., Marinduque State College, Barangay Tanza, Boac, Marinduque (Philippines)., Mindoro State College of Agriculture and Technology, Alcate, Victoria, Oriental Mindoro 5205 (Philippines)., Palawan State Univ., University Road, Puerto Princesa, 5300 Palawan (Philippines)., Western Philippines Univ., Aborlan, Palawan (Philippines). *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation*

of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines), 2017. TR-1835.- p. 147-202.

With the massive destructions caused by frequent disaster occurrences in the Philippines. It is evident to design measures in mitigating such extremities. Hence, the Department of Science and Technology Grants-In-Aid (DOST-GIA) sought to answer the call to action through the use of Light Detection and Ranging (LiDAR) technology. It is an emerging remote sensing tool which is capable of providing spatial data and information hazard assessments, disaster risk management, flood modeling, urban development and site assessments. In the light, the project entitled 'Project 4. LiDAR Data Processing, Modeling, and Validation by HEIs for Detailed Resources Assessment in Luzon: MIMAROPA [Mindora, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines] under program 'Phil-LiDAR 2. Nationwide DEtailed Resources Assessing using LiDAR-Program B. LiDAR Data Processing and Validation by SUCs and HEIs' was implemented to generally produce detailed resource maps using LiDAR derived data for Agriculture, Coast, Forest, Renewable energy, and Hydrology components. Specifically, it aimed to (a)automate feature extraction from LiDAR data and various types of remotely-sensed data; (b)produce high resolution maps for high value crops (HVCs), renewable energy sources, irrigation and hydrology, coastal resources and forest resources; (c)assesses vulnerability of HVCs and aquatic resources to climate change; and (d)formulate recommendations on the inventory and vulnerability assessment of the above said resources. Generally, the project follows scientific framework developed by the University of the Philippines Diliman Field validation of LiDAR measurement was done to assess its quality and validity. Then validated LiDAR data were processed and used as input for mapping and assessment of resources. The project's outputs included validated accuracy for LiDAR collected data; algorithm that delineates, extracts and quantifies objects to detect high value crops (HVCs) and coastal resource features from LiDAR data sets and/or orthrophotos, features salient to HVC and aquatic production, detailed resorce maps for MIMAROPA region and Laguna, vulnerability assessment maps of HVC and aquatic resources to climate change, and scientific papers published and presented in local and international conferences.

REMOTE SENSING; TECHNOLOGY; RISK ASSESSMENT; RISK MANAGEMENT; DISASTER PREPAREDNESS; DISASTER PREVENTION; DISASTERS; FLOOD CONTROL; PHILIPPINES

Plant life in the Philippine Teak forest of Verde Island Passage [Batangas, 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.*

In the Philippines, there is a semi-evergreen forest dominated by Tectona philippinensis Benth. and Hook., f, APG: Lamiaceae) - a Critically Endangered tree flora endemic to Batangas and Occidental Mindoro within the Verde Island Passage. Specifically, the study aimed to determine the general floristic composition of this unique 'formation'. Vegetation data were collected between October 2016 - February 2017 from 24: 20m x 20m (=0.96ha) quadrats randomly established along the 56 km island-mainland agro-ecosystem continuum. Photographs of plant life were produced. A total of 128 species under 111 genera in 48 families were found. Plant life was observed in different morpho-species composed of trees (68 species), shrubs (5) and subshrubs (9), bush palm (1) and palm-like tree (1), lianas (7), epiphytic tree (1), semi-woody climbers (3), epiphytic and geophytic orchids (4), epiphytic and terrestrial ferns (5), annuals to erect succulent perennial herbs (9), herbaceous climbers and creepers (6), geophytic herbs and climber (1), low and tall

grasses including bamboo (5), and sedges (2). Taken physiognomically, such structural diversity comprised some of the unique botanical ensembles in the Philippine teak forest landscape.

TECTONA; SPECIES; FORESTS; EPIPHYTES; TREES; INDIGENOUS ORGANISMS; ENDANGERED SPECIES; BIODIVERSITY; BOTANICAL COMPOSITION; PHILIPPINES

Q- PROCESSING OF AGRICULTURAL PRODUCTS

Q02 Food processing and preservation

Buzzing with fun on a hillside farm. **Urlanda, R.V.** *Agriculture (Philippines) v. 28(10) p. 36-38 (Oct 2019).*

APIS MELLIFERA; APIS CERANA; APICULTURE; POLLINATION; HONEY; FOOD PROCESSING; PROCESSED PRODUCTS

Cookbook showcasing Cordillera [Philippines] heirloom recipes launched. **Lacson, S.P.** *Agriculture (Philippines) v. 28(10) p. 58-59 (Oct 2019).*

RICE; VEGETABLES; FOODS; PRESERVATION; FOOD PROCESSING; HEALTH FOODS; ETHNIC GROUPS; CULTURAL VALUES; CULTURAL DEVELOPMENT

Couple makes money turning sour batuan into sweet jam. **Taculao, P.B.S.** *Agriculture (Philippines) v. 23(12) p. 60-61 (Dec 2019).*

INDIGENOUS ORGANISMS; FRUITS; INGREDIENTS; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; ANTIOXIDANTS

Cup of story: red soil cafe and coffee roaster. **Malabed, L.** *Agriculture (Philippines) v. 23(11) p. 46-47 (Nov 2019).*

COFFEA ARABICA; COFFEE; PLANT PRODUCTS; FOOD PROCESSING; HIGHLANDS; FARMERS

Development and process optimization of batuan [Garcinia binucao (Blanco) Choisy) fruit concentrate using response surface methodology. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 186-211.*

Following the Box-Behnken Design of the Response Surface Methodology, three (3) different variables namely time, temperature, and extraction (fruit: water ratio), and 15 treatments were used for optimization of processing conditions in batuan concentrate production. The physico-chemical properties (TSS, TA, and pH) of each treatment was determined and used to optimize the processing parameters. Among the three responses, only TSS and TA were chosen for optimization since the model for pH was not significant. The optimum conditions for the batuan concentration process is at time of 150 minutes, temperature of 75ᵒC and fruit:water extraction rate of 60:40. The concentrate under optimum setting was used to evaluate the proximate composition, and simple cost analysis study. The sensory properties of all 15 treatments were evaluated following the incomplete block design by Cochran and Cox

(1975). The color was found to have ranged from pale olive green to brown, flavor obtained a score of slightly undesirable to moderately desirable, mouth-feel description varied from slightly perceptible acidity to moderately perceptible acidity, and aroma of the soup have desirable to moderately desirable smell. The acceptability of color, flavor, mouth-fell, and general acceptability obtained a score of 5-7 which all falls under acceptability of neither like nor dislike or like moderately, while the aroma has the acceptability of like slightly to like moderately which has a score of 5.62-7.33. There is no significant difference found in ash and crude fat content of the batuan concentrate and pulp. The moisture content of the concentrate was significantly lower than the pulp, while the protein, fiber, and carbohydrate contents of the concentrate are significantly higher compared to that of the pulp. The total cost in producing batuan concentrate was computed; the cost of 141.67 grams of batuan concentrate was found to be PhP 35.766 approximately equal to 36 peso.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; OPTIMIZATION METHODS; ORGANOLEPTIC ANALYSIS; FOOD TECHNOLOGY

Development of jelly from recipe and unripe batuan [Garcinia binucao (Blanco) Choisy] fruit. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 174-185.*

The study was conducted to develop a standard formulation for batuan jelly. The effects of the stage of maturity of the fruit on the chemical and sensory properties of the developed products were evaluated. The cost of the most acceptable batuan jelly was determined. The ripe and unripe stages of maturity of batuan fruits were studied in the development of jelly. The jelly were formulated in both stages of maturity using the same set of treatments, namely, 1:1 and 1:0.75 batuan juice extract to sucrose ratio, and 1:1 and 1:0.75 batuan juice extract to a combination of sucrose and high fructose corn syrup. Sensory evaluation results revealed that batuan jelly with 1:1 juice extract to sucrose ratio in both ripe and unripe batuan extracts were found most acceptable compared with a combination of sucrose and high fructose corn syrup. However, no significant differences were found in the overall general acceptability on both jellies. Hence, the ripe and unripe stage of maturity of batuan fruits can be utilized and processed into jelly.

GARCINIA; SPECIES; FRUIT; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; ORGANOLEPTIC ANALYSIS; CHEMICOPHYSICAL PROPERTIES; MATURITY; ORGANOLEPTIC PROPERTIES

Drying and storage characteristics of batuan fruit powder. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 72-108.*

The study evaluated the drying and storage characteristics of the batuan fruit powder including optimization of parameters for powder production, Moisture Sorption Isotherm (MSI), and Accelerated Shelf-life Test (ASLT). The optimum sodium metabisulfite (SMS) concentration and drying temperature were determined where the physicochemical, functional and sensory characteristics of the powder were considered as the responses. The optimum drying temperature and SMS concentration were found to be 50.0001 deg C and 106.249 ppm, respectively, with a desirability of 0.578. The moisture sorption behavior of the powder revealed that the equilibrium moisture content (EMC) increased with water activity (aw) while the EMC values generally decreased when the temperature was increased. The BET Isotherm and Halsey Equation gave the best fit models to describe the MSI of the powder. The monolayer value and

water activity, aw, of the batuan powder were calculated to be 0.08499 g water/g solids and 0.36, respectively, at room temperature. During the ASLT of the powder, Maillard browning was predominant and found to be a first-order reaction in terms of whiteness index (WI). The shelf-life of the product at room temperature was predicted to be 202 days (6.73 months).

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; DRYING; STORAGE; TEMPERATURE; KEEPING QUALITY; CHEMICOPHYSICAL PROPERTIES; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

For Cordillera [Philippines] people, giving value to food is giving respect to cultural heritage. **Lacson, S.P.** *Agriculture (Philippines) v. 28(10) p. 60-63 (Oct 2019).*

RICE; COFFEA ARABICA; COFFEE; COFFEA; FOOD PROCESSING; FOODS; PRESERVATION; ETHNIC GROUPS; CULTURAL BEHAVIOUR; CULTURAL DEVELOPMENT

Innovativeness is the name of the game for this Bacolod [Philippines]-based entrepreneur. **Lacson, S.P.** *Agriculture (Philippines) v. 23(12) p. 46-48 (Dec 2019).*

FISH PASTES; FOOD TECHNOLOGY; PROCESSING; PROCESSED PRODUCTS; INNOVATION ADOPTION; MARKET RESEARCH; PHILIPPINES

Isolation and salinity of hydroxycitric acid from batuan [Garcinia binucao (Blanco) Choisy] as affected by different processing methods. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Elazigue, D.D..- College, Laguna (Philippines), 2016. TR-1765.- p. 237-271.*

Hydroxycitric acid, a compound with anti-obesity property, is commonly extracted from Garcinia cambogia. Batuan (Garcinia binucao), a close relative of Garcinia cambogi, is a Philippine indigenous fruit. Since these trees belong in the same genus, there is a high possibility that hydroxycitric acid is also present in batuan fruit. Hence, this study was conducted to isolate hydroxycitric acid from fresh batuan and determine the stability of this compound once the fruit is subjected to different processing conditions including steam blanching, drying, brine fermentation and freezing. Results revealed that Garcinia binucao is potential source of hydroxycitric acid. The extracted acid from batuan ranges from 4.81 +- 0.12 to 4.83 +- 0.13 g/100 g sample. Water extraction method, compared to methanol and acetone extraction methods, is more effective in isolation of hydroxycitric acid from fresh batuan fruits. Steam blanching can reduce the hydroxycitric acid content of batuan by 13.66% up to 23.90% while drying can decrease the hydroxycitric acid content of the sample by 7.28% up to 17.39%. Brine fermentation for 20 days decreased the acid content of the sample by 39.54%. Lastly, freezing for 2 months reduced the acid content by 15.52% due to ice formation during freezing and drip loss during the thawing. Based on the results of the study, the best conditions of batuan processing is drying at 60ᵒC, steam blanching at 100 deg C for 10 minutes, brine fermentation for maximum of 8 days and freezing up to 2 months. Among the studied processing methods, freezing was considered to be the most effective in preserving the hydroxycitric acid content of batuan fruits.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; INDIGENOUS ORGANISMS; BLANCHING; DRYING; FERMENTATION; FREEZING; FOOD TECHNOLOGY

Leading coco sugar producer has El Niño to thank for. **Sarian, Z.B.** *Agriculture (Philippines) v. 23(11) p. 62-63 (Nov 2019).*

COCOS NUCIFERA; COCONUTS; SEEDLINGS; ORGANIC AGRICULTURE; PROCESSED PLANT PRODUCTS; FOOD PROCESSING; CERTIFICATION

Physico-chemical, microbial properties of brine-fermented batuan [Garcinia binucao (Blanco) Choisy] fruit. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 58-71.*

The main objective of the study was to evaluate the physic-chemical, microbial and sensory properties of brine-fermented batuan. Three concentrations of the brine solution (5%, 10% and 15%) were prepared and the pH, total soluble solids (TSS), total titratable acidity (TTA) and microbial analysis of the fermenting batuan fruits were conducted. The physico-chemical analysis showed that the values of TSS and TTA are highest in 15% salt concentration, followed by the 10% and 5% the lowest. On the other hand, the lowest pH was obtained from 15%, 10% and 5% in decreasing order. For the microbial analysis, the effect of salt concentration on the rate of fermentation was established. Microorganisms were able to grow in all levels of salt concentration, while spoilage yeasts and molds were kept at the safe level at the highest salt concentration. Except for saltiness, sensory evaluation showed that there is no significant difference in color, aroma, texture, sourness and general acceptability among treatments. Based on the mean scores, the 10% salt concentration came out to be the most preferred by the panel of judges.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; FERMENTED FOODS; BRINES; PROCESSED PRODUCTS; CHEMICOPHYSICAL PROPERTIES; MICROBIAL PROPERTIES; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Processing can triple the income from mangosteen. **Sarian, Z.B.** *Agriculture (Philippines) v. 28(10) p. 4; 6-7 (Oct 2019).*

GARCINIA MANGOSTANA; PLANTING; CROP MANAGEMENT; FOOD PROCESSING; FRUITS; BYPRODUCTS; KEEPING QUALITY; MEDICINAL PROPERTIES

Processing of batuan [Garcinia binucao (Blanco) Choisy] fruit into different forms of souring agents. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 109-150.*

The fruits of batuan were processed into different forms of souring agents, namely: frozen pasteurized fruits, puree, powdered fruit, and dried whole fruits. Frozen fruits served as the control treatment. The souring agents were found highly acidic (pH ranging from 1.91 to 2.44), with varied total soluble solids (0.8 to 5.13 deg Brix) and moisture content (9.91% to 97.25%). The organic acid profile of the prepared souring agents was analyzed using reversed-phase HPLC coupled with UV detector. It was shown that the dominating acids in all of the souring agents was malic acid, followed by ascorbic acid, and then citric acid, while oxalic acid was below the detection level. The powdered batuan fruits had the highest levels of all acids. Generally, the souring agents which utilized only the pulp of the fruit and undergone dehydration had higher acid contents as compared to those which utilized the whole fruit. In addition, those which

undergone pasteurization showed decreased in the level of acids. The profile of the target sugars was established using HPLC coupled with refractive index (RI) detector. Fructose and glucose were observed in all of the souring agents, except in batuan puree. Sucrose, on the other hand, was detected in fresh and frozen samples only. The amount of sugars generally decreased after processing. When compared to broths prepared using tamarind and calamansi extract, sensory evaluation revealed that the different souring agents were not significantly different in terms of aroma, typical sinigang flavor, and sweetness. In terms of sourness, broth prepared using frozen fruits and dried whole fruits were not significantly different from the broth prepared using calamansi extract, while the broths prepared using the frozen fruits and batuan powder were not significantly different from the broth prepared using tamarind extract.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; FROZEN PRODUCTS; FRUIT; POWDERS; DRIED FRUITS; FOOD TECHNOLOGY

Product and process R and D [research and development] of batuan jam. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 165-173.*

The study was conducted to develop formulation and process for batuan jam. Four treatments of batuan jam were formulated namely: TA (1:1), TB (1:0.75) ratio of batuan puree and sugar, TC (1:1), TD (1:0.75) ratio of batuan puree and high fructose corn syrup (HFCS). The batuan puree used was diluted with water at 1:2 ratio. The sensory properties of the jam were determined using the quality scoring and analyzed using analysis of variance (ANOVA). The physicochemical test such as pH, total titratable acidity (TTA), total soluble solids (TSS) and color analyses were conducted. The TSS of the developed batuan jam was found above 65 deg Brix which is within the standard limit set by the Bureau of Product Standard. However, jams with high fructose corn syrup were more acidic compared with added sugar. Titratable acidity is highly correlated with pH, the more acidic the jam is, the higher is the resulting value of the titratable acid (TTA). Color analysis of the different treatments of batuan jam with sugar indicates similar lightness value and was not significantly different with each other while significant difference was observed in jams with HFCS. The less amount of sugar and HFCS in TB and TD with 1:0.75 puree to sugar ratio indicates a decreasing redness values compared with TA and TC with 1:1 puree to sugar ratio. The results of the sensory analysis of the four jam samples revealed that sugar added in jam were found more acceptable than that containing high fructose corn syrup (HFCS). Treatment A with 1:1 batuan puree and sugar ratio had the highest mean score and was the most preferred treatment for batuan jam.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED FOODS; JAMS; ORGANOLEPTIC ANALYSIS; FOOD TECHNOLOGY; ORGANOLEPTIC PROPERTIES

Product and process R and D [research and development] of butuan juice concentrate. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 226-236.*

The study aimed to develop batuan juice concentrate and determine the most acceptable ready to drink juices from the concentrate. The concentrate with 50:50 and 60:40 batuan juice extract to sugar was formulated. Dilution of the ready-to-drink (RTD) juice from each concentrate was made to determine the most acceptable juice concentration and was subjected to sensory evaluation and physicochemical analysis. The batuan fruit used in the study had a total soluble solids (TSS) content of 8-9 ᵒBrix, pH

of 2.0 and titratable acidity (TTA) of 4.15%, while the extracted batuan juice used in the formulation of the concentrate had 8 ᵒBrix, 2.0 pH and 1.75% TTA. The 50:50 concentrate had 50ᵒBrix, 2.2 pH and 0.93% TTA while the 60:40 concentrate had slightly lower TSS (42 deg Brix) but slightly higher pH (2.31) and TTA (1.06%). The TSS of the ready-to-drink (RTD) batuan juices ranged from 8.4 to 16 ᵒBrix, pH of 2.59 to 2.72 and TTA of 1.7 to 1.06%. The juice samples from the 50:50 concentrate had slightly higher TSS and pH, but slightly lower TTA than the 60:40 concentrate. TSS and TTA of the juice samples decreased while the pH increased as dilution was increased from 1:2 to 1:4 in both concentrates. The use of 50:50 and 60:40 batuan juice extract to sugar ratio and dilutions of the juice sample significantly affected the sensory attributes of the RTD batuan juice. The most acceptable juice dilution was 1:2 in both in both concentrates. However, the juice with slightly sweet taste and right degree of sourness from the 50:50 concentrate had the highest general acceptability.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; ORGANOLEPTIC ANALYSIS; CHEMICOPHYSICAL PROPERTIES; FOOD TECHNOLOGY; FRUIT JUICES; ORGANOLEPTIC PROPERTIES

Product and process R and D [research and development] of reday-to-drink batuan juice. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 212-225.*

The main objective of the study was to develop ready-to-drink juice from batuan fruit. A ready-to-drink batuan juice was developed and formulated. Five dilutions of batuan extract to water ratio were made (1:1, 1:3, 1:5, 1:7, and 1:10). The five (5) batuan juice samples were then subjected to sensory evaluation and physicochemical analysis. The pH of the juice samples increased while the total titratable acidity (TTA) decreased as the dilution was increased from 1:1 to 1:10. The total soluble solids (TSS) for all treatments increased slightly as the dilution was increased. The viscosity of the ready-to-drink juices generally increased as the dilution of the batuan extract was increased from 1:1 to 1:7. Batuan puree had a high vitamin C content of 278.42 mg/100mL. Hence, the dilution of the extract significantly reduced the vitamin C content of the ready-to-drink juices. The vitamin C content of the most acceptable juice was 58.05mg/100mL. The use of various dilutions affected significantly the sensory attributes of batuan juice. Sensory attributes such as colour, aroma, flavor and sourness generally decreased as the dilution of the fruit extract to water was increased. The sensory results indicated that the 1:3 fruit extract to water ratio (Treatment B) was the most preferred dilution for the batuan juice.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; ORGANOLEPTIC ANALYSIS; CHEMICOPHYSICAL PROPERTIES; FOOD TECHNOLOGY; FRUIT JUICES; ORGANOLEPTIC PROPERTIES

Production and stabilization of microbial rennet from Rhizopus chinensis. **Mercado, S.M.** *Department of Agriculture, 2nd Floor BSWM Bldg., Elliptical Rd., Diliman, Quezon City (Philippines). Biotechnology Program Office. TR-1842.*

Microbial rennet was initially produced from Rizophus chinensis by submerged fermentation using 30L stirred tank batch bioreactor with 4% wheat bran as substrate. The substrate was substituted with the less expensive coconut paring meal which was found to be a better substrate for fermentation. The optimized condition was able to shorten the fermentation condition to less than 24 hour and resulted to higher product yield coefficient of 1.7 liters per kilogram substrate. Aflatoxin assay of coconut paring meal and the resulting concentrated rennet gave negative results therefore safe to be used as food ingredient. Solid

substrate production of microbial rennet was done due to malfunction of all the fermenter at BIOTECH pilot plant. Production using 12'X8'X 2.5 enamel tray loaded with 200 grams hydrated coconut paring meal was able to produce more rennet. The process had a product yield coefficient of 2.5 liters per kilogram substrate which is higher compared to submerged fermentation. Comparative study of the cost of production of microbial rennet using submerged and solid substrate fermentation showed that the later was scale up the production using trays compared to the use of the stirred tank reactor and the enzyme yield is higher. Granulation of liquid rennet was done by addition of binders and fillers to further stabilize the microbial rennet. The study on the production of high milk clotting enzyme (MCE) activity granule through the wet granulation of liquid rennet using the excipients cornstarch as filler and maltodextrin as binder was done. Large scale experiment showed consistent among trial runs which simply highly reproducible agglomeration mechanism during the granulation step. The granulated rennet with the highest activity was tried in preparation of white cheese at the rate of 2%, however, the corn starch from the granule settled at the bottom of the container. Rennet granules composed of gelatin, lactose and skim milk was developed. Result showed that the only concentration of the rennet and the drying temperature significantly affect the milk- clotting activity of the granules produced. The amount of gelatin was found not to affect the activity of the granules. Result also showed consistent Sauter means and average particle sizes between trial runs and a direct relationship occurred between particle size and the activity of the enzyme. The liquid rennet was pack in high density polyethylene bottle as per advise of the DOST Packaging Center while the granulated rennet was packed in foil packs. Evaluation of the microbial rennet which was conducted at the Department of Paraclinical Sciences, College of Veterinary Medicine, UPLB [University of the Philippines Los Baños] showed that the microbial rennet is safe to be used as food ingredient based on its toxicological and pathological studies using Swiss Webster Mice. The consumer preferences survey conducted showed that the microbial rennet has a better comparative advantage over animal rennet in terms of quality and is highly competitive with the imported rennet, in terms of the product attributes such as reliability, economy, ease of use and availability. Based on the analysis, production and distribution of BIOTECH rennet will generate an average net profit after tax of PhP 1.9 M every year with 42.7% average return of investment, while the net present value of income streams when discounted at 15% will be 1.92M pesos. The cost and benefit of using microbial rennet in white cheese making compared to other milk coagulants was done. Result showed that the use of the microbial rennet can increase the yield of cheese from cow's and carabao's milk by 28% and 22%, respectively compared to use of the animal rennet and ChyMax. Analysis of the by-product or biomass of microbial rennet fermentation showed an increase on protein and fiber content which suggested enrichment of the coconut paring meal substrate which can possibly be used as feed supplement for dairy animals. The washed biomass was acceptable to the young water buffalo when added to the fluid supplement which also contains honey. The study was suspended until enough material is produced because feeding trials required 40 to 50 kilograms per animal.

RHIZOPUS; RENNET; FERMENTATION; SOLID STATE FERMENTATION; CHEESE; COST BENEFIT ANALYSIS; PRODUCTION; ECONOMIC STABILIZATION

Sweet, sweet wine: Deewan's [social enterprise] dragon fruit artisan wine. **Malabed, L.** *Agriculture (Philippines) v. 28(10) p. 48-49 (Oct 2019).*

HYLOCEREUS UNDATUS; FOOD PROCESSING; ENTERPRISES; AGROINDUSTRIAL SECTOR; WINES; WINEMAKING; FARMERS

Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products. **Dizon, E.I., De Villa, T.M., Ombico, M.T., Lascano. R.A.** *Department of Agriculture, BPI Cmpd. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1765.*

The project aimed to develop high value processed products from underutilized, minor batuan [Garcinia binucao (Blco.) Choicy] fruit. Various activities were undertaken by the project team for the development of different products from batuan fruit. Survey of the batuan fruits from various areas or regions in the country was done during the the course of the project implementation. At the same time, information on the existing products and utilization of batuan fruits in particular regions were determined. Among the areas/regions visited by the project team include Iloilo City; Negros Occidental; Puerto Princesa City, Palawan; Ilocos Region; Masbate City; and Guinobatan , Albay. The first year of project implementation was focused on the production of brine fermented and pickled batuan fruits, standardized process for the batuan powder and its utilization into batuan sinigang mix. On the second year, additional potential products from batuan fruit such as concentrate, other forms of souring agent aside from sinigang mix, ready-to-drink juice, juice concentrate, jam and jelly processing. The quality of the products was evaluated based on physico-chemical, proximate composition and sensory properties. In addition, shelf-stability of selected products was determined. The sugar and organic profiles of fresh and processed products from batuan fruits were also determined. Additional study was conducted on the possible hydroxycitric acid (a known anti-obesity substance) content of selected processed batuan products. Overall, the study revealed that batuan can be utilized as a raw material for the production of high value products such as pickles, jam, jelly, concentrate and ready-to-drink fruit juice. Most especially, batuan powder is a potential substitute for tamarind instant soup. Furthermore, with the new findings of the study regarding the considerable high hydroxycitric acid content in fresh and processed batuan products, regular consumption of such products could help minimize the upward trend of obesity problem in the country. With proper technology promotion of the developed batuan products for commercialization, it is also hoped that the demand of this neglected and underutilized fruit will increase which could help the local farmers expand their production and thus become their source of additional income.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; MARKETING; CHEMICOPHYSICAL PROPERTIES; PROXIMATE COMPOSITION; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Utilization of powdered batuan into sinigang mix. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 151-164.*

The study aimed to develop sinigang mixes from the batuan fruit powder. Batuan fruits processed into puree, dehydrated using a cabinet dryer and pulverized into powder were used in the formulation of sinigang mixes. In the development of formulation, different treatments were done by varying powder and citric acid level together with other ingredients. All the treatments were subjected to physicochemical and sensory tests together with the commercial brands. The pH and titratable acidity of the different treatment formulations differed with each other. Formulation B had the same pH with Brand X but slightly lower than Brand Y, and had nearly the same TTA with both commercial brands. The TSS of the different treatments was the same but differed with commercial Brand Y. The results indicated that as the level of batuan powder was increased, corresponding decrease in pH and increased TTA was noted. The physical properties of all the formulations and two samples of the commercial sinigang mixes exhibited good

dipersibility and flowability, and fair sinkability and solubility. Bulk density of the formulations increased as the level of citric acid was decreased. Formulation B with batuan powder twice as much as citric acid had the highest general acceptability and was not significantly different from the commercial brands, X and Y in terms of flavor and sourness. Proximate composition of the different treatments of sinigang mixes indicated no significant differences from each other.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; PROCESSED PRODUCTS; FRUIT; FRUIT PRODUCTS; POWDERS; CHEMICOPHYSICAL PROPERTIES; FOOD TECHNOLOGY

Validation of scale-up production of microbial rennet. **Mercado, S.M., Nayve, F.R.P., Jr., Garing, C.I.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Industry, Energy and Emerging Technology Research and Development. TR-1841.*

The applicability of coconut paring cake as substrate for solid substrate fermentation. Analysis of the locally produced cheese coagulants (granulated and liquid coagulants) produced from Rhizopus chinensis showed that the coagulants conformed to specifications set by JEPCA [] in the Microbiological Guidelines for specification and Considerations for Enzyme Preparations Used in Food Processing in terms of coliform. E. coli, S. aureus and Salmonella. These specific pathogenic microorganisms were absent in 25g/mL of the samples. It was noted that heterotrophic and aerobic plate counts for both coagulants exceeded the guideline's acceptable values (greater 50,000 CFU/g or mL). Yeast and mold counts for both coagulants also failed to meet acceptable counts specified for commercially available coagulant. Environmental monitoring, particularly the assessment of air quality inside the processing area and the safety cabinet, showed non-conformance to the established standards. Interestingly, the cleaning procedure and practices employed in cleaning contact surfaces in the processing area were effective, as indicated by the attained hygiene status of-PASSI or less than or equal to 100 RLU using the ATP biolumino for the production of microbial rennet was validated through the kinetics study made on the growth Rhizopus chinensis Saito BIOTECH 3273. Growth kinetics of R. chinensis was evaluated using substrate-independent kinetic models namely linear, exponential, logistic and two-phase. Among the four equations used, only the linear model cannot describe the growth of R. chinensis due to a negative value of initial biomass (-0.136%). The logistic model has the highest specific growth rate (0.414/h), closest predicted initial biomass concentration (0.1155%) to experimental data (0.083%), and the least SSE (0.126). It is therefore concluded that the logistic model best described the growth of R. chinensis BIOTECH 3273 using sold substrate fermentation of coconut paring cake. Optimization study was conducted to determine the most suitable conditions for the microbial rennet production of Rhizopus chinensis BIOTECH 3273 in a solid substrate fermentation system of coconut paring cake. In the scale of production of microbial rennet, the target volume for liquid rennet was easily attained. Microbial evaluation of raw materials in the raw materials and the process was done before of the complete installation of the equipment needed in the processing area for rennet production. The possibility of utilizing the fermentation by-product (fermented coconut paring meal or FCPM) as feed ingredient for broilers, a total of 300 day-old chicks were subjected for 38-day feeding trial. Under the conditions which the study was conducted, it can be concluded that the addition of FCPM in the broiler ration had reduced the growth performance of broilers indicating poor feed utilization. DNA sequencing was done to determine the amino acid sequence of the rennet protein. Under the specified PCR conditions, the primer set RCAP II_F2/RCAP II_R2 successfully amplified a single DNA and of the expected product length in both the CBS Type Strain (standard organism) and BIOTECH 3273. With primers set RCAP II_R5, the expected product was faintly amplified only in CBS. Production of rennet casein from skimmed milk was studied and was used in the production of imitation cheese to improve fat and water binding, texture

and matrix formation. Numerous trainings were conducted in different parts of the country to demonstrate the application of microbial rennet in cheese making. Furthermore, several technology forums and food expo were attended to promote microbial rennet to dairy processors and potential technology takers.

RHIZOPUS; SPECIES; RENNET; PRODUCTION; CHEESE; FERMENTATION; COCONUTS; DNA; AMINO ACIDS

Village-level processing, technology development and promotion of Dillenia philippinensis (Katmon): an underutilized fruit in Quezon Province [Philippines]. **Wagan, A.D.M., Agangan, N.S., Artes, L.A., Ombico, M.T., Tamisin, L.L., Jr., Omaña, M.E.** *Department of Agriculture, RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave. Diliman, Quezon City (Philippines). Bureau of Agricultural Research. TR-1844.*

This is an R and Project in support of the development of Katmon (Dillenia philippinensis) for rural livelihood in Quezon province [Philippines] specially Real, Infanta and General Nakar, Quezon, where Katmon is still abundant. The aim of the project is to provide agricultural production technology and technical support to product development of Katnon. As such the project conducted on-station and on-site studies on seedling establishment using stem cuttings; on site and on-station and on-site and on-station test on postharvest handling and storage of fresh Katmon fruits for processing of Katmon fruits to rural women's groups; provided technical support to three rural women's groups who pursued processing and product development of Katmon and developed scientific and extension materials about Katmon and Katmon product development. Results showed that Katmon can be propagated using either matured or juvenile stem cuttings and their growth are best when treated with UPLB [University of the Philippines Los Baños]-developed biofertilizer MykoVAM combined with vermicompost or with chicken manure. Katmon propagated using matured stem cuttings also exhibited early fruiting at 14 months after planting while the use of juvenile stem cuttings provided an alternative propagation technique to current practice of collecting wildings from their natural habitat. A protocol of obtaining quality fruits for processing was also developed where information on proper harvesting, handling and storage before processing are provided. For longer storage life, Modified Atmospheric Packaging and low temperature (15 deg C) are recommended for Katmon fruits. On capability enhancement on UPLB-developed procedures on processing Katmon food products, about 75 women representing at least 19 rural women's groups from Real, Infanta and General Nakar benefitted from the series of on-site and hands-on training activities conducted by the project. Among the products, Katmon powder, Katmon juice and Katmon jelly were introduced by these women's groups to potential consumers from urban and rural areas in local and national fests and fares. Katmon juice and jelly were rated highly acceptable by the respondents during product evaluation. Katmon pure powder on the other hand, is the sole product identified by Quezon DOST [Department of Science and Technology and DTI [Department Trade and Industry] as having the best potential for further development. There is continuous processing of Katmon powder by one of the trained women in Real Quezon but in Real Quezon but in very limited capacity using the fruit dryer fabricated by the project for training purpose. Furthermore, five extension materials about Katmon propagation, harvesting and postharvest handling of Katmon for livelihood exhibits great potential in the project sites. Sustaining the interest and achieving the full potential of developing Katmon for natural livelihood in the study sites will depend on how well this venture will further be supported by the local stakeholders and agencies.

DILLENIACEAE; FOREST TREES; SPECIES; FRUITS; FRUIT PRODUCTS; CHEMICOPHYSICAL PROPERTIES; TECHNOLOGY TRANSFER; FOOD TECHNOLOGY; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES; RURAL COMMUNITIES; RURAL DEVELOPMENT; SEEDLINGS; PLANT ESTABLISHMENT; PHILIPPINES

Young academic uses indigenous plants to connect with his family history. **Tan, Y.** *Agriculture (Philippines) v. 28(10) p. 26-28 (Oct 2019).*

AMORPHOPHALLUS CAMPANULATUS; LOTUS; INDIGENOUS ORGANISMS; FOOD PROCESSING; VEGETABLES; INGREDIENTS

Q03 Food contamination

BAR-NSR [Bureau of Agricultural Research-Natural Science Research Inst.] research fellow presents study results on Escherichia coli. **Fontanil, L.C.** *BAR [Bureau of Agricultural Research] (Philippines) v. 19(5) p. 14 (May 2018).*

FOODS; QUALITY; FOOD SAFETY; ESCHERICHIA COLI; BIOLOGICAL CONTAMINATION; MONITORING; PATHOGENS

Pilot production and market testing of DAS sup TM kits. **Mercado, S.M.** *Department of Science and Technology, Bicutan, Taguig City (Philippines). Technology Innovation for Commercialization. TR-1843.*

Detected kits for foodborne pathogens such as Salmonella, E. coli, E. coli O157:H7 and Staphylococcus aureus were developed at the National Institute Molecular Biology and Biotechnology, UP Los Baños to address the growing concerns in food safety and occurrences of food borne illness. With the globalization of the world's food supply, it is recognized that the food and beverage industry, regulatory agencies and service laboratories should upgrade its efforts in quality assurance and in monitoring both the locally-produced foods and hose imported from other countries. The project aimed to produce the kits in pilot-scale volume for distribution to different laboratories in NCR, Region 3 and Region 4, to conduct product promotions through seminars and trainings, and market testing. A total number of 2,162 reaction tubes were produced with the breakdown of 350 tubes of Salmonella DAS sup TM, 350 tubes E. coli DAS sup TM, 626 for E. coli O157:H7DAS and 836 for S. aureus DAS sup TM. Laboratories which performed actual testing of the kits were: (1) DA-NMIS Laboratory Services Division, (2) Regional Standards and Testing Laboratory DOST 4, (3) Hacienda Macalauan, Inc. and (4) Food Science Laboratory UP Visayas. These are the most likely to adopt the DAS kits as a means of detecting pathogens in foods, water ad swabs of food contact surfaces. Other food companies and service/diagnostic laboratories which participated during the product launching at DA-NMIS were able to test the kits during the training held 17-18 March 2009. The product launching and training held at Visayas State University (VSU) on 29-30 July 2009 was also a venue for the kit testing. There are five attributes that clients are usually looking for in detection kit. The product attributes preferred by the respondents according to the survey are 'reliability' or accuracy in detecting food and feed pathogens (mean = 3.96): 'economy' or lower cost of using the product (mean = 3.80); 'easy' or the case in using the product (mean = 3.76);'fast' or the product's ability to get faster results (mean = 3.72); and 'available' or availability of the product in the market (mean = 3.56). Majority of the respondents are using the traditional plating method (48.6%) and 3M Petri Films (29.7) in monitoring these organisms. While eight of them revealed that they are also occasionally using other detection products such as Reveal and Bax Qualicon. The participants gave highest rating to DAS kits for all product attributes, namely reliability, economy, ease of use, rapidly of detection and availability compared to traditional culture method and 3M Petri Film method. After the product testing, the respondents gave the highest combined rating on Das kits (mean = 3.50), as compared to traditional plating method with combined mean value of 2.58 and 3M Petri film with mean value of 3.00. The multiple comparison showed that the mean differences among DAS kits,

traditional plating method and 3M Petri Film is significant at the 0.05 level (palpha). Based on the comparative analysis of the five product attributes, DAS kits is highly competitive product because it has comparatively better attribute rating than the traditional plating method and 3M Petri Films.

SALMONELLA; STAPHYLOCOCCUS AUREUS; PATHOGENS; FOODBORNE DISEASES; FOOD SAFETY; SENSORS

Q04 Food composition

Physico-chemical, microbial properties of brine-fermented batuan [Garcinia binucao (Blanco) Choisy] fruit. *Utilization of batuan [Garcinia binucao (Blanco) Choocy] into value added products, Dizon, E.I.De Villa, T.M.Ombico, M.T.Lascano. R.A..- College, Laguna (Philippines), 2016. TR-1765.- p. 58-71.*

The main objective of the study was to evaluate the physic-chemical, microbial and sensory properties of brine-fermented batuan. Three concentrations of the brine solution (5%, 10% and 15%) were prepared and the pH, total soluble solids (TSS), total titratable acidity (TTA) and microbial analysis of the fermenting batuan fruits were conducted. The physico-chemical analysis showed that the values of TSS and TTA are highest in 15% salt concentration, followed by the 10% and 5% the lowest. On the other hand, the lowest pH was obtained from 15%, 10% and 5% in decreasing order. For the microbial analysis, the effect of salt concentration on the rate of fermentation was established. Microorganisms were able to grow in all levels of salt concentration, while spoilage yeasts and molds were kept at the safe level at the highest salt concentration. Except for saltiness, sensory evaluation showed that there is no significant difference in color, aroma, texture, sourness and general acceptability among treatments. Based on the mean scores, the 10% salt concentration came out to be the most preferred by the panel of judges.

GARCINIA; SPECIES; FRUITS; INDIGENOUS ORGANISMS; FERMENTED FOODS; BRINES; PROCESSED PRODUCTS; CHEMICOPHYSICAL PROPERTIES; MICROBIAL PROPERTIES; ORGANOLEPTIC ANALYSIS; ORGANOLEPTIC PROPERTIES

Q70 Processing of agricultural wastes

DBP [Development Bank of the Philippines] financing program for solid waste management investments. **Salayon, A.C.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 66-68.*

SOLID WASTES; WASTE MANAGEMENT; FINANCING; INVESTMENT; LOANS

Municipal solid waste and its potential for waste-to-energy. **Cabeso, B.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of*

biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 37-44.

SOLID WASTES; WASTE MANAGEMENT; WASTE UTILIZATION; ENERGY; LOCAL GOVERNMENT; COMPOSTING; RECYCLING; LANDFILLS

Production of polyphenols and specialty flours from wastes of the mango processing industry. **Sapin, A.B. Ramirez, T.J. Tavanlar, M.A.T.** *TR-1888.*

The mango processing industry generates tons of mango peel and seed wastes and their disposal has become a major problem of the industry. One rational solution to solve the industry's waste disposal problems is to utilize these wastes in developing high value products. The two important health enhancing products, natural phenolics powder and antioxidant-fiber-rich specialty flours, were developed from mango peel and seed wastes. The standardized process protocols for production of phenolic powders from mango peel and seed wastes were established. The natural antioxidant phenolic powders were found to have great potential in the cosmetics/cosmeceutical industry. The powers can prevent skin damages due to their high total phenolic contents that can scavenge photo-induced free-radicals and reduce metal ions reactivity. They possess whitening and anti-ageing properties owing to their tyrosinase and elastase inhibitory activities. The phenolic powders were also effective against both Gram positive and Gram negative common skin pathogens as well as a dandruff-causing fungus, Malassezia furfur. Some of the phenolic compounds initially detected in the powders are simple phenols like gallic acid and p-coumaric acid, and polyphenolics such as mangiferin quercetin and kaemferol reported to have high high sunscreen activity. Stability study conducted on irradated mango seed phenolics powder packed in polypropylene palstic bottle showed a shelf-life of 1 year at room temperature. Lotion hand sanitizer, liquid hand soap shampoo and sunscreen products with mango seed phenolics powder were formulated to utilize the above properties of the phenolics powder. Plant design for commercial production of phenolic powder from mango seed waste was proposed and the estimated cost of the phenolics powder is PhP 1,500/kg. The phenolics powder was given a trade name of 'Phenofera'. For specialty flours, the optimum conditions for enzyme modification of fine (0.25 mm) and coarse (0.25 mm)mango peel powders were established. The functional properties of both the unmodified and modified fibers were evaluated. Their incorporation into various bakery products and composite flours were were also assessed. These bakery products have acceptable sensory attributes and higher nutritive value in terms of bioactive substances. The specialty flours were given a trade name of 'Mango Fiber Plus'. Thus, utilization of fibers from both mango feel and mango kernel would not only open new business and profits, but would also contribute to give alternative uses to the huge quantities of the by-products wasted in the mango processing industry.

MANGOES; PEEL; SEED; POLYPHENOLS; FLOURS; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE UTILIZATION

Status and potential of agricultural residues in the Philippines. **Benavidez, P., II.** 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy, , Clark Pampanga (Philippines), 16-18 Jun 2015. *Planning-workshop and hosting of the Philippine International Biomass Conference, Briones, M.Movillon, J.Dizon, L.S.Obligado, F.Demafelis, F.A..- College, Laguna (Philippines), 2015. 2015 Philippine International Biomass Conference: Exploring the market potentials of biomass for bio-based fuel and energy,2015 Philippine International Biomass Conference:*

Exploring the market potentials of biomass for bio-based fuel and energy, Clark Pampanga (Philippines), 16-18 Jun 2015. TR-1823.- p. 28-29.

RICE; MAIZE; COCONUTS; CROP RESIDUES; BIOMASS; PHILIPPINES

U- METHODOLOGY

U10 Mathematical and statistical methods

Land use change and impacts on watersheds of large urban lakes (Project 3). **Bantayan, N.C., Tiburan, C.L., Avellabo, J.A., Carada, C.E.D., Montecillo, E.V.** *TR-1861.*

This project was characterized the biological and physical components of three watersheds of Laguna de Bay [Philippines] with the intention of identifying critical areas within the study area through vulnerability assessment. Major activities included land cover/land use characterization using satellite images covering two decades and six time periods, spatio-temporal land cover/land use change analysis, and assessment of the hydrologic regime through the installation of automatic weather system (AWS) and water level (AWLS) instruments in various sites of the study area. The hydrologic and land use/land cover analysis became the basis for identifying criteria of watershed health, namely: hydrologic response, biodiversity and connectivity, socio-ecological system, hazards assessment, and ecological footprint analysis.All these criteria are anchored on land use/land cover dynamics. This project used the GAME [Geographic Information System-Based Assessment Monitoring and Evaluation] Model gridding system for vegetation assessment, ArcSWAT for modeling the hydrologic response of the watershed to land management practices, and unit hydrographs from storm and heavy rainfall events for vulnerability assessment. Results of the biophysical assessment show that majority of the watershed exhibit Macolod soil (Undifferentiated) series, and the geology is mostly under Pliocene-Quaternary. Analysis of the land cover changes reveal that Tigbi has the largest increase of built-up area from 2003 to 2010, but it also has the largest increase in area for closed forest (387.57 ha to 628.86 ha). In terms of the overall area of the watersheds, only the closed forests and cultivated lands (annual copy) have decreased, while the rest of the other land classes reported in increase in area. The vegetation surveys showed that Family Moraceae has the most number of representatives for each family (26 species), while Fabaceae and Sapindacceae have the lowest number (nine species each). Results from the key information interviews showed that farmers within the boundary of MFR use traditional agroforestry practices. The analysis of vulnerability to landslide showed that in Cambantoc Watershed. only about 7% or 132 ha are found to ave high vulnerability to landslide. Most of these are located in Brgy. [village] Batong Malake (55 ha) in Los Baños and in Brgy Bitin (28 ha) in Bay. For the Molawin-Dampalit Watershed, about 4% or 149 ha are highly vulnerable to landslide. These are situated mostly in Brgy Anos (66 ha), Brgy Bambang (53 ha), and Brgy Batong Malake (22 ha) in Los Baños Large portions of the moderate vulnerable areas are observed in the same barangays with high vulnerabilities in Los Baños including Bagong Silang (128 ha) and in Brgy Santa Cruz (126 ha) in Bay. Meanwhile for Tigbi Watershed, an approximate of 8% or 157 ha are classified as high and most of the barangays affected are Brgy Bambang (76 ha) and Brgy Lalakay (76 ha) in Los Baños. Moderate areas to landslide are situated mostly in Brgy. Puting Lupa (246 ha) in Calamba City and in Brgy Lalakay (275 ha) in Los Baños. Flood-prone areas were identified in In Cambantoc Watershed, about 20% or 395 ha are classified under high vulnerable areas with Brgy Maitim (99 ha) and Santo Domingo (164 ha) having the largest areas prone to flooding in Bay. Meanwhile in Molawin-Dampalit Watershed, approximately 26% or around 1,071 ha have high vulnerabilities. Mostly these are located in Brgy. Maahas (288 ha), Brgy Batong

Malake (221 ha), Brgy Putho Tuntungin (170 ha), and Brgy Anos (128 ha in the municipality of Los Baños. As for the Tigbi Watershed,about 20% or 378 ha are vulnerable to flooding and these are mostly located in Brgy Sucol (124 ha). Brgy Bagong Kalsada (47 ha), Brgy Masili (42 ha), and Brgy Pansol (41 ha) in Calamba City and Lalakay (115 ha) in Los Baños. On the other hand, Cambantoc (approx. 9% or 166 ha) and Molawin-Dampalit (approx 11% or 472 ha) are vulnerable to drought. These are located in barangays Santo Domingo (76 ha), Paciano Rizal (43 ha), and Maitim (35 ha) in Los Baños in Cambantoc. Meanwhile in the Molawin-Dampalit Watershed, affected areas are in Brgy Batong Malake (93 ha), Brgy Mayondon (84 ha), and Brgy Bayog (76 ha) in Los Baños while part of Brgy Paciano Rizal (38 ha) is also classified under high vulnerabilities. However, in Tigbi Watershed, only 5% or roughly 90% ha are affected with high vulnerability to drought. Brgy Sucol (39 ha) has the highest vulnerable areas to drought in Calamba City while Brgy Lalakay (25 ha) in Los Baños. Assessment of the hydrologic behavior of the study areas using SWAT [Soil and Water Assessment Tool] modeling suggest that water yield and surface runoff may be substantial. In other words, the water balance ratios indicate taht majority of the precipitation goes to streamflow while majority of the total flow is composed of surface runoff. Results of this study can be used in the development of a Watershed Vulnerability Index (WVI) that is based to a large extent on land use/land cover change dynamics using the criteria listed earlier. The WVI can be a useful basis for policy actions on a watershed scale.

LAND USE; WATERSHEDS; WATERSHED MANAGEMENT; LAKES; AGROFORESTRY; LANDSLIDES; RISK ASSESSMENT; GEOGRAPHICAL INFORMATION SYSTEMS; MONITORING; MODELS; PHILIPPINES

U40 Surveying methods

Phil-LiDAR [Philippines-Light Detection and Ranging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines]. **Magcale-Macandog, D.**

Philippines Univ. Diliman, Diliman, Quezon City (Philippines)., Department of Science and Technology, Bicutan, Taguig City (Philippines)., Occidental Mindoro State Coll., San Jose, Occidental Mindoro (Philippines)., Marinduque State College, Barangay Tanza, Boac, Marinduque (Philippines)., Mindoro State College of Agriculture and Technology, Alcate, Victoria, Oriental Mindoro 5205 (Philippines)., Palawan State Univ., University Road, Puerto Princesa, 5300 Palawan (Philippines)., Western Philippines Univ., Aborlan, Palawan (Philippines). *Phil-LiDAR [Philippines-Light Detection and Raging] 2. nationwide detailed resources assessment using LiDAR: Program B. LiDar processing, modeling, and validation for nationwide resources assessment:Project 4. LiDAR data processing, modeling and validation of HEIs for the detailed resources assessment in Luzon: MIMAROPA [Mindoro, Marinduque, Romblon, Palawan] and Laguna (Region IV) [Philippines], Magcale-Macandog, D..- College, Laguna (Philippines), 2017. TR-1835.- p. 147-202.*

With the massive destructions caused by frequent disaster occurrences in the Philippines. It is evident to design measures in mitigating such extremities. Hence, the Department of Science and Technology Grants-In-Aid (DOST-GIA) sought to answer the call to action through the use of Light Detection and Ranging (LiDAR) technology. It is an emerging remote sensing tool which is capable of providing spatial data and information hazard assessments, disaster risk management, flood modeling, urban development and site assessments. In the light, the project entitled 'Project 4. LiDAR Data Processing, Modeling, and Validation by HEIs for Detailed Resources Assessment in Luzon: MIMAROPA [Mindora, Marinduque, Romblon,

Palawan] and Laguna (Region IV) [Philippines] under program 'Phil-LiDAR 2. Nationwide DEtailed Resources Assessing using LiDAR-Program B. LiDAR Data Processing and Validation by SUCs and HEIs' was implemented to generally produce detailed resource maps using LiDAR derived data for Agriculture, Coast, Forest, Renewable energy, and Hydrology components. Specifically, it aimed to (a)automate feature extraction from LiDAR data and various types of remotely-sensed data; (b)produce high resolution maps for high value crops (HVCs), renewable energy sources, irrigation and hydrology, coastal resources and forest resources; (c)assesses vulnerability of HVCs and aquatic resources to climate change; and (d)formulate recommendations on the inventory and vulnerability assessment of the above said resources. Generally, the project follows scientific framework developed by the University of the Philippines Diliman Field validation of LiDAR measurement was done to assess its quality and validity. Then validated LiDAR data were processed and used as input for mapping and assessment of resources. The project's outputs included validated accuracy for LiDAR collected data; algorithm that delineates, extracts and quantifies objects to detect high value crops (HVCs) and coastal resource features from LiDAR data sets and/or orthrophotos, features salient to HVC and aquatic production, detailed resource maps for MIMAROPA region and Laguna, vulnerability assessment maps of HVC and aquatic resources to climate change, and scientific papers published and presented in local and international conferences.

REMOTE SENSING; TECHNOLOGY; RISK ASSESSMENT; RISK MANAGEMENT; DISASTER PREPAREDNESS; DISASTER PREVENTION; DISASTERS; FLOOD CONTROL; PHILIPPINES