

PHILIPPINE AGRICULTURAL BIBLIOGRAPHY

April to June 2021

Vol. 2 No. 2

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USER'S GUIDE

Consecutively numbered, the bibliographic entries are classified according to subject category.

SAMPLE ENTRIES

SERIAL ARTICLE

- 1
2
3
7
8
9
10
- E16 Production economics
- Enhancing soybean productivity and local availability in Region 2 [Cagayan Valley, Philippines]. Calderon, V.J.F., Aquino, R.M.G., Olinares, R.B., dela Cruz, C.G., Batang, E.F. Jr., Atalin, V.U., de Guzman, S. 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi City, Albay (Philippines), 2-7 Jul 2018. *Philippine Journal of Crop Science (Philippines)* . v.43 (Supplement no. 1) p. 43-44 (Jul-2018).
- 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 ...
- 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
10. AGROVOC DESCRIPTORS
11. Title and Author of the book/report
12. Collation/page

Table of Contents

Title	i
User's Guide	ii
Table of Contents	iii
A50- Agricultural research	1
C- EDUCATION, EXTENSION AND INFORMATION	
C20 - Extension	1
C30 - Documentation and information	3
E- AGRICULTURAL ECONOMICS, DEVELOPMENT AND RURAL SOCIOLOGY	
E10- Agricultural economics and policies	4
E13-Investment, finance and credit	6
E14-Development economics and policies	7
E20- Organization, administration, and management of agricultural enterprises of farms	9
E50-Rural sociology and social security	10
E70- Trade, marketing and distribution	11
E80-Home economics, industries and crafts	11
F- PLANT SCIENCE AND PRODUCTION	
F01- Crop husbandry	12
F02- Plant propagation	21
F03- Seed production and processing	24
F04- Fertilizing	26
F06- Irrigation	31
F08- Cropping patterns and systems	32
F30- Plant genetics and breeding	34
F40-Plant ecology	76
F50- Plant structure	77
F60- Plant physiology and biochemistry	77
F61- Plant physiology - Nutrition	78
F62- Plant physiology - Growth and development	79
F63- Plant physiology - Reproduction	80
F70- Plant taxonomy and geography	80
H- PLANT PROTECTION	
H10- Pests and plants	81
H20- Plants diseases	87
H50- Miscellaneous plants disorders	91
H60- Weeds and weed control	94
J- Postharvest Technology	
J11- Handling, transport, storage and protection of plant products	95
J14- Handling, transport, storage and protection of fisheries and aquacultural products	99
L- ANIMAL SCIENCE, PRODUCTION AND PROTECTION	
L01- Animal husbandry	100
M- FISHERIES AND AQUACULTURE	
M01- Fisheries and aquaculture - General aspects	100

M12- Aquaculture production and management	102
M40- Aquatic ecology	102
N-AGRICULTURAL MACHINERY AND ENGINEERING	
N20- Agricultural machinery and equipment	103
P- NATURAL RESOURCES AND ENVIRONMENT	
P01- Nature conservation and land resources	103
P06- Renewable energy resources	106
P10- Water resources and management	107
P32- Soil classification and genesis	108
P36- Soil erosion, conservation and reclamation	109
P40- Meteorology and climatology	109
Q- PROCESSING OF AGRICULTURAL PRODUCTS	
Q02- Food processing and preservation	110
Q04- Food composition	113
Q70- Processing of agricultural wastes	114
T - POLLUTION	
T01- Pollution	114
U- METHODOLOGY	
U10- Mathematical and statistical methods	115

A. AGRICULTURE IN GENERAL

A50 Agricultural research

Inspiring a new generation of botanists [Dr. Benito Tan]. Taculao, P.B.S. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 28-29. Feb 2020.

FLORA; BRYOLOGY; BRYOPHYTA; RESEARCH; SCIENTISTS; STUDENTS; TEACHERS

C. EDUCATION, EXTENSION AND INFORMATION

C20 Extension

Evaluation of WeRise, a decision support tool for rainfed rice areas, on its applicability to improve rice production in the Philippines. Llorca, L.P., Hayashi, K., Capistrano, A.O.V., Ramos, J.U., Aungon, J.J.E., Bugayong, I.D., Pantine, F.L.A. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 60. Sept 2019.

The application of seasonal climate predictions is imperative to harness uncertainties for rainfed rice production areas. WeRise (Weather-rice-nutrient integrated decision support system) is a seasonal climate prediction-based decision support tool initially developed by the IRRI [International Rice Research Institute]-Japan collaborative research project for Indonesia's rainfed rice areas. It functions through ORYZA, a crop growth model for grain yield simulations developed by IRRI, and SINTEX-F, a global circulation model for seasonal climate predictions developed by the Japan Agency for Marine-Earth Science and Technology. This study aims to evaluate WeRise for Philippine rainfed areas. On-station field experiments were conducted at PhilRice, Nueva Ecija during the 2017-18 dry and wet seasons to gather observed datasets. Popular rice cultivars (NSIC Rc216 and PSB Rc10) and climate-smart varieties (NSIC Rc346 and NSIC Rc348) were used for model calibration. ORYZA was used to extrapolate the experiment conditions over 14 years using outputs from SINTEX-F (Data 1) and bias-corrected SINTEX-F (DATA 2) to compare the simulated grain yield from historically observed weather data (Data 0). Data 2 was obtained through a statistical downscaling method. The goodness of fit between observed and simulated grain yields was evaluated based on normalized root mean square error (RMSEn, %). Results showed that better fit was achieved when Data 2 was used in the simulations. RMSEn using Data 0 and Data 1 were 51%, 53%, 59% and 62% for PSB Rc10, NSIC Rc216, NSIC Rc346, and NSIC Rc348, respectively. On the other hand, RMSEn using Data 0 and Data 2 were 18%, 22%, 27%, and 30% for the same varieties. This implies that statistical downscaling method is a crucial step prior to the application of seasonal climate predictions into ORYZA. The ongoing IRRI-PhilRice-JIRCAS collaborative research project is conducting on-farm field validation experiments over wider geographical areas to evaluate the capability and predictability of WeRice as a decision support system.

RICE; PRODUCTION; RAINFED FARMING; INFORMATION TECHNOLOGY; SOWING; DECISION SUPPORT; KNOWLEDGE BASED SYSTEMS; TIMING; PHILIPPINES

Mapping of smallholder rice farms in the Philippines through Information and Communication Technology (ICT)-enabled platform. Jardinero, B.B., Calda, L.B.L., Vila, J.R., Sazon, P.M.R. Jr., Liwanag, E.C.A. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 59. Sept 2019.

Smallholder farms play critical role in combating global hunger and achieving food security. Increasing productivity of smallholder farms through production and policy support are pivotal in order to attain higher food supplies and improve livelihoods of farmers and farming communities. One of the first steps to do this is put smallholder farms on the map with corresponding identity including accurate size and profile, farm status, vulnerability, and the needs for intervention support. On October 2015, the Department of Agriculture and the International Rice Research Institute have started mapping smallholder rice farms through the ICT platform 'Farmer and Farm Lot Registration' (FFR) which is part of the suite of tools known as Rice Crop Manager (RCM) Advisory Service (<http://phapps.irri.org/ph/ras/>). The mapping of smallholder rice areas starts with short interview of farmers using FFR to register basic information about them and their farms, followed by perimeter measurement of the farm using handheld GPS device. This step makes use of Area Calculation function in Garmin Etrex models, which automatically captures trackpoints as the user walks along the perimeter of farm lots. These saved trackpoints are part of the whole track that is saved as GPS Exchange Format (GPX) file. GPX files are then submitted and saved in RCM database for subsequent use in fertilizer calculation and overlaying on Google map. This process has been rolled out nationwide through trained extension staff that led to mapping of more than 57,000 hectares in 72 provinces. The process of mapping smallholder farms is relatively simple to follow and requires less technical know-how on Geographic Information System on the part of users since the ICT platform does the processing and consolidation of tracks into useful maps. This same process has the potential to scale up and expand into other commodities beyond rice.

RICE; SMALL FARMS; CARTOGRAPHY; CADASTRES; INFORMATION TECHNOLOGY; TECHNOLOGY; MARKETING

Smarter Pest Identification Technology (SPIDTECH) : digital identification of insect pest and crop disease using convolutional neural networks. Ebuenga, M.D., Guiam, A.C., Gamba, K.E., de Panis, W.N. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 60-61. Sept 2019.

Correct insect pest and crop disease identification plays a vital role in crop protection and management as it serves as a factor in determining suitable pest and disease control methods and management practices in farms. This study focuses on building an Android application named Smarter Pest Identification Technology (SPIDTECH) that aims to guide its users through digital identification of insect pest and disease of rice, corn, coffee, cacao, banana, sugarcane, coconut, soybean, and tomato in the Philippines. The system uses Inception-v3, a pre-trained image recognition model, comprised of a feature-extraction layer with convolutional neural network and a classification layer with a fully connected and softmax layer. The model was pre-trained from ImageNet dataset and can classify 1000 object categories. The model was retained, in a progress called transfer learning, with insect pest and disease dataset comprised of no less than 500 images of each pest and disease of each crop captured from different sites in the Philippines. The transfer learning process utilizes the feature extraction capability of the pre-trained model to classify input images

using new dataset. This study uses a total of 18 models: two models for each of the nine focus crops, one for the pest and one for the disease identification. The model accepts image input and outputs a ranked classification based on accuracy. The model extracts general features from the input image and classifies them based on those features. Along with the identification results, the application also includes a library data comprised of relevant information about each pest and disease such as identification signs, life cycle, and management practice to help its users in correctly managing the pest and disease. Moreover, the application logs data from its users such as GPS location, top results, and image data for tracking and remote monitoring of pest and disease occurrence.

INFORMATION TECHNOLOGY; DIFFUSION OF INFORMATION; PLANT PROTECTION; CROP MANAGEMENT; PEST INSECTS; PLANT DISEASES; MODELS

C30 Documentation and information

Development and evaluation of an android-based mobile application version of the leaf color chart or LCC [leaf color chart] App. **Capistrano, A.O.V., Hernandez, J.E.G., Auñgon, J.J.E., Ramos, J.U.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 38. Sept 2019.

This paper presents the development an android-based mobile application simulating a rice chlorophyll meter for determining real-time nitrogen (N) requirement and evaluated its performance as a recommending tool for topdressing. At present, chlorophyll meters are commercially available but are too expensive for ordinary farmers. Hence, PhilRice [Philippine Rice Research Inst., Nueva Ecija, Philippines], in the past, developed the leaf color chart (LCC), a cheap but effective alternative to chlorophyll meters capable of diagnosing and recommending N requirements in real-time. However, farmers adoption rate of the LCC despite years of techno-promotion, was not so significant. With the current access to digital platforms, the underlying principle/process of the LCC was developed into an android-based mobile application to revive the useful tool. Initially, a conversion process for digital leaf images into dark green color index (DGCI) was developed, coded into a computer program and then used to identify the DGCI to the original 6-panel LCC to establish its correlation. Similarly, the correlation between the 6-panel LCC and SPAD readings were also established to finally determine a connection between DGCI and SPAD values by merging the two correlations. A prototype android-based mobile application (LCC App) was therefore developed with the merged correlation embedded that made use of smartphone's built-in cameras to capture rice leaf images, process it into DGCI and generate N-topdressing rates. Comparison between the DGCI against actual SPAD values showed strong correlation in both DS2017 and WS2018 field assessments. However, N-content of rice leaves sampled in DS2017 were found better correlated with DGCI than actual SPAD values. While yield evaluation trails using NSIC Rc216 with 5 treatments and 4 replications showed a very comparable yield performance between LCC and LCC App during WS2018 with the agronomic efficiency of applied N (AEn) under LCC App better than other treatments except one. However in DS2019, grain yield under LCC App surpassed all treatments but its AE sub N was now only better than LCC.

ORYZA SATIVA; LEAVES; COLOUR; CHLOROPHYLLS; NITROGEN; COMPUTER SOFTWARE; EVALUATION; CROP YIELD; YIELD INCREASES

E. AGRICULTURAL ECONOMICS, DEVELOPMENT AND RURAL SOCIOLOGY

E10 Agricultural economics and policies

ASEAN contrasting narrative of agriculture. **Dy, R.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 8-9. Jan 2020.

AGRICULTURAL DEVELOPMENT; AGRICULTURAL SECTOR; EXPORTS; PRODUCTIVITY; POVERTY; RURAL POPULATION; ASEAN

Effect of infrastructure on the technical efficiency of Cavendish banana growers. **Astronomo, I.J.T., Balgos, C.Q., Digal, L.N., Loquias, M.P., Orbeta, M.L.G., Placencia, S.G.P., Sarmiento, J.M.P.** b25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 57. Sept 2019.

Cavendish banana is considered the most consumed and traded agricultural product globally with Philippines among the main exporters. However, Cavendish banana industry in the country has been challenged with poor or lack of infrastructure such as cable wires, roll ways, packing houses, and roads that affects quality. This shortfall results to bruising and exposure from much sunlight leading to off-grading and/or rejection of fresh bananas, hence, loss of potential income of farmers. This study aims to determine the effect/impact of infrastructure facilities to the technical efficiency of individual Cavendish growers in Santo Tomas, Davao del Norte in Mindanao [Philippines]. Furthermore, probe extends to compare how infrastructure affects existing grower-buyer arrangement in the area. Using 187 observations gathered in 2012, Stochastic Frontier Analysis was employed to address these objectives. Results showed that growers with access to good infrastructure gained higher technical efficiency than growers located in areas with poor infrastructure condition. Moreover, farmers engaged in contract arrangement including members of Cavendish banana cooperatives have access to good infrastructure and are more technically efficient than their counterparts who are neither engaged in contract arrangement nor member of cooperatives. Findings imply that adequate and well-conditioned post-harvest infrastructure improves farmer's technical efficiency which transforms into higher profitability. These results may guide future decisions of government and other concerned stakeholders relating to the industry's infrastructure facilities.

MUSA (BANANAS); FARMERS; EFFICIENCY; INFRASTRUCTURE; INDUSTRY; PHILIPPINES

Factors affecting food security among children of corn farmers in Cagayan Valley, Philippines. **Yra, A.J.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 55. Sept 2019.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2009). This study was conducted from January to April 2019 which aims to determine the factors affecting household food security among children of corn farmers in Cagayan Valley, Philippines. Multistage random sampling and cross-sectional design were applied. The sample size of the study was determined using population proportion formula. About 408 school children who were about one (1) to ten (10) years old during the conduct of the study were included. These children belong to the households of

corn farmers from the provinces of Isabela, Quirino, Nueva Vizcaya and Cagayan [Philippines]. The research also used a pre-tested questionnaire to gather needed information on socio-demographic and socio-economic profile of children. Radimer-Cornell standard questions were used to determine the household food security. Household food security is increased when educational attainment of fathers is increased, when mothers are employed and when the households are farming Bt corn. Food-insecure households should be encouraged to increase availability and access to food through more productive and diversified agriculture and livestock production, sustainable fisheries and forestry and non- agricultural employment and income opportunities.

MAIZE; FARMERS; FARMING SYSTEMS; CHILDREN; EDUCATION; HOUSEHOLDS; FOOD SECURITY; PHILIPPINES

Farm-level impact of the International Rice Genebank (IRG) on improved rice varieties: evidence from Eastern India. Villanueva, D.B., Capilit, G.L.S., Smale, M., Jamora, N.V., Sackville-Hamilton, R. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 56. Sept 2019.

The International Rice Genebank (IRG) is an important source of rice germplasm for crop improvement and India is the top country recipient of plant genetic materials from IRG. This paper investigates the impact of rice genetic resources through varietal improvement on the rice productivity of farmers in Eastern India. Pedigree analyses are conducted to construct indicators of the genetic contribution of ancestors maintained by the International Rice Genebank (IRG) to cultivated rice varieties. The countries of origin of the IRG progenitors were examined and three of the most popular IRG progenitors were characterized. Results show that 45-77% of the genetic composition of improved rice varieties came from the genes of IRG accessions. Employing data collected from almost 9000 farmers in Eastern India, we empirically test the relationship of ancestry to productivity changes while controlling for the effects of other farm inputs and environmental factors. The preferred translog model indicates that a 10% increase in the genetic contribution of IRG accession on an improved rice variety increases the yield by an estimate of 27%. The Coefficient of Parentage (COP) was computed to determine the level of diversity among the 10 most adopted improved rice varieties. The average COP of all pairwise combinations of 10 most adopted varieties is 0.0973, which implies high diversity. High diversity among these varieties is likely a result of crossing germplasm received from 19 countries of origin. The latent diversity measured by the COP may also translate into multiple, functional trait combinations in a released variety. This study demonstrates the contribution of IRG's genetic resources in the development of improved rice varieties.

ORYZA SATIVA; VARIETIES; GENETIC RESOURCES; GENE BANKS; YIELDS; PRODUCTIVITY; INDIA

Profitability and value chain analyses of soybean in Bukidnon and Davao Oriental [Philippines]. Ligue, K.J.B. Enicola, E.E., Alviola, P.A. IV., Romo, G.D.A., Acuña, T.R., Ebarle-Bancaya, E.J.N., Laorden, N.L. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 58. Sept 2019.

Soybean is one of the Philippines' high-valued crops and can be processed into many products for consumption and industrial uses. However, the country is heavily dependent on imports as local farmers

only produce less than 1% of the supply since 2009. This study aims to investigate the profitability and value chain situation of soybean in Bukidnon and Davao Oriental [Philippines], year 2017-2018. Two methods were used to investigate the condition of soybean farmers: cost and return, and value chain analyses limited to farmer's perspective. Farmers in Davao Oriental produce either Manchuria or mixed varieties of Manchuria, Tiwala 8 and Tiwala 10 while farmers in Bukidnon grow IPB SY 96-27-23 variety. Cost and return analysis indicated that labor cost contributed the largest in both cash and imputed cost incurred by the farmers. In Davao Oriental, soybean farmers can gain P0.66 for every peso outlay. Comparison of Manchuria and Mixed cost and returns showed that Mixed growers have higher gross returns and net profit. The value chain analysis revealed that the main problems in Davao Oriental farmers are the lack of infrastructure and technological support, unstable and expensive seed supply, lack of capital, and unstable market conditions. In Bukidnon, farmers lack technological support and consistent buyers. Only drying was found to be the value-adding process contributed by farmers in both areas. Also, the regional agricultural offices and their corresponding stations are found to be the most active agency to contribute support to both areas. The study recommends various interventions to boost productivity such as various trainings for seed preservation and post-harvest operations as well as infrastructure support that will eventually reduce their cost and strengthen the supply of soybeans in the value chain.

GLYCINE MAX; SOYBEANS; VARIETIES; COST BENEFIT ANALYSIS; PROFITABILITY; PRODUCTIVITY; PROFIT; PHILIPPINES

E13 Investment, finance and credit

Credit access and technical efficiency of Cavendish banana growers in Santo Tomas, Davao del Norte [Philippines]. **Astronomo, I.J.T., Balgos, C.Q., Digal, L.N., Loquias, M.P., Orbeta, M.L.G., Placencia, S.G.P., Sarmiento, J.M.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 57. Sept 2019.

Cavendish banana substantially boosts the economy of Philippine as one of the leading suppliers worldwide. However, production problems and constraints, such as the spread of diseases and challenging cost of production due to expensive inputs, hinder farmers to acquire higher incomes. As such, access to credit becomes an important tool to afford better inputs, invest in equipment, and eventually improve production. Therefore, credit access could potentially increase farm efficiency. This study aims to investigate the effect of credit access on the technical efficiency level using an econometric approach Stochastic Frontier Analysis. Data gathered in 2012 from individual Cavendish banana farmers in Santo Tomas, Davao del Norte showed that growers with access to credit attained higher technical efficiency. Furthermore, farmers who borrowed from formal financial institutions reaped higher technical efficiency compared to farmers who sourced from informal financiers. Study concludes that farmers in a developing country like Philippines lack capital and need available and accessible credit sources to purchase adequate volume of inputs necessary to maximize technical efficiency. Additionally, borrowing from banks and/or cooperative could give better efficiency. These results could guide government and other industry actors in designing future agricultural credit programs to aid farmers.

MUSA (BANANAS); VARIETIES; FARMERS; CREDIT; FINANCING; PRODUCTION COSTS; EFFICIENCY; PHILIPPINES

Factors affecting the choice of credit sources of Cavendish banana farmers in Davao del Norte, Philippines. **Loquias, M., Astronomo, I.J., Placencia, S.G., Orbeta, M.L., Digal, L.N., Bargas, C.Q.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 56. Sept 2019.

In the Philippine Cavendish banana industry, farmers incur almost Php500,000 per hectare for production cost. On top of standard inputs necessary for production, the spread of diseases and occurrence of climate extremes such as drought and typhoons would mean more costs to the farmers. To sustain production, agricultural credit becomes the fastest solution. Credit sources can be classified as formal and informal. Formal credit sources may include banks and cooperatives while informal sources include moneylenders and traders. The choice of credit source would have implications to the farmers. Informal credit, for example, could be exploitative due to high interest rates while formal institutions may have strict requirements discouraging farmers from borrowing. Because of this, it becomes relevant to understand the factors affecting the choice of credit source by farmers. Using a multinomial regression model, data gathered in 2012 from 187 Cavendish banana farmers in Sto. Tomas, Davao del Norte were analyzed to determine what influences farmers to choose a credit source over the other. Three types of sources were identified: no credit, formal credit, and informal credit; the credit sources were classified as categorical variables with 'no credit' as the base outcome. Results showed that factors such as education, farm size, net profit per hectare and membership to organizations significantly affected the choice of credit source of the farmers. Key findings also show that majority of the farmers loan money for capital from formal institutions. The results of this study can potentially aid the government in crafting policies and interventions relating to agricultural credit. Consequently, this study may enable reliable credit sources to be more accessible to farmers.

MUSA (BANANAS); VARIETIES; FARMERS; CREDIT; FINANCING; PHILIPPINES

Grant and zero interest loans for young agripreneurs. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 4-6. Mar 2020.

ENTERPRISES; MARKETS; FARMS; FINANCING; LOANS

E14 Development economics and policies

Evaluation of WeRise, a decision support tool for rainfed rice areas, on its applicability to improve rice production in the Philippines. **Llorca, L.P., Hayashi, K., Capistrano, A.O.V., Ramos, J.U., Aungon, J.J.E., Bugayong, I.D., Pantine, F.L.A.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 60. Sept 2019.

The application of seasonal climate predictions is imperative to harness uncertainties for rainfed rice production areas. WeRise (Weather-rice-nutrient integrated decision support system) is a seasonal climate prediction-based decision support tool initially developed by the IRRI [International Rice Research Institute]-Japan collaborative research project for Indonesia's rainfed rice areas. It functions through ORYZA, a crop growth model for grain yield simulations developed by IRRI, and SINTEX-F, a global

circulation model for seasonal climate predictions developed by the Japan Agency for Marine-Earth Science and Technology. This study aims to evaluate WeRise for Philippine rainfed areas. On-station field experiments were conducted at PhilRice, Nueva Ecija during the 2017-18 dry and wet seasons to gather observed datasets. Popular rice cultivars (NSIC Rc216 and PSB Rc10) and climate-smart varieties (NSIC Rc346 and NSIC Rc348) were used for model calibration. ORYZA was used to extrapolate the experiment conditions over 14 years using outputs from SINTEX-F (Data 1) and bias-corrected SINTEX-F (DATA 2) to compare the simulated grain yield from historically observed weather data (Data 0). Data 2 was obtained through a statistical downscaling method. The goodness of fit between observed and simulated grain yields was evaluated based on normalized root mean square error (RMSEn, %). Results showed that better fit was achieved when Data 2 was used in the simulations. RMSEn using Data 0 and Data 1 were 51%, 53%, 59% and 62% for PSB Rc10, NSIC Rc216, NSIC Rc346, and NSIC Rc348, respectively. On the other hand, RMSEn using Data 0 and Data 2 were 18%, 22%, 27%, and 30% for the same varieties. This implies that statistical downscaling method is a crucial step prior to the application of seasonal climate predictions into ORYZA. The ongoing IRRI-PhilRice-JIRCAS collaborative research project is conducting on-farm field validation experiments over wider geographical areas to evaluate the capability and predictability of WeRice as a decision support system.

RICE; PRODUCTION; RAINFED FARMING; INFORMATION TECHNOLOGY; SOWING; DECISION SUPPORT; KNOWLEDGE BASED SYSTEMS; TIMING; PHILIPPINES

Foodshed project aims to make partner communities food secure while earning a profit. **Tan, Y.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 36-38. Jan 2020.

FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER; ENTERPRISES; FOOD SECURITY; RURAL COMMUNITIES; GREENHOUSES; HYDROPONICS

Halal goat industry eyeing vast local, international markets. **Yap, J.P.Jr.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 62-63. Jan 2020.

GOATS; ANIMAL PRODUCTION; TECHNOLOGY; TECHNOLOGY TRANSFER; TRANSPORT; WORLD MARKETS; MARKETING; FOOD TECHNOLOGY

Mapping of smallholder rice farms in the Philippines through Information and Communication Technology (ICT)-enabled platform. **Jardinero, B.B., Calda, L.B.L., Vila, J.R., Sazon, P.M.R. Jr., Liwanag, E.C.A.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 59. Sept 2019.

Smallholder farms play critical role in combating global hunger and achieving food security. Increasing productivity of smallholder farms through production and policy support are pivotal in order to attain higher food supplies and improve livelihoods of farmers and farming communities. One of the first steps to do this is put smallholder farms on the map with corresponding identity including accurate size and profile, farm status, vulnerability, and the needs for intervention support. On October 2015, the Department of Agriculture and the International Rice Research Institute have started mapping smallholder rice farms through the ICT platform 'Farmer and Farm Lot Registration' (FFR) which is part of the suite of tools known as Rice Crop Manager (RCM) Advisory Service (<http://phapps.irri.org/ph/ras/>). The mapping of smallholder

rice areas starts with short interview of farmers using FFR to register basic information about them and their farms, followed by perimeter measurement of the farm using handheld GPS device. This step makes use of Area Calculation function in Garmin Etrex models, which automatically captures trackpoints as the user walks along the perimeter of farm lots. These saved trackpoints are part of the whole track that is saved as GPS Exchange Format (GPX) file. GPX files are then submitted and saved in RCM database for subsequent use in fertilizer calculation and overlaying on Google map. This process has been rolled out nationwide through trained extension staff that led to mapping of more than 57,000 hectares in 72 provinces. The process of mapping smallholder farms is relatively simple to follow and requires less technical know-how on Geographic Information System on the part of users since the ICT platform does the processing and consolidation of tracks into useful maps. This same process has the potential to scale up and expand into other commodities beyond rice.

RICE; SMALL FARMS; CARTOGRAPHY; CADASTRES; INFORMATION TECHNOLOGY; TECHNOLOGY; MARKETING

E20 Organization, administration and management of agricultural enterprises or farms

Angie king's castle: hotelier turns Batangas [Philippines] rest home into a farm. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 30-33. Jan 2020.

FARMS; AEROPONICS; HYDROPHIIDAE; APICULTURE; RURAL AREAS; PHILIPPINES

'Kangkong queen' helps her community while fully rehabilitating her organic farm after typhoons Yolanda and Ursula. Hubilla, E.K. *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 36-38. Mar 2020.

IPOMOEA AQUATICA; LEAF VEGETABLES; ORGANIC AGRICULTURE; FARMS; FARMERS; DIFFUSION OF INFORMATION

Look! a garden called little Amsterdam in the Cebu City [Philippines] highland. Sarian, Z.B. *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 34-35. Jan 2020.

FLOWERING; PLANTS; FLOWERS; VEGETABLE CROPS; VARIETIES; HIGHLANDS; GARDENS; FARMS; RURAL AREAS; TOURISM; PHILIPPINES

Maverick Thai Murrah dairy makes money from milk and fun activities. Sarian, Z.B. *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 56-57. Jan 2020.

DAIRY INDUSTRY; RURAL AREAS; TOURISM; INCOME

Quezon [Philippines] farm makes money from crops and vacation crowds. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 58-60. Feb 2020.

VEGETABLE CROPS; DRUG PLANTS; ORNAMENTAL PLANTS; LIVESTOCK; APICULTURE; CHICKENS; CROP ROTATION; CROPS; MIXED FARMING; PHILIPPINES

Rising from the ashes through right attitude and the passion to farm. **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 42-46. Mar 2020.

FARMS; RURAL AREAS; TOURISM; FRUIT TREES; INDIGENOUS ORGANISMS; LIVESTOCK; CHICKENS; INDIGENOUS KNOWLEDGE; DIFFUSION OF INFORMATION; ORGANIC AGRICULTURE

Success comes from converting lands and transforming lives. **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 24; 26-29. Jan 2020.

ZEAL MAYS; EDIBLE FUNGI; PLANTING; PLANT CONTAINERS; GARDENING; URBAN AGRICULTURE; FOOD TECHNOLOGY; FARMS; RURAL AREAS; TOURISM

Wasteland turned into flower farm for agritourism. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 40-41. Mar 2020.

FLOWERS; FARMS; RURAL AREAS; TOURISM; INCOME

Weekend getaway advocates the importance of native trees. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 62-64. Feb 2020.

FARMS; INDIGENOUS ORGANISMS; FOREST TREES; BIODIVERSITY; TOURISM; FARM HOLIDAYS

E50 Rural sociology and social security

Participatory evaluation and selection of heirloom rice varieties in three ethno-communities of Benguet Province [Philippines]. **Tad-awan, B.A., Masangcay, T.P., Gayomba, H.C., Chomawat, J.M., Mauting, W.S.** 25. Federation of Crop Science Societies of the Philippines, Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 101. Sept 2019.

Heirloom rice varieties are grown by ethno-communities in Benguet [Philippines] as part of their culture. These are valuable genetic resources, thus, communities play a key role in preventing genetic erosion. Participatory selection is an excellent way to select varieties in Benguet. Free prior informed consent (FPIC) consultation was done with the community folks in collaboration with responsible government agencies. Documentation of heirloom rice varieties in three ethno communities was done after the consultation and granting of FPIC. Participatory evaluation of heirloom rice varieties with market potential was conducted with farmer-partners for two cropping seasons: January-July and August-January from 2018-2019 in three locations namely; Bakun (1196 m asl), Kibungan (843-853 m asl) and Kapangan (930-963 m asl). Each that was laid-out in randomized complete block design. The most preferred variety by the farmers was determined with the use of preference score index. Stability analysis was also done. A total of 82 heirloom rice varieties were documented; 26 in Bakun, 37 in Kapangan, and 19 in Kibungan. The yield performance of heirloom rice varieties in the three experimental sites for the two cropping seasons varied. The highest yielders were Lablabi and Lasbakan in Bakun; Sapaw, Balatinaw and Bongkitan in Kapangan, and in Kibungan were Balatinaw and Bongkitan. The most preferred varieties were Bongkitan and Lablabi in Bakun; Lablabi, Sapaw and Bongkitan in Kapangan, and Lasbakan, Bongkitan and Balatinaw in Kibungan. The reasons cited by the heirloom rice farmers for preferring a variety were; more productive tillers

produced, long panicles with full and plump grains, uniform ripening and resistance to lodging. Stability analysis showed that the most stable varieties in Bakun were Lasbakan and Kalipago; Balatinaw and Bongkitan in Kapangan; and Lasbakan and Balatinaw in Kibungan.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; SELECTION; SOCIAL PARTICIPATION; ETHNIC GROUPS

E70 Trade, marketing and distribution

Market structure of selected Benguet [Philippines] highland vegetables given developments in market infrastructure and policy interventions. **Launio, C.C., Altaki, M.J., Paing, M.D., Talastas, M.C., Longay, N.T.**

25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 58. (Sept 2019).

Benguet, Philippines is the single most important producer of highland vegetables in the country. The highland vegetable industry in Benguet is faced with opportunities and challenges brought about by market liberalization, government investments on market infrastructure, urbanization, local policy changes and progress on information technology. Hence, updating and better understanding of the market structure is important and relevant to bring to the attention of the national and local government policy and decision making the state of industry stakeholders. This study was conducted covering 2018-2019 reference period to determine the developments in the marketing channels and the nature of competition in the highland vegetable industry, and present constraints and opportunities for the highland vegetable farmers. It employed mixed methods in the analysis, using quantitative data from surveys of farmers, traders, porters, washers, and other players, and qualitative information based on key informant interviews and document reviews. Data collected include market outlets of farmers, suppliers and buyers of the various traders involved in vegetable marketing; estimated procurement and delivery volume; and perceived constraints and opportunities by stakeholders. Preliminary analyses point to the importance of grassroots and social planning, accurate information dissemination, transparency, and critical consideration of political economy and institutions when planning or implementing government interventions. Continuous monitoring and evaluation of the outcome of government interventions is important for real-time feed backing for policy making.

VEGETABLES; INDUSTRY; HIGHLANDS; MARKETING CHANNELS; MARKETS; INFRASTRUCTURE; MARKETING; PHILIPPINES

E80 Home economics, industries and crafts

Showcasing the Negrense through a farm to fabric business model [Philippines]. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 50-51. Jan 2020.

COTTON; ENTERPRISES; FARMS; HANDICRAFTS; PROCESSED PLANT PRODUCTS

Weaving beauty and success behind every fabric. **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 34-37. Feb 2020.

NATURAL FABRICS; HANDICRAFTS; TEXTILE INDUSTRY; ROLE OF WOMEN; ENTERPRISES; INDIGENOUS KNOWLEDGE; CULTURAL VALUES

F. PLANT SCIENCE AND PRODUCTION

F01 Crop husbandry

Adaptability of recommended rice varieties under PhilRice Negros environment [Philippines]. Dogeno, L.A.G., Pajarillo, A.O., Seville, C.U. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 76. Sept 2019.

Rice is notably one of the most in-demand crops in the Philippines considering its extensive utilization for food. Considering the growing population and decreasing land areas for rice farming, it is inevitable to experience a shortage of domestically grown rice. Recently, the average national yield of palay is 3.87 t/ha at an incurred cost of P12 per kilogram which seemingly implies farmers' un competitive management practices. Its high production requirement thrusts various agricultural research institutions both in government and private sectors to engage in the development of farming innovations and the promotion of adaptable varieties to optimize rice production per unit of land. For this cause, the Department of Agriculture generated and released sets of suggested rice varieties at national and regional levels. In PhilRice Negros, the R&D team established and evaluated these varieties on dry season, 2019 alongside with other rice cultivars (farmers' preference and modern). National recommended varieties include: NSIC Rc222, Rc216 and Rc300; regionally recommended varieties: NSIC Rc400, Rc426, Rc484, Rc478 and Rc482. The area allotted is a total of 1,200m² where each varietal plot comprised of 30 rows and 80 hills/row at a distance of 25cm x 25cm. The fertilizer application is based on NPK rate of 100-10-40. Yield data shows that for nationally recommended varieties, NSIC Rc222 and Rc216 are comparable with yields of 7.5 and 7.0t/ha, respectively. As for its regional counterpart, NSIC Rd358 produced significantly among others with a yield of 7.7t/ha. In contrast, NSIC Rc27 as a preferred variety by farmers produced 7.48t/ha while NSIC Rc400 topped the yields of all other modern varieties at 8.0t/ha. In conclusion, these results will help in the verification of recommended varieties, and likewise to identify new and potential varieties for promotion.

ORYZA SATIVA; VARIETIES; ADAPTABILITY; CROP YIELD; FERTILIZER APPLICATION; SPACING; PHILIPPINES

Angie king's castle: hotelier turns Batangas [Philippines] rest home into a farm. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 30-33. Jan 2020.

FARMS; AEROPONICS; HYDROPHIIDAE; APICULTURE; RURAL AREAS; PHILIPPINES

Basic tips [for plants] to recover from ashfall. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 10; 12. Feb 2020.

CROPS; CROP MANAGEMENT; GREENHOUSES; PLASTIC FILM COVERS; ROOFS; VOLCANIC MATERIALS

Carbon sequestration as affected by tillage practices and fertilizer application. Pabiona, M.G., Ugay, P.P. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of

the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 80. Sept 2019.

The study was conducted at the Agricultural Experiment Center, Central Mindanao University [Philippines]. It aimed to determine the soil chemical properties such as pH, organic matter content, extractable phosphorus and exchangeable potassium as affected by tillage practices and fertilizer application; to evaluate the soil organic carbon and plant carbon as potential C stock; and to determine the yield components of corn as affected by tillage practices and fertilizer application. The experiment was laid out following factorial in Randomized Complete Block Design in three replications with tillage practices (No tillage and conventional tillage) as factor A and inorganic and organic fertilizer (No Fertilizer, 60-30-100 kg N-P sub 2 O sub 5-K sub 2 O/ha, 2 tons Vermicompost/ha and 4 tons Vermicompost/ha) as factor B. The different tillage system and fertilizer application affects the soil chemical properties. It was found out that the soil was strongly acidic (pH of 4.67 to 5.04), has marginal organic matter content (2.49 to 3.59%), high extractable phosphorus (14.45 to 21.78 mg/kg), and exchangeable potassium (0.191 to 0.37 cmol/kg). Results shows that the interaction of tillage practices and kind of fertilizers applied had significant effect on soil organic carbon, corn grain yield and weight of 1000 seeds. Corn plants under conventional tillage applied with 4 tons vermicast/ha and 30-60-100 of N-P sub 2 O sub 5-K obtained the highest grain yield and heaviest 1000 seeds weight. Across the tillage practices, the two practices did not significantly differ in all chemical properties. Highest soil organic carbon sequestered was obtained in no tillage and yield parameters was found significant on conventional tillage. Soil organic carbon, grain yield and weight of 1000 seeds were significantly affected by the fertilizers. However, further study is suggested to validate this result.

CROP MANAGEMENT; TILLAGE; CARBON; SOIL CHEMICOPHYSICAL PROPERTIES; FERTILIZER APPLICATION; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS

Characterization of cacao (*Theobroma cacao* L.) phenology under Type III climate. **Protacio, C.M., Lagrimas, A.J.M., Del Rio, S.P., Salazar, B.M., Gonzaga, A.B.Jr., Cena, R.B., Sarausa, D.N., Cantil, D.M.N.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 80-81. Sept 2019.

Smart agriculture calls for location-specific data of weather parameters vis-a-vis growth responses. The study aims to characterize the annual production cycle of cacao, from flowering to harvesting, to become strong bases in recommending specific practices ahead of time, given a climate outlook. Phenology was characterized using the Biologische Bundesanstalt Bundassorternamt Chemische Industrie (BBCH) scale for cacao. Flowers (BBCH 51-69), cherelles (BBCH 70-75), pods (BBCH 76-89) and leaf flushing intensity per tree were monitored monthly in different locations under Type III Climate, from October, 2018 to May During the dry months, January to March, flowering intensity was low. UPLB in Los Baños, Laguna [Philippines], where the average rainfall was 15.33 mm, had an average of 78.7 flowers monthly. Kabacan, North Cotabato, represented by USM, maintained higher number of flowers with 521.3 despite having received the lowest rainfall. During this time was also a low leaf flushing intensity. Since there were low number of flowers during the dry months, low number of cherelles were observed in the following months in all sites. Therefore, low to no harvest is likely 5 to 6 moths after. In April, when rainfall started to increase, flowering also intensified. UPLB [University of the Philippines Los Baños] and USM [University of Southern Mindanao] had more than 1,100 flowers per tree. In May, number of flowers in UPLB jumped to 2,400 corresponding

to an increase in rainfall from 32.8 mm in April to 160 mm. High number of flowers in April was followed by higher number of cherelles in May. The data, so far, suggest that climate controls the scheduling of harvesting peaks by affecting the intensity of flowering and sustenance of fruit development.

THEOBROMA CACAO; PLANT PRODUCTION; FLOWERING; HARVESTING; GROWTH; PRODUCTION LOCATION; CLIMATE; PHENOLOGY

Creating a legacy through a dragon fruit association. Taculao, P.B.S. Agriculture (Philippines). 0118-857-7. v. 24(2) p. 40-42. Feb 2020.

HYLOCEREUS UNDATUS; FRUITS; ENTERPRISES; FARMERS ASSOCIATIONS; FOOD PROCESSING; PROCESSED PLANT PRODUCTS; TRADITIONAL FARMING

Cropping advisories of rainfed rice and corn using seasonal climate forecasts. Dalagan, J.I., Lansigan, F.P., Sta. Cruz, P.C., Hernandez, J.E., Fajardo, A.T. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. Philippine Journal of Crop Science (Philippines). 0115-463X. v. 44(Supplement no. 1) p. 83. Sept 2019.

The onset of rain is one of the determinants in scheduling the planting of rice and corn. Hence, typical planting for wet season and dry season starts in June and October, respectively. Philippines is among the countries that are most vulnerable to the effects of climate change due to its geographic characteristics and its ability to recover after a calamity. Furthermore, literatures on the country's rainfall distribution and projected climate assert that its weather has become more erratic. A systematic approach in determining the best planting window for rainfed rice and corn using seasonal climate forecasts is being employed in issuing cropping advisories to farmers in selected sites. The approach makes use of knowledge on the crop's required amount of water before sowing for it to have a reasonable yield. Expected dates of flowering and maturity can also be drawn from the identified planting dates. Given this information, interventions on cropping management can be prepared ahead of time.

ZEA MAYS; ORYZA SATIVA; RAINFED FARMING; PLANTING; CROP MANAGEMENT; CLIMATE; WEATHER FORECASTING

Effects of irrigation and fertilization on the quality of 'Super Pinoy' onion (Allium cepa L.) bulbs. Lualhati, R.A.O., Gonzales, D.C.H., Esguerra, E.B., Dumlao, C.A.P., Nate, K.J.R., Patricio, M.G., Espino, A.N., Mandac, J.N.R. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. Philippine Journal of Crop Science (Philippines). 0115-463X. v. 44(Supplement no. 1) p. 54. Sept 2019.

Cultural management practices like irrigation and fertilization affect the quality and storage behavior of onion bulbs his study, 'Super Pinoy' onions at a farm Brgy. Sta. Rita, Sto. Domingo, Nueva Ecija from January to March 2019 were subjected to various irrigation regimes (drip irrigation at 3-, 5- and 7-day intervals and flooding every 9 days) from 45 to 97 days after transplanting. Each plot measured 1.4 m by 7 m with 12 rows. Water from elevated reservoir was distributed to six laterals in each plot to emitters with 30-cm spacing with drip of 0.71 L-h-1. Flooding was done at 13.35 L-s-1 for 79 s. On the other hand, two fertilization treatments (90-80-40 based on soil analysis and 114-85-54 based on farmer's practice) were

employed. Split plot design with triplicates per treatment was done. Bulbs were harvested at commercial maturity and were cured at ambient condition then profiled using different quality parameters. Higher proportion (31.51%) of large-sized bulbs was obtained in flooded plots compared to those subjected to drip irrigation (14.28-16.78%). Fertilization did not affect bulb size. Flooding appeared to increase the susceptibility of bulbs to insect damage. The incidence of bulbs with wide neck, however, was lowest in flooded plots. Flooding when combined with fertilization using the farmer's practice further increased susceptibility to insect damage. On the other hand, flooding in combination with fertilization regime that was based on soil analysis had more mechanically damaged bulbs. No differences in misshapen, diseased and split bulbs were obtained between treatments. Physic-chemical properties of the bulbs like pungency, total soluble solids, and total phenolic content were almost similar in all treatments. The free-radical scavenging activity of bulbs was higher in plots drip-irrigated at 7-d interval in combination with soil analysis-based fertilization. Mechanical properties (stiffness, boiyield and rupture points) did not vary among treatments.

ALLIUM CEPA; ONIONS; QUALITY; CHEMICOPHYSICAL PROPERTIES; STORAGE; FERTILIZER APPLICATION; IRRIGATION

Farmers love practical farm tips. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 46-47. Feb 2020.

FRUIT TREES; VEGETABLE CROPS; CROP MANAGEMENT; INTERCROPPING; FERTILIZER APPLICATION; INDUCED FLOWERING; SPRAYING; PEST CONTROL; FARMERS

From curiosity to advocacy: how an urban gardener grows her own food and encourages everyone to do the same. **Victoriano, R.A.D.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 14-16. Feb 2020.

VEGETABLE CROPS; CULINARY HERBS; ORGANIC GARDENING; DOMESTIC GARDENS; HYDROPONICS

Foodshed project aims to make partner communities food secure while earning a profit. **Tan, Y.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 36-38. Jan 2020.

FARMING SYSTEMS; TECHNOLOGY; TECHNOLOGY TRANSFER; ENTERPRISES; FOOD SECURITY; RURAL COMMUNITIES; GREENHOUSES; HYDROPONICS

Green therapy: gardening as healing for millennial with bipolar disorder. **Victoriano, R.A.D.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 56-57. Feb 2020.

CULINARY HERBS; VEGETABLE CROPS; ORNAMENTAL PLANTS; DOMESTIC GARDENS; GARDENING; URBAN AREAS; PLANTING; PLANTS; THERAPY

Help for ubi growers and processors available at DMMMSU [Don Mariano Marcos Memorial University, Bacnotan, La Union, Philippines]. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 8-9. (Mar 2020.

DIOSCOREA ALATA; YAMS; FOOD PROCESSING; FOODS; PROCESSED PLANT PRODUCTS; ENTERPRISES; CROP MANAGEMENT; PHILIPPINES

I started a backyard farm with no knowledge about gardening-here's how i did it. **Fernandez, J.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 43-45. Feb 2020.

CULINARY HERBS; PLANTING; DOMESTIC GARDENS; GARDENING; FARMING SYSTEMS; SMALL FARMS

Isabela [Ilagan City, Philippines] farmer heats things up with superhot chillies. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 22; 24-25. Feb 2020.

CAPSICUM ANNUUM; VARIETIES; CHILLIES; PLANTING; PLANT ESTABLISHMENT; HARVESTING; PHILIPPINES

'Kangkong queen' helps her community while fully rehabilitating her organic farm after typhoons Yolanda and Ursula. **Hubilla, E.K.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 36-38. Mar 2020.

IPOMOEA AQUATICA; LEAF VEGETABLES; ORGANIC AGRICULTURE; FARMS; FARMERS; DIFFUSION OF INFORMATION

Lady is up and about at 88 doing pleasure farming. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 4-6. Jan 2020.

VEGETABLE CROPS; FRUIT CROPS; PLANTING; ORGANIC FERTILIZERS; FARMERS; FARMING SYSTEMS

Litson manok [grilled chicken] magnate [Mr. Sandy Javier] goes for sweet jackfruit. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 50-51. Feb 2020.

ARTOCARPUS HETEROPHYLLUS; PLANTING; CROP MANAGEMENT; PROPAGATION MATERIALS; SEEDLINGS; OLIGOCHAETA; COMPOSTING

Living mess art pieces make beautiful décor. **Necessario, N.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 52-53. Jan 2020.

ORNAMENTAL PLANTS; BRYOPHYTA; TILLANDSIA; PLANT CONTAINERS; PLANT ESTABLISHMENT

Look! a garden called little Amsterdam in the Cebu City [Philippines] highland. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 34-35. Jan 2020.

FLOWERING; PLANTS; FLOWERS; VEGETABLE CROPS; VARIETIES; HIGHLANDS; GARDENS; FARMS; RURAL AREAS; TOURISM; PHILIPPINES

Lush among the luxe: empty lots inside one of Metro's luxurious villages turned into urban farms. **Victoriano, R.A.D.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 8-9. Feb 2020.

VEGETABLE CROPS; DRUG PLANTS; PLANTING; URBAN AREAS; FARMS; URBAN AGRICULTURE; DOMESTIC GARDENS; ORGANIC FERTILIZERS

Meat a lady achiever [Rolita Spowart]. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 38-39. Feb 2020.

ORYZA SATIVA; EDIBLE FUNGI; ORNAMENTAL PLANTS; FLOWERS; TISSUE CULTURE; FARMERS

Meyer lemon: very juicy, but no seeds! **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 39. Mar 2020.

LEMONS; SEEDLESS VARIETIES; AGRONOMIC CHARACTERS; PLANTING; FRUITING; FRUITS; GRAFTING

P12,000 worth of guavas a day on 2.7-hectare rented land. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 20; 22. Jan 2020.

PSIDIUM GUAJAVA; GUAVAS; CROP MANAGEMENT; PLANT PROTECTION; PHYSICAL CONTROL; ORCHARDS

Performance evaluation of tissue culture-derived chrysanthemum (*Chrysanthemum morifolium* Ramat) planting materials and cut flower vase life assessment. **Valida, I.A., Acedo, V.Z.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 101-102. Sept 2019.

Chrysanthemum (*Chrysanthemum morifolium* Ramat) is conventionally propagated using suckers and stem cuttings which often result to low quality plants and flowers. With in vitro techniques, clean planting materials resulting to quality flowers can be obtained. The study was conducted to evaluate the performance of tissue culture-derived chrysanthemum plants and the vase life of the flowers produced. Suckers and stem cuttings measuring 10-12 cm were planted in black polyethylene pots (6x6x11) containing growing medium consisting of garden soil (GS): vermicast (V) and carbonized rice hull (CRH) at 1:1:1 by volume. Complete fertilizer (14-14-14) and a calcium-based fertilizer were applied at the rate of 1tbsp per gallon on weekly interval for two months. The vase life of cut-flowers was tested using different holding solutions (distilled water, 2% sucrose, 4% sucrose, 100 mg/l citric acid, and 200 mg/L citric acid). Results showed that stem cutting-derived plants produced flowers earlier than sucker-derived ones at 6 and 8 weeks from planting respectively. However, the former produced more flowers per stalk (51.07) than the latter (46.85). with regard to the vase life, citric acid at 200 mg/L was the best among the treatments wherein the flowers were still fresh-looking after 7 days while those in the other treatments were wilted and dehydrated after 4 days.

CHRYSANTHEMUM; SPECIES; TISSUE CULTURE; CUT FLOWERS; CUTTINGS; KEEPING QUALITY; CROP PERFORMANCE; EVALUATION

Performance of late-maturing rainfed rice lines under different rice growing environments in the Philippines. **Madrid, I.J.W., Embate, M.V.G., Lubigan, J.V.DC., Hernandez, J.E., Borromeo, T.H., Magnaye, A.M.A., Sta. Cruz, P.C., Lalicán, D.J., Bon, S.G., Orbon, C.A., Machica, T.C.B., de Ramos, R.C., Alvarez, A.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 138. Sept 2019.

Yield trials were conducted in three locations in the Philippines (Los Baños, Laguna; Pili, Camarines Sur; and Tupi, South Cotabato) in 2018 wet season to determine yield performance of 35 late-maturing rainfed rice lines from UPLB, PhilRice and IRRI, and 10 check varieties across three environments: upland in South Cotabato, favorable rainfed lowland in Camarines Sur, and unfavorable rainfed lowland in Laguna. Total rainfall during the cropping season was highest in South Cotabato (7,574.00 mm), followed by Camarines Sur (803.40 mm), and lowest in Laguna (248.30 mm). Even with lesser rainfall than South Cotabato, Camarines Sur had the highest mean yield of 3.79 t ha/per, attributable to the presence of paddy water throughout the trial. Yield range varied greatly across environments: 2.21-7.73 t ha/per for favorable rainfed lowland, 0.59-6.53 t ha/per for upland, and 0.02-2.09 t ha/per for unfavorable rainfed lowland. Across environments, PR41398-ICRL2008WS-PSBRc68-27-2-3 under favorable rainfed lowland was the top yielder among entries (7.73 t ha/per) while the lowest yield (0.02 t ha/per) was from PR40060-YDamDo-IVC2008DS7-2-DRT2 under unfavorable rainfed lowland. Per environment, PR41398-ICRL2008WS-PSBRc68-27-2-3 (7.73 t ha/per) was the top yielder in the favorable rainfed lowland condition while PUR91 was a consistent top yielder in upland and unfavorable rainfed lowland environments with 6.53 t ha/per and 2.09 t ha/per yield, respectively. The study shows that performance of rainfed rice lines is highly influenced by the environment particularly climatic factors, and while this is the case, outstanding lines can be identified across environments.

ORYZA SATIVA; PROGENY; RAINFED FARMING; HIGHLANDS; LOWLAND; CROP YIELD; CROP PERFORMANCE; ENVIRONMENT; PHILIPPINES

Phenology and growth of semi-determinate soybean varieties across two different seasons. **Cantimprate, S.C., Cuizon, A.J.V., Aquino, A.M., Enicola, E.E., Makahiya, H.A.F.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 102. Sept 2019.

Seasonal variation in growth, development and productivity of soybean is driven by changes in photoperiod and other agroclimatic factors. Field experiment was conducted at the Central Experiment Station, UPLB [University of the Philippines Los Baños, Laguna, Philippines] to evaluate the phenology and growth of soybean varieties across two different seasons. Varieties tested were 1) Tiwala 6, 2) Tiwala 8, 3) Tiwala 10, 4) CLSoy and 5) Manchuria. Crops were grown under optimum management practices in October 2018-January 2019 and in February-June 2019. Pests and diseases were controlled. The average daylength was 11.5 hours day⁻¹ in Oct 2018-Jan 2019 (short-day period) and 12.4 hours day⁻¹ in Feb-Jun 2019 (long-day period). Results showed that varieties had significantly longer mean days to floral initiation (R1) during the long-day period than short-day period. Across seasons, CLSoy and Manchuria flowered earlier than Tiwala 6, 8 and 10. Tiwala varieties flowered within 22 days while CLSoy and Manchuria flowered within 18 days during the short-day period but all varieties flowered within 19 days in the long-day period which was significantly higher than about 42 days during short-day period. In general, soybean varieties matured at about 86 days after planting (DAP) during short-day period and about 106 DAP during long-day period. The maximum leaf area index (LAI) of 3.7 during long-day period was significantly higher than LAI of 3.0 during short-day period than long-day period. These indicate that soybean varieties had delayed flower initiation and physiological maturity and extended vegetative growth due to long photoperiods. Tiwala varieties were observed to be the more sensitive to seasonal changes than CLSoy and Manchuria.

GLYCINE MAX; SOYBEANS; VARIETIES; BIOMASS; PHENOLOGY; SEASONS; LEAF AREA INDEX

Pioneer in the fruit and vegetable industries engages in okra [*Abelmoschus esculentus*] production for export. Taculao, P.B.S. *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 34-35. Mar 2020.

ABELMOSCHUS ESCULENTUS; PLANTING; CROP MANAGEMENT; HARVESTING; CONTRACT FARMING; FARMERS; EXPORTS

Probing into why farmers continue to plant unclassified rice lines. Romero, M.V., Corpuz, G.A., Hulinganga, R.C., Mamucod, H.F. 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 104. Sept 2019.

Despite the massive promotion of certified seeds, a significant number of farmers still plant unclassified rice lines of unknown identity. Since they only have popular names without the standard NSIC code. They are assumed to have not undergone the formal seed system. The possible reasons behind the use of unclassified rice lines could be unique genetic traits, pest and disease resistance, or good grain quality. This was better elucidated when PhilRice [Philippine Rice Institute] conducted a survey among these rice farmers who identified good eating quality as their most common reason why they persistently use unclassified lines. To better understand the likely meaning of 'good eating quality' among the farmers, 150 rice lines were collected from different regions across the Philippines and subjected to a comprehensive grain quality evaluation. Results showed that total milled rice recovery ranged from 65.-75.7%, classified as Grade 1 to Premium. This good milling recovery promotes better marketability. Malagkit Exotic from Region 4-B [Mindoro, Marinduque, Palawan, Philippines] exhibited the highest brown rice, total milled rice, and head rice recoveries. Majority of the rice lines had intermediate amylase content (17.8-22.0%), indicating softer texture and good eating quality. Based on alkali spreading value, most samples had intermediate gelatinization temperature (70-74%), thus, with shorter cooking time. The rice lines had good crude protein content ranging from 5.7-11.4%, with highest values from Bulaw Super 60 from Region 3 [Central Luzon] and Blonde from Region 5 [Bicol region]. This study confirms that grain quality, including milling recovery, texture, and cooking time, play an important role in farmers' selection of rice lines for planting. In combination with DNA fingerprinting and agro-morphological characterization, grain quality evaluation is an effective tool in helping determine the identity of unclassified rice lines. Those lines that matched commercially-released NSIC varieties may be grown using certified seeds for higher and stable yield.

ORYZA SATIVA; PROGENY; DNA FINGERPRINTING; GRAIN; QUALITY; AMYLOSE; AGRONOMIC CHARACTERS; FARMERS; SELECTION

QC [Quezon City, Philippines] businessman [Dr. Lorgene A. Mata] is proud of his thriving 37-year-old edible garden. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 30-32. Sept 2019.

VEGETABLE CROPS; CULINARY HERBS; FRUIT TREES; PLANT ESTABLISHMENT; CROP MANAGEMENT; CROPS; DOMESTIC GARDENS

Radiation-modified carrageenan increased productivity of mungbean in Isabel, Cagayan Valley, Philippines. Calderon, V.J., Aquino, R.M.G., Manaligod, K., Atalin, V. 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 105. Sept 2019.

Cagayan Valley being tagged as the largest producer and mungbean capital of the Philippines has a total of 13,853.24 hectares production area (PDA, 2018), however it only ranks 2nd among the mungbean-producing provinces in the Philippines because of low yield (564 kgs/ha) and farmers are harvesting mungbean for one or two primings only. It is with this reason the need to increase the yield of the mungbean farmers through introduction of improved varieties and application of Carrageenan PGP at the rate of 100 ppm as supplement to the Farmers Existing Practices. The combination of Carrageenan PGP applied every 14-15 days interval, inoculant and recommended rate of inorganic fertilizer gave the highest yield advantage of 94.25% and 192.91% over the control (no application) for UPL Mg 7 and NSIC Mg 21, respectively which can be translated to increase income ranging from Php53,265.00 to Php79,335 per hectare. Further, application of Carrageenan PGP alone either every 7-10- and 14-15 days interval is capable of increasing yield by 50% for UPL Mg 7 and 125% for NSIC Mg 13 variety. Apparently, the significant increase in yield is due to more fully developed pods and larger and heavier seeds. Good fodder yield and presence of beneficial insects is observed in plots applied with Carrageenan PGP, thus lowering damages of cutworm and other diseases.

VIGNA RADIATA RADIATA; MUNG BEANS; PRODUCTIVITY; CARRAGEENANS; PLANT GROWTH SUBSTANCES; APPLICATION METHODS; PHILIPPINES

Rizal [Philippines] community makes a profit selling orchids. **Tan, Y.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 40-41. Jan 2020.

ORCHIDACEAE; ORNAMENTAL PLANTS; VARIETIES; CUT FLOWERS; PROFIT; PHILIPPINES

Soil concoction that works wonders for urban gardeners. **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 50-52. Mar 2020.

DOMESTIC GARDENS; VEGETABLE CROPS; FARMS; URBAN AREAS; ORGANIC AGRICULTURE; COMPOSTS; CROP MANAGEMENT; CROPS; FERTILIZER APPLICATION; WATERING

Success comes from converting lands and transforming lives. **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 24; 26-29. Jan 2020.

ZEA MAYS; EDIBLE FUNGI; PLANTING; PLANT CONTAINERS; GARDENING; URBAN AGRICULTURE; FOOD TECHNOLOGY; FARMS; RURAL AREAS; TOURISM

Sylvia, a new green lettuce variety. **Ancheta, A.V.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 20-22. Mar 2020.

LACTUCA SATIVA; VARIETIES; PLANTING; AGRONOMIC CHARACTERS; PRICES; DEMAND

There's money in talbos [vegetable tops]. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 4; 6-7. Feb 2020.

VEGETABLE CROPS; LEAVES; PLANTING; COMMON MARKETS; FARMERS; INCOME; FARMERS

Three important things to remember when growing ornamental cacti. **Hubilla, E.K.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 53-55. Mar 2020.

ORNAMENTAL PLANTS; CACTACEAE; SUCCULENT PLANTS; PLANTING; PLANTS; WATERING; PLANT PROPAGATION; CROP MANAGEMENT

Urban gardening idea for the building mixologist: growing herbs for your home bar. **Villa, J.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 18; 20-21. Feb 2020.

CULINARY HERBS; PLANTING; DOMESTIC GARDENS; ORGANIC GARDENING; PLANT CONTAINERS; URBAN AREAS

Vanilla, vanilla how pricey art thou? **Lacson, S.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 12-14; 16; 18. Mar 2020.

VANILLA PLANIFOLIA; ESSENTIAL OIL CROPS; CROP MANAGEMENT; VANILLIN; MARKETS; USES; MARKETING; PLANT PROPAGATION

Wasteland turned into flower farm for agritourism. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 40-41. Mar 2020.

FLOWERS; FARMS; RURAL AREAS; TOURISM; INCOME

Why is there only one piece of fruit on my Jalapeño plant? (and other issues will might have about growing hot peppers). **Villa, J.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 47-49. Mar 2020.

CAPSICUM ANNUUM; CHILLIES; VARIETIES; FRUITS; FLOWERING; POLLINATION; CROP MANAGEMENT; FOLIAR APPLICATION

F02 Plant propagation

Approaches to in vitro conservation of Philippine sugarcane (*Saccharum officinarum*) genetic resources. **Alcachupas, C.G., Guevarra, P.R., Valle, M.L.S., Huelgas, V.C., Damasco, O.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 77. Sept 2019.

The Philippines has approximately 1,285 sugarcane varieties developed locally or introduced from other countries which are maintained in the field genebanks of Sugar Regulatory Administration (2016) excluding the variety collection from other research institutions or in small and big sugarcane plantations through the country. In vitro conservation of sugarcane offers a means of maintaining valuable genotypes in a small space, free from pests and diseases, with high multiplication potential. For the last two years, a total of 317 sugarcane accessions were successfully introduced in vitro and currently maintained in MS medium with 1 mg/L BAP or MS + 0.2 mg/L BAP + 0.1 mg/L Kinetin (SRA medium) and sub-cultured onto fresh medium every 1-2 months. To prolong culture storage duration, studies on the use of different culture vessel covers to minimize media losses and slow growth medium by addition mannitol were conducted. In vitro

parameters such as number of shoots, length of longest shoot, number of roots, length of longest roots, shoot vigor and degree of culture media browning were recorded 60 days after inoculation. Five types of culture vessel cover (rubbers stopper, cotton plug, aluminum foil, polypropylene plastic cap and aluminum foil + cotton plug) were used to determine the optimum culture vessel cover for sugarcane in vitro cultures. Cultures covered with cotton plug showed the lowest shoot growth and proliferation and highest culture media loss. On the other hand, the lowest shoot vigor and relatively high culture media browning, and highest culture contamination were observed on cultures covered with foil + cotton plugs. The lowest media reduction, highest vigor, least culture contamination, and relatively low culture media browning were observed in cultures covered with polypropylene plastic cap. The effects of mannitol (0, 1 and 2%) on shoot growth and vigor were determined using two culture media (MS basal medium and SRA medium. Culture media supplemented with 1 and 2% mannitol showed no significant differences on all in vitro parameters. SRA medium supplemented with 1% mannitol showed the lowest shoot growth and proliferation and highest shoot vigor. On the other hand, cultures with 2% mannitol showed highest culture media browning. The response of different sugarcane accessions to SRA medium + 1% mannitol will be conducted.

SACCHARUM OFFICINARUM; VARIETIES; IN VITRO; RESOURCE CONSERVATION; CULTURE MEDIA; GROWTH; MANNITOL

Capacity building on the tissue culture and virus indexing of garlic (*Allium sativum* L.). **Sanchez, F.M.M., Espino, M.R.M., Espino, R.R.C., Perez, E.A., Eugenio, E.A., Plaza, R.U.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 79-80. Sept 2019.

Garlic (*Allium sativum* L.) is an annual vegetable crop widely cultivated for food, condiment, and medicinal uses. In the Philippines, a decrease in the production has been observed in recent years due to the presence of virus infections in the planting materials being used by the farmers. As part of the general strategy enunciated by DA-High Value Crops Development Program through the Bureau of Plant Industry in the production and multiplication of virus-free planting materials, increase manpower capability was identified to undertake tissue culture and virus indexing on the commodity. To date, two trainings in shoot tip propagation and one training on virus indexing using molecular techniques were undertaken. These were participated by personnel coming from the Bureau of Plant Industry, DA [Department of Agriculture]-Pangasinan Research and Extension Center and DA-Oriental Mindoro Agricultural Station. Evaluation of the training yielded positive results and lectures and hands-on activities were deemed very innovative by the participants. In addition, renovation of existing laboratory facilities was undertaken, and provision of additional equipment and manpower were done. Currently, all facilities are fully operational and are now being used to mass produce and maintain garlic plantlets.

ALLIUM SATIVUM; GARLIC; TISSUE CULTURE; IDENTIFICATION; PLANT VIRUSES; TRAINING PROGRAMMES

Optimization of an embryo rescue protocol in abaca (*Musa textilis* Nee. **Vera, S.V.I., Lalusin, A.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 37. (Sept 2019).

Abaca (*Musa textilis* Nee), a fiber crop endemic to the Philippines, has been in high demand by the global market for its tensile strength and quality. However, one of the challenges that breeding and production of abaca is facing is its low germination rate in soil. To address this, the use of in vitro techniques such as embryo rescue has gained the interest of many researchers. This study was conducted to optimize an embryo rescue protocol for two abaca hybrid genotypes, BC2-2 and BC2-7. Developmental parameters which include percent germination, days to germination, number of leaves per explant, incidence of multiple shoot formation and plant height for each hybrid were observed. Two hundred and forty (240) embryos of each genotype were inoculated on media with four varying kinetin concentration. The control treatment consists of the basal medium with no kinetin supplementation, while treatments 1, 2 and 3 were augmented with 0.1 mg L⁻¹, 0.3 mg L⁻¹ and 0.5 mg L⁻¹ kinetin, respectively. For BC2-2, all parameters except for the days to germination, were found to be best in treatment 3. For BC2-7, it was concluded that the performance of embryos improved as kinetin concentration is increased while for BC2-7, only an optimum level of kinetin that is 0.1 mg L⁻¹ worked best.

MUSA TEXTILIS; ABACA; PLANT EMBRYOS; GENOTYPES; GERMINATION; KINETIN; INDIGENOUS ORGANISMS

Performance evaluation of tissue culture-derived chrysanthemum (*Chrysanthemum morifolium* Ramat) planting materials and cut flower vase life assessment. **Valida, I.A., Acedo, V.Z.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 101-102. Sept 2019.

Chrysanthemum (*Chrysanthemum morifolium* Ramat) is conventionally propagated using suckers and stem cuttings which often result to low quality plants and flowers. With in vitro techniques, clean planting materials resulting to quality flowers can be obtained. The study was conducted to evaluate the performance of tissue culture-derived chrysanthemum plants and the vase life of the flowers produced. Suckers and stem cuttings measuring 10-12 cm were planted in black polyethylene pots (6x6x11) containing growing medium consisting of garden soil (GS): vermicast (V) and carbonized rice hull (CRH) at 1:1:1 by volume. Complete fertilizer (14-14-14) and a calcium-based fertilizer were applied at the rate of 1tbsp per gallon on weekly interval for two months. The vase life of cut-flowers was tested using different holding solutions (distilled water, 2% sucrose, 4% sucrose, 100 mg/l citric acid, and 200 mg/L citric acid). Results showed that stem cutting-derived plants produced flowers earlier than sucker-derived ones at 6 and 8 weeks from planting respectively. However, the former produced more flowers per stalk (51.07) than the latter (46.85). with regard to the vase life, citric acid at 200 mg/L was the best among the treatments wherein the flowers were still fresh-looking after 7 days while those in the other treatments were wilted and dehydrated after 4 days.

CHRYSANTHEMUM; SPECIES; TISSUE CULTURE; CUT FLOWERS; CUTTINGS; KEEPING QUALITY; CROP PERFORMANCE; EVALUATION

Plantlet regeneration through somatic embryogenesis in different cacao (*Theobroma cacao* L.) varieties using flower staminodes. **Dizon, A.P.R., Zara, R.R., Espino, M.R.M., Perez, E.A., Caliwagan, S.M., Espino, R.R.C.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 102-103. Sept 2019.

Cacao (*Theobroma cacao* L.) is generally propagated either by seeds or asexually through cuttings and grafting. An alternative method is by means of somatic embryogenesis. In this study, the protocol developed by Li et al. (1998) on somatic embryogenesis and plantlet regeneration with staminodes as explants of cacao was used with some modifications to produce plantlets of NSIC-registered varieties, namely 'BR 25', 'K1', 'K2', 'K9', 'PBC 123' 'UF 18' and 'UIT'. The staminodes of 'K1', 'K9' and 'UIT' were the most responsive in terms of producing somatic embryos. The first globular somatic embryo was produced 84 days after transfer to an embryo development (ED) medium. During the early stage of development, globular embryos were yellowish or creamy white. These embryos further developed into torpedo-shaped after about 2 week of dark incubation in the ED medium. Among the cacao varieties used. 'K9' produced the highest number of somatic embryos per staminode explants (6 somatic embryos per explant). The somatic embryos were allowed to germinate and further develop into plantlets in a modified plant regeneration medium. The varieties 'K1', 'K9', 'UF 18' and 'UIT' produced plantlets with up to 4 leaves and 1-2 roots nearly 10 months after staminode implantation. Currently, the plantlets are being maintained in the same culture medium until ready for field establishment. The use of amino acids in the culture medium to increase conversion of somatic embryos to plantlets is now being explored.

THEOBROMA CACAO; VARIETIES; SOMATIC EMBRYOGENESIS; VITROPLANTS; FLOWERS; ANDROECIUM

F03 Seed production and processing

Development of seed-to-seed monitoring system to ensure high yield and quality of rice seed production of PhilRice [Philippine Rice Research Inst.] Negros [Philippines]. Mondejar, C.L.C., Bello, G.E., Palanog, M.O., Parina, C.J.E., Etchon, M.O., Austria, R.F., Canto, K.V., Dogeno, L.G., Norbe, M.A.D., Pantin, F.L.A., Palanog, A.D. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 37-38. Sept 2019.

PhilRice [Philippine Rice Research Inst.] Negros leads the efforts of producing high quality seeds for seed growers and farmers in Central and Western Visayas [Philippines]. To ensure adequate and timely supply of seeds, its Research and Development unit supports the Business Development unit through seed-to-seed research-based advisory services to guarantee high yield and quality of rice seeds produced by the station. Monitoring and evaluation activities include the conduct of real-time surveillance and generation of real-time management decisions for the crop, pest, water, nutrients and other stresses present in the field, and seed quality assurance in the seed stocks. Seed-to-seed monitoring protocols are developed, tested and fine-tuned. Decision support systems using mobile applications are designed to aid researchers in the monitoring and evaluation activities. WIDGEN, a weed identifier mobile application was developed as aid for the identification of weed species in different rice environments. Another mobile application is being developed to make data collection and generation of database faster, and recommendations of management options at real-time. These tools will be tested and fine-tuned for use of target users namely researchers, extension workers, field technicians, students and farmers. Since the implementation of seed-to-seed research-based advisory services in 2018, seed yield and quality of rice in the station was improved.

ORYZA SATIVA; RICE; SEED; SEED PRODUCTION; CROP YIELD; QUALITY; MONITORING; RESEARCH; PHILIPPINES

Germination and vigor of maize (*Zea mays* L.) seeds in response to film coatings with fruit extracts. **Cuizon, A.J.V., Mercado, M.F.O., De Guzman, L.E.P., Fernandez, P.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 53. Sept 2019.

Seeds are exposed to adverse conditions during germination in the field. During imbibitions, substances and ions leaked from tissues leading to increased decay and thus, poor germination. Seed coating was found to address these concerns. This study conducted at the Seed Science and Technology Laboratory, Institute of Crop Science, College of Agriculture and Food Science, University of the Philippines Los Baños in March 2018, aimed to determine the germination and vigor of maize seeds in response to film-coating with fruit extracts. The experiment was laid out as factorial in Completely Randomized Design. The treatments include water presoaking: with and without; fruit extract presoaking: calamansi, chili and tomato at 5, 10 and 15 percent concentration; and seed coating: non-coated, Agnihotra ash, starch film and Agnihotra ash combined with the starch film. The test parameters were percent germination and vigor index. Results showed that starch film-coated maize seeds without fruit extracts showed higher percent germination when combined with Agnihotra ash. Agnihotra ash is known to have many uses, which include enhancement of seed germination, purification of air and water, and even improvement of health. Across fruit extracts, Agnihotra ash combined with starch film-coatings increased the percent germination of seeds by 4%. Across starch film-coatings, calamansi extracts with Agnihotra ash increased the percent germination by 8%, however, chili and tomato extracts showed decreased percent germination by 8% and 2%, respectively. Presoaking with fruit extracts increased the germination index by 9% compared to with and without water presoaking across Agnihotra ash and starch film-coatings. Across fruit extracts, the starch film-coatings significantly reduced percent germination by 5% but increased vigor by 7% while Agnihotra ash decreased the seed vigor by 7% compared to maize seed without Agnihotra ash. In general, the starch film-coatings increased the vigor of maize seeds while Agnihotra ash increased the germination.

ZEA MAYS; MAIZE; SEEDS; VIGOUR; GERMINATION; SEED PELLETING; PLANT EXTRACTS; FRUIT

Seedling development of selected medicinal plants in the Philippines. **Cejalvo, R.D., Altoveros, N.C., Borromeo, T.H., Bartolome, M.C.B., Gentallan, R.P.Jr., Timog, E.B.S., Villavicencio, M.L.H.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 141. Sept 2019.

The Philippine medicinal plants can also be propagated through seeds; however, the seed germination patterns of these medicinal plants are not yet established. The study aimed to elucidate the seedling developmental patterns of lagundi (*Vitex negundo* L.), niyog-niyogan (*Combretum indicum* L.), pansit-pansitan (*Peperomia pellucida* (L.) Kunth), sambong (*Blumea balsamifera* (L.) DC.), tsaang gubat (*Ehretia microphylla* Lam.), serpentine (*Andrographis paniculata* (Burm.f.) Nees) and pandakaki (*Tabernaemontana pandacacui* Lam.) based on the extended Biologische Bundesanstalt, Bundessirtenamt and Chemical industry (BBCH) scale. Thirty seeds per species were germinated, and observed for growth and developmental changes until the first true leaf emerged. Epigeal phanerocotylar type of germination with foliaceous cotyledons was observed in lagundi, pandakaki, pansit-pansitan, sambong, serpentine, and tsaang gubat while niyon-niyogan showed hypogeal cryptocotylar type of germination with reserve storage

cotyledons. During emergence, niyog-niyogan, pansit-pansitan, sambong and tsaang gubat were observed to characteristically bear a single first true leaf, whereas the rest of the species bore two. Another distinct and non-plastic feature was also observed during the radical emergence (BBCH 05) at the stylar end of tsaang gubat and niyog-niyogan, and at the peduncle end in lagundi. Information about the growth and development of the seeds can enhance propagation, diversification and conservation of these medically important crop species.

DRUG PLANTS; SEEDLINGS; GENETIC RESOURCES; RESOURCE CONSERVATION; GERMINATION; SEEDS; PHILIPPINES

F04 Fertilizing

Agro-physiological effect of Fertigro N, P, and K in corn in different levels and timing of fertilization. **Cantimprate, S.C., Lorenzo, J.C.A., Lalap, A.A., Gauna, G.B., Villegas, G.M., Aguilar, E.A.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 38-39. Sept 2019.

The use of nanofertilizer is one of the emerging technologies that can be address the need to continuously increase productivity and profit without compromising the health of the soil and the environment. This research was conducted to determine growth and yield of corn in response to the different timing and rates of conventional fertilizer and Fertigro N, P, and K nanofertilizer. Variety tested was Pioneer sup R hybrid corn 30B80. Fertilizer treatments were 1) control or no fertilizer, 2) 50% of the recommended rate (RR) on conventional fertilizer (CF), 3) 100% RR-CF, 4) 125% RR-CF, 5) 50% RR on nanofertilizer (NF), 6) 100% RR-NF and, 7) 125% RR-NF done in three replicates in a two-factorial randomized complete block design (RCBD). Each fertilizer rates were applied 1) once at basal, 2) two-split at basal and at 25 days after planting (DAP) and, 3) three-split at basal, 25 DAP and tasseling stage. Tasseling occurred a week earlier in conventionally fertilized than nanofertilizer-applied plants, thus, days to harvest also occurred a week earlier. With 50 to 125% RR of conventional and nanofertilizer, significantly improved agronomic characteristics were observed compared to the control. With time, total leaf weight per unit plant dry weight and total aboveground biomass were similar in two- and three-split application of the fertilized treatments but was not statistically higher than the single fertilizer application. Across treatments, mean ear weight and number of kernels were statistically similar between 125% RR-NF and 50-125% RR-CF. In general, growth and grain yield were significantly higher in corn plants applied with Fertigro nanofertilizer than the control but were not statistically different with conventional fertilizer. Uniformly in application of nanofertilizer due to its fine, powdery nature still needs to be improved to have a precise application.

ZEA MAYS; FERTILIZER APPLICATION; TIMING; APPLICATION RATES; GROWTH; CROP YIELD; NPK FERTILIZERS

Agro-physiological effect of Fertigro N, P and K nanofertilizers in corn at different levels and timing of fertilization. **Cantimprate, S.C., Lorenzo, J.C.A., Lalap, A.A., Gauna, G.B., Villegas, G.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 76. Sept 2019.

A research was conducted to investigate the effect of different timing and rate of FertiGroe nanofertilizers N, P and K on the growth and yield of corn. Agronomic and physiological parameters measured indicated that generally, FertiGroe treated plants performed better than the control, however, same treatment have no advantage over conventionally fertilized corn plants. Days to tasseling of conventionally fertilized corn plants occurred a week earlier compared to FertiGroe treated plants, thus days to harvest was also a week earlier. With fertilizer rates from 50%-125% of the recommended rate (RR) for both conventional and nanofertilizer, better agronomic characteristics were observed. Split application (2x and 3x) of nanofertilized and conventionally treated corn plants resulted to more consistent crop growth as measured by physiological parameters such as leaf weight ratio (LWR) and total dry matter (TDM) compared to 100% RR fertilizer (control) applied only once at planting. Timing and fertilizer rate interaction did not significantly affect the parameters measured. The highest rate of nanofertilizer (125%) had statistically similar ear weight and number of kernels with conventionally fertilized treatments of the same rate. Uniformity in application of nanofertilizer due to its fine, powdery nature still needs to be improved to have a precise application.

ZEAL MAYS; MAIZE; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; TIMING; AGRONOMIC CHARACTERS

Carbon sequestration as affected by tillage practices and fertilizer application. **Pabiona, M.G., Ugay, P.P.**

25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 80. Sept 2019.

The study was conducted at the Agricultural Experiment Center, Central Mindanao University [Philippines]. It aimed to determine the soil chemical properties such as pH, organic matter content, extractable phosphorus and exchangeable potassium as affected by tillage practices and fertilizer application; to evaluate the soil organic carbon and plant carbon as potential C stock; and to determine the yield components of corn as affected by tillage practices and fertilizer application. The experiment was laid out following factorial in Randomized Complete Block Design in three replications with tillage practices (No tillage and conventional tillage) as factor A and inorganic and organic fertilizer (No Fertilizer, 60-30-100 kg N-P sub 2 O sub 5-K sub 2 O/ha, 2 tons Vermicompost/ha and 4 tons Vermicompost/ha) as factor B. The different tillage system and fertilizer application affects the soil chemical properties. It was found out that the soil was strongly acidic (pH of 4.67 to 5.04), has marginal organic matter content (2.49 to 3.59%), high extractable phosphorus (14.45 to 21.78 mg/kg), and exchangeable potassium (0.191 to 0.37 cmol/kg). Results shows that the interaction of tillage practices and kind of fertilizers applied had significant effect on soil organic carbon, corn grain yield and weight of 1000 seeds. Corn plants under conventional tillage applied with 4 tons vermicast/ha and 30-60-100 of N-P sub 2 O sub 5-K obtained the highest grain yield and heaviest 1000 seeds weight. Across the tillage practices, the two practices did not significantly differ in all chemical properties. Highest soil organic carbon sequestered was obtained in no tillage and yield parameters was found significant on conventional tillage. Soil organic carbon, grain yield and weight of 1000 seeds were significantly affected by the fertilizers. However, further study is suggested to validate this result.

CROP MANAGEMENT; TILLAGE; CARBON; SOIL CHEMICOPHYSICAL PROPERTIES; FERTILIZER APPLICATION; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS

Comparison of grain yield and yield components of rice grown under different rates of conventional and Fertogroe tm N, P and K fertilizers. **Bicaldo, J.J.B., Hernandez, J.E., Liwag, R.S., Malabayabas, M.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 82. Sept 2019.

The use of nanofertilizers can be beneficial in improving nutrient use efficiency, maximizing crop productivity, and reducing environmental impact through controlled release of nutrients in the soil. The objective of the study was to develop FertiGroe sup TM N, P and K nanofertilizers application protocols under on-farm conditions. The study was conducted in Nueva Ecija, Philippines during the 2018 wet season. The experiment was laid out in a randomized complete block design (RCBD) with three replicates. The response of rice grown under different rates of FertiGroe N, P, K (RRF) and conventional fertilizer (RRC) were compared based on grain yield, number of spikelets, and number of panicles. The fertilizer treatments were F1-0% NPK, F2-50% RRF, F3-100% RRF, F4-150 RRF, F5-50% RRC, F6-100% RRC, and F7-150% RRC. The grain yield of rice ranged from 4.9-5.7 tons ha⁻¹ under RRF treatments from 4.4 - 4.9 tons ha⁻¹ under RRC treatments. Among all treatments, the grain yield of F2 was not significantly different to that of F3, F4, F5, F6, and F7. Yield can therefore be maintained using lower rates of nanofertilizer, which may translate to decreased cost of production. Between RRF and RRC, 100% RRF performed better than 100% RRC and similarly, 150% RRF performed better than 100% RRC. Additionally, an added benefit of RRF treatments is an increase in spikelet number (RRF - 110 to 129; RRC - 96-110). However, the number of panicles under RRF treatments were lower than RRC treatments, which led to their similar yield production. This result shows a potential of RRF treatment to improve the rice plant's yield production efficiency, maximizing the capacity of each panicle to produce gain. Overall, these results showed the potential of FertiGroe sup TM nanofertilizers. Further collection of data in 2019 will be done to confirm and strengthen the conclusions from these preliminary data.

ORYZA SATIVA; GRAIN; CROP YIELD; FERTILIZER APPLICATION; NPK FERTILIZERS; NUTRIENT UPTAKE

Nutrient management practices of processing-type and table-type tomato farmers in Ilocos Provinces [Philippines]. **Magnaye, A.A., Aquino, A.L., Pontesor, A.L., Sta. Cruz, P.C., Dela Cruz, R.G., Mendoza, N.D., Sta. Cruz, F.C.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 100. Sept 2019).

Nutrient management involves three main aspects: kind of fertilizer, amount and timing of application. In Ilocos provinces [Philippines], farmers generally plant processing- and table-type tomato. The farmers' nutrient management practices vary in terms of type and amount of fertilizer, which is partly dependent on tomato type. Processing-type tomato farmers are encouraged to follow the rate recommended by Northern Foods Corporation, a government-owned tomato processing plant in the region. This study assessed the nutrient management practices of farmers in Ilocos provinces through a series of surveys in major tomato-growing municipalities. Majority of processing-type tomato farmers apply complete fertilizer as basal, and side-dress with muriate of potash and either ammonium sulfate (Ilocos Norte) or ammonium phosphate (Ilocos Sur). More than 80% of farmers also spray foliar fertilizer at flowering stage in both provinces. The amount of fertilizer applied varies widely from farmer to farmer despite NFC recommendations. Nutrient application ranges extremely from 0 kg N, P or K to as high as 358 kg P and 900 kg K/ha. On the average, application rate is 110-34-99 kg NPK/ha in Ilocos Norte and 123-57-151 kg NPK/ha

in Ilocos Sur, which are either lower or higher than the NFC recommendation (116-40-120 kg NPK/ha), respectively. On the other hand, most table-type tomato farmers basally apply ammonium sulfate and ammonium phosphate as source of nitrogen and phosphorus, and side-dress muriate of potash. Foliar fertilizer application at flowering is also practiced in both Ilocos Sur (73%) and Ilocos Norte (57%). While table-type tomato farmers generally apply less than their processing-type counterparts, their fertilizer rate ranges are also extremes, with an average of 106-21-68 kg NPK/ha for Ilocos Norte and 120-36-109 kg NPK/ha for Ilocos Sur, which are both lower than the PCAARRD [Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development] blanket recommendation for tomatoes (165-95-215 kg NPK/ha).

LYCOPERSICON ESCULENTUM; TOMATOES; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; FOLIAR APPLICATION; FARMERS

Optimizing the yield of irrigated lowland rice varieties (hybrid and inbred rice) to a sustainable 4 tons/ha under an organic-based nutrient management. **Javier, E.F., Sevilla, M.L.H., Mercado, J.M.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 100-101. Sept 2019.

A field experiment was carried out during dry and wet season of 2018 to optimize at least one organic-based nutrient management (OBNM) for irrigated rice that would at least yield to a sustainable 4 tons per hectare for both seasons. The organic-based nutrient management (OBNM) was the basal application of rice straw plus chicken manure (OBNM1), and rice straw plus vermicompost (OBNM2). Azolla microphylla was applied as alternative topdress fertilizer at 30 and 45 days after transplanting (DAT). Inorganic-based nutrient management (IBNM) following keycheck No.5 of the Palaycheck System served as check. Test plants were high yielding inbred and hybrid varieties. The experiment was replicated four times in a split plot factorial experimental design. In dry season, the highest grain yield was observed in IBNM for both hybrid (7.89 t/ha) and inbred (7.18 t/ha) varieties. While the lowest grain yield were recorded in OBNM2 (Rice straw with vermicompost and topdressed of Azolla at 30 and 45 DAT) for both inbred (4.09 t/ha) and hybrid (4.64 t/ha) varieties. The hybrid rice (5.245 t/ha) under the OBNM1 generally have higher yield than the inbred (4.27 t/ha) in the dry season. In the wet season, the yield of the IBNM, OBNM1 and OBNM2 was comparable. Under the OBNM, the inbred variety (4.68 t/ha) gave higher yield than the hybrid rice (4.09 t/ha). With the annual average yield ranging from 4.28 to 5.06 tons/ha under OBNM even in flooded soils showed potential in increasing the grain yield by the recycling farm wastes. However, judicious use of organic waste like proper timing of application of farm waste should be considered due to their mineralization process under flooded soil condition.

ORYZA SATIVA; HYBRIDS; INBRED LINES; ORGANIC FERTILIZERS; APPLICATION METHODS; AZOLLA; SPECIES; CROP YIELD

Pilot testing and technology transfer of improved IPM and INM strategies of mungbean in Region 2 [Cagayan Valley, Philippines]. **Aquino, R.M.G., Calderon, V.J.F., Aquino, R.Y., Atalin, V.U., Manaligod, K., Batang, E.F., Jr., Bagunu, J., Francisco, C.O.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 41. Sept 2019.

This study aims to promote and demonstrate the improved IPM and INM strategies in mungbean for farmers' adoption. Five different treatment (T1 - Farmer's practice or no application; T2 - Carrageenan PGP; T3 - Boron Fertilizer; T4 - Vermi-tea and T5 - Metarhizium) were tested in major mungbean growing areas of Region 2 [Cagayan Valley, Philippines] (rice-based and con-based condition). Results of the trails revealed that the application of Oligo-Carageenan PGP economically increased yield by 546.9 kg/ha or 50.7% under com-based areas and 500 kg/ha or 74% under rice-based areas with additional profit or net income of PhP36,145.00 and PhP24,065.00, respectively. Based on the observations, UPL Mg 7 (Pagasa 7) variety applied with Carrageenan PGP were found to have more branches; minimal or absence of Cercospora leaf spot; more flowers that developed into pods; larger and heavier seeds; extended flowering and fruiting prolonging harvest time; number of priming increased from 3 to 6; and has extensive/better root system. On the other hand, spraying of Boron Fertilizer is capable of increasing yield by 333 kg/ha or 30.9% in corn-based and 237.3 kg ha⁻¹ or 35% in rice-based areas with additional net income ranging from PhP 10,315 - PhP14,665.00. Further, application of Vermi-tea is effective in increasing yield of 100-300 kg ha⁻¹ with additional net income or profit of PhP5,000 - PhP13,000.00. All tested foliar fertilizers are generally effective in improving the yield of UPL Mg 7 (Pagasa 7) when applied three times (at 14-15 days interval after 14 DAE).

VIGNA RADIATA RADIATA; MUNG BEANS; FERTILIZER APPLICATION; CROP YIELD; YIELD INCREASES; INTEGRATED PEST MANAGEMENT; NUTRIENT UPTAKE; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

Practical diagnostic tools for nitrogen management in irrigated lowland rice. **Grospe, F.S., Vera Cruz, J.R.A., Capistrano, A.O.V.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 104. Sept 2019.

A field experiment was conducted in PhilRice CES [Philippine Rice Research Ins. Central Experiment Station, Nueva Ecija, Philippines) to evaluate the existing diagnostic tools for nitrogen (N) management based on grain yield, N use efficiency (AEn) and net return. Four decision support tools for N management namely; (1) Leaf color chart (LCC), (2) Minus One Element Technique (MOET) App, (3) Chlorophyll meter (soil plant analysis development/SPAD-502) and Soil test kit (STK-based N)) were used as treatments in 2018 and 2019 dry seasons (DS). The total N rates used based on the different diagnostic tools were: (1) 101 kg N/ha for LCC-based in 2018 DS and 122.02 kg N/ha in 2019 DS, (2) 158.1 kg N/ha in 2018 and 84.7 kg N/ha in 2019 for MOET App; (4) 101 kg N/ha in 2018 and 122.02 kg N/ha in 2019 for SPAD based and (4) 120 kg N/ha both in 2018 and 2019 for STK based. Result showed that there was no significant grain yield difference among diagnostic tools used in two dry seasons. The yield ranged from 6.80 to 7.35 t ha⁻¹ in 2018 DS and 7.23 to 8.12 t/ha in 2019 DS. In 2018 DS, use of LCC and SPAD-502 gave significantly higher AEn than STK and MOET App. In 2019 DS, MOET App had the highest AEn among the diagnostic tools used. Except the cost of the diagnostic tools the net return of all diagnostic tools were comparable.

ORYZA SATIVA; LOWLAND; IRRIGATED RICE; NITROGEN; DIAGNOSIS; NUTRITIONAL REQUIREMENTS

Productivity of red-fleshed dragon fruit (*Hylocereus polyrhizus* Britton and Rose) as influenced by different levels of phosphorus under Claveria, Northern Mindanao [Philippines] agroecosystem. **Gonzaga, A.B.Jr., Gonzaga, N.R., Dollen, A.T., Silverio, B.G.S.** 25. Federation of Crop Science Societies of the Philippines, ,

Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 105. Sept 2019.

Phosphorus (P) is a nutrient that requires attention, because its deficiency can reduce the development of shoots and roots of crops, knowingly P application is critical factor in dragon fruit production. Red-fleshed dragon fruit is an epiphyte plant of the Cactaceae family also considered as 'fruit crop for the future'. This study was conducted to determine the optimum recommended amount of P nutrient applied to red-fleshed dragon fruit under Claveria, Misamis Oriental [Philippines] agroecosystem. The experiment was laid out in a simple Randomized Complete Block Design with three replications and four treatments namely: T sub 1=N sub 60-P sub 120-K sub 60, T sub 2=N sub 60-P sub 180-K sub 60, T sub 3=N sub 60-P sub 2 sub 40-K sub 60 and T sub 4=N sub 60-P sub 300-K sub 60. Results revealed that application of P (T sub 1) attained heaviest individual fruit weight, fruit size (polar and equatorial), percent edible portion and total soluble solids (Obrix). However, application of P (T sub 4) showed highest number of flower emergence, more number of fruits per post, highest fruit yield tha-1 and return of investment. Therefore, T sub 4 (N sub 60-P sub 300-K sub 60) is the most suitable fertilizer rate as positively correlated with higher level of productivity.

HYLOCEREUS; SPECIES; FRUITS; NPK FERTILIZERS; FERTILIZER APPLICATION; APPLICATION RATES; PHOSPHATE FERTILIZERS

F06 Irrigation

Allelopathic effects of banana (Musa sp.) fermented extract on germination and vigor of soybean (Glycine max (L.) merrill) seeds. **Cejalvo, R.D., Mercado, M.F.O.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 77. Sept 2019.

Presoaking is one of the seed-priming treatments to improve germination and to hasten the time to seedling emergence. Fermented Fruit Juice (FFJ) is becoming a popular organic amendment to farmers who engage in organic farming; however, there are limited studies on the effects of organic inputs on the growth of seeds. Thus, this study aimed to determine the effect of banana-fermented extract on germination and vigor of soybean seeds [Glycine max (L.) Merrill]. Saba banana (Musa sp.) fruits and molasses were utilized to make the FFJ. Soybean seeds (PSB Sy2) were presoaked overnight in 3% concentration of banana FFJ. Seeds were sown on paper towels for seed testing. International Seed Testing Association (ISTA) Rules were followed in determining seed germination and vigor. Banana FFJ improved shoot length, seedling biomass and seedling emergence of soybean seeds. However, it reduced root length, from 5.61cm to 3.94cm and inhibited percentage germination, from 95% to 80%. The results of this experiment suggest that banana FFJ had allelopathic effects on germination and vigor of soybean seeds. This study may open a possibility in testing for the effect of banana FFJ on germination and vigor of weedy species to develop and formulate on organic pesticide.

MUSA (BANANAS); GLYCINE MAX; SOYBEANS; SEEDS; PLANT EXTRACTS; FERMENTATION; ALLELOPATHY; SEED CHARACTERISTICS; SEED; VIGOUR

F08 Cropping patterns and systems

Community structure of herbivores in peanut and corn intercropping system. **Lauron, Ma.R.B., Ibisate, M.T., Guarino, E.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 82. Sept 2019.

The abundance and diversity of herbivores in peanut and corn intercropping system applied with varying levels (0, 20, 40 and 60 kg/20 sq m) of vermicopost (VC) were studied. The community structure of herbivores was analyzed using Shannon-Weiner Index (SWI). Results revealed that five functional groups of arthropods were identified such as predators, pollinators, parasitoids, decomposers and herbivores. These arthropods were collected during maturity stage. It was observed that grasshoppers and crickets (orthoptera) were dominated in plants applied with 60 kg VC kg/20 sq m. Also, collembola (springtail) was collected in plots treated with 20-60 VC kg/20 sq m indicating that mixture of substrates like VC added into the soil serves as food for the collembola. Although, the SWI ranged from 1.16 (20 kg VC/20 sq m) to 0.31 (60 kg VC/20 sq m) the natural enemies (neuroptera) increases. The fresh marketable seed yield (3.71 kg/20 sq m) was significantly higher than the control (2.48 kg/20 sq m).

ARACHIS HYPOGAEA; ZEA MAYS; INTERCROPPING; HERBIVORES; PLANT ANIMAL RELATIONS; POPULATION STRUCTURE; OLIGOCHAETA; COMPOSTING; COMPOSTS

Cup quality assessment of Arabica coffee grown under different agroforestry systems in coffee growing areas in Benguet [Philippines]. **Pablo, J.P., Laurean, C.P., Fagyan, A.W., Bao-idang, C.C., Moreno, N.A., Rimas, L.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 83. Sept 2019.

Coffee is one of Department of Agriculture's top priority crop in the Cordillera Administrative Region (CAR) such as in Benguet [Philippines]. Coffea Arabica, in the province are grown in agroforestry system based or intercropped with other taller plants. These trees and plants serve as shades and are equally important for both cup quality improvement and maintaining sustainable production. The study would like then to assess the cup quality of coffee originating from existing tree and plant shades including open field systems in Benguet. Coffee cherries were harvested from agroforestry system under Alnus, Pine, Mango and Chayote shades from five growing areas in Atok. Tublay and La Trinidad, Benguet located at elevations ranging from 1495 to 1648 m asl. The cherries were dried and processed following similar standard methods for all samples. Green beans were roasted and evaluated using procedures described by Specialty Coffee Association (SCA) for sensorial attributes involving olfaction, gustation and mouthfeel sensation by three professional Q Graders/Cuppers. All samples cupped under different agroforestry system including open field were rated Very Good (7.0 - 7.75) for aroma/fragrance, flavor, aftertaste, acidity, body and balance in accordance with SCA's quality scale. However, samples grown under Alnus shade (Coroz, Tublay) had scored 8.0 for overall flavor experience by Q Graders or rated Excellent (8.0 - 8.75) based on SCA's quality scale. The same samples under Alnus shade obtained the highest total score of 84.63 from the summation of all the attributes. Overall, all cupped samples obtained total scores more than 80, for which all fall under quality. Furthermore, future studies should include proper management practices to achieve excellent cup quality to be able to command the best price of green beans in the market.

COFFEA ARABICA; COFFEE; QUALITY; AGROFORESTRY; ORGANOLEPTIC PROPERTIES; ORGANOLEPTIC ANALYSIS

Energy inputs and carbon footprints of the different agroforestry systems in Zamboanga City, Philippines.

Tabal, E.P., Mendoza, T.C., Paelmo, R.F., Visco, R.G. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 40-41. Sept 2019.

This study aimed to estimate the energy inputs and carbon footprints of the different agroforestry systems (AFSs) with the 16 Community Based Forest Management (CBFM) sites in Zamboanga City, Philippines. Descriptive statistics was employed using a structured questionnaire. All Mcal units were converted to liter diesel oil equivalent or LDOE, where 1.0 LDOE = 11.414 Mcal. Of the nine AFSs, the rubber + 1based AFS had the lowest total energy inputs (TEI) at 5,790.53 Mcal/ha (507.35 LDOE/ha), while the rubber + 3based AFS had the highest TEI at 11,801.34 Mcal/ha (1,033.93 LDOE/ha) compared to coconut + 1based at 6,267.16 Mcal/ha (549.1 LDOE/ha), mango-based at 7,559.77 Mcal/ha (662.32 LDOE/ha), marang-based at 7,738.74 Mcal/ha (678.0 LDOE/ha), lanzones-based at 10,122.59 Mcal/ha (886.86 LDOE/ha), coconut + 3based at 11,172.10 Mcal/ha (978.81 LDOE/ha), rubber + 2based at 11,242.11 Mcal/ha (984.94 LDOE/ha) and coconut + 2based at 11,250.24 Mcal/ha(985.65 LDOE/ha) AFSs, respectively. The TEI of each of the AFSs were computed from the direct energy inputs (DEI), indirect energy inputs (IEI) and embedded energy inputs (EEI), where each contributed at 1.68-5.37%, 94.7-98.0% and 0.35-0.53%, respectively. More than 94% (5,648.0-11,356.24 Mcal/ha) of the TEI derived from the IEI, of this total, energy use on agrochemicals (chemical fertilizers and pesticides) was at 34.1-75.0% (2,517.13-4,141.1 Mcal/ha) and labor (human and animal labor) was at 25.0-65.9% (1,378.91-4866.6 Mcal/ha), respectively, hence considered as the 'energy hotspots'. The use of external inputs required to increase crop yield also increases the TEI, where increase in TEI also increases the energy footprint (EP) of each AFSs, hence increase in carbon emission equivalents.

RUBBER; COCOS NUCIFERA; MANGIFERA INDICA; LANSIUM DOMESTICUM; AGROFORESTRY; ENERGY; CARBON; POLLUTION; PHILIPPINES

Plant biodiversity associated with corn cropping systems in the Philippines. **Gruezo, Wm.Sm.** *Asia Life Sciences (Philippines)*. *The Asian International Journal of Life Sciences*. 0117-3375. v. 26(1) p. 71-169. Jan-Jun 2017.

A comprehensive inventory and assessment of plant diversity associated with 15 selected representative corn cropping systems in Isabela Province (Luzon, Philippines) showed that a relatively high total plant diversity level exists within the province, with H' value of 4.15 and a species richness of 268. On a per locality/study site basis, the species diversity index of study plots ranged from H' = 1.91 to 3.70 and species richness ranging from S = 16 to 60 (Table 17). Comparison of these values with those obtained from the border areas of study plots showed that the latter had a much higher species diversity index, ranging from H' = 1.11 to 7.20; the highest value being nearly twice the highest value recorded from the study plots. The border areas had species richness ranging from S = 19 to 96 which are also much higher than the highest value obtained from the study plots. Using Sorensen's Similarity Index (S.I.) formula, the similarity in species composition per study plot and their border area basis ranged from 6.5 to 100%. On the other hand, a similarity index of 71% was obtained for the entire Isabela Province where 147 species were found

common to the study plots and their border areas out of a total of 268 species recorded from the 15 study localities. In terms of taxon composition, the 268 species recorded for the entire Isabela Province belong to 212 genera and 40 families. Of the 40 families, the top 5 families with the highest number of species are Gramineae (37 spp.), Papilionaceae (29 spp.), Euphorbiaceae (16 spp.), Compositae (12 spp.), and Moraceae (11 spp.). The rest of the 35 families had each a species number ranging from 1 to 9. In terms of habit composition, the 268 species were broken down into 37 grasses, 80 herbs, 2 lianas or woody vines, 3 large trees, 6 medium-sized trees, 12 shrubs, 10 small trees, and 13 vines.

ZEA MAYS; BIODIVERSITY; SPECIES; GENERA; PLANT HABIT; CROPPING SYSTEMS; PHILIPPINES

Quezon [Philippines] farm makes money from crops and vacation crowds. Tan, Y. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 58-60. Feb 2020.

VEGETABLE CROPS; DRUG PLANTS; ORNAMENTAL PLANTS; LIVESTOCK; APICULTURE; CHICKENS; CROP ROTATION; CROPS; MIXED FARMING; PHILIPPINES

F30 Plant genetics and breeding

Adaptability of recommended rice varieties under PhilRice Negros environment [Philippines]. Dogeno, L.A.G., Pajarillo, A.O., Seville, C.U. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 76. Sept 2019.

Rice is notably one of the most in-demand crops in the Philippines considering its extensive utilization for food. Considering the growing population and decreasing land areas for rice farming, it is inevitable to experience a shortage of domestically grown rice. Recently, the average national yield of palay is 3.87 t/ha at an incurred cost of P12 per kilogram which seemingly implies farmers' un competitive management practices. Its high production requirement thrusts various agricultural research institutions both in government and private sectors to engage in the development of farming innovations and the promotion of adaptable varieties to optimize rice production per unit of land. For this cause, the Department of Agriculture generated and released sets of suggested rice varieties at national and regional levels. In PhilRice Negros, the R&D team established and evaluated these varieties on dry season, 2019 alongside with other rice cultivars (farmers' preference and modern). National recommended varieties include: NSIC Rc222, Rc216 and Rc300; regionally recommended varieties: NSIC Rc400, Rc426, Rc484, Rc478 and Rc482. The area allotted is a total of 1,200m² where each varietal plot comprised of 30 rows and 80 hills/row at a distance of 25cm x 25cm. The fertilizer application is based on NPK rate of 100-10-40. Yield data shows that for nationally recommended varieties, NSIC Rc222 and Rc216 are comparable with yields of 7.5 and 7.0t/ha, respectively. As for its regional counterpart, NSIC Rd358 produced significantly among others with a yield of 7.7t/ha. In contrast, NSIC Rc27 as a preferred variety by farmers produced 7.48t/ha while NSIC Rc400 topped the yields of all other modern varieties at 8.0t/ha. In conclusion, these results will help in the verification of recommended varieties, and likewise to identify new and potential varieties for promotion.

ORYZA SATIVA; VARIETIES; ADAPTABILITY; CROP YIELD; FERTILIZER APPLICATION; SPACING; PHILIPPINES

Agro-morphological characterization and fragrance evaluation of selected special purpose rice accessions.

Aquino, J.D.C., Alvaran, P.J., Agustin, L.M., Orden, M.E.M. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 145-146. Sept 2019.

Special purpose rice (aromatic, pigmented and glutinous) are promising competitive rice group as it possesses special qualities and command higher price in the market. Aroma is an important characteristic of high quality rice because of strong human preferences for fragrance. Thus, this study aimed to evaluate the fragrance and characterize the agro-morphological attributes of 50 special purpose rice accessions. Leaf KOH assay method was used to evaluate the level of aroma and characterization of agro-morphological traits was based on Standard Evaluation System for rice by IRRI [International Rice Research Institute. Cluster analysis for multivariate experiment was carried out using the Statistical Tool for Agricultural Research Software. Four major clusters were formed in each of the agro-morphological attributes (agronomic, morphological, grain quality). On the other hand, 19 and 7 varieties were found out to be moderately and strongly scented, respectively. With the results gathered, a potential parent has been selected for recommendation on variety development, production, and promotion. Further analysis, such as quantification of aroma amylose, anthocyanin and molecular analysis will also be carried out.

ORYZA SATIVA; VARIETIES; AGRONOMIC CHARACTERS; PLANT ANATOMY; EVALUATION

Anthocyanin qualification and modular profiling of gene controlling pigment in selected pigmented rice accessions.

Aquino, R.R., Gaban, P.B.V., Alvaran, P.J., Gonzales, M.A., Aquino, J.D.C. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 146. Sept 2019.

Pigmentation in rice pericarp is governed mostly by Ra, Rc, and Rd genes, and the presence or absence of these genes determine the variation of anthocyanin deposition. Thus, this study aimed to quantify the anthocyanin content, profile selected genes controlling pigmentation and characterize the agro-morphological traits of 20 pigmented rice accessions. High amount of anthocyanin were obtained from purple pericarp, significant amount on red and brown pericarp and negligible amount on white rice pericarp. Moreover, molecular characterization revealed the presence of selected genes in most of the pigmented rice. Furthermore, seven clusters were formed in the dendrogram based from the morphological characteristics. The phenotypic and genotypic data gathered from this study provides a valuable information that can be used as basis for selection of accessions with high yielding ability and high anthocyanin that could be reproduced as a source of pigmented rice with healthier benefits.

ORYZA SATIVA; VARIETIES; GENES; MOLECULAR GENETICS; AGRONOMIC CHARACTERS; ANTHOCYANINS

Approaches to in vitro conservation of Philippine sugarcane (*Saccharum officinarum*) genetic resources.

Alcachupas, C.G., Guevarra, P.R., Valle, M.L.S., Huelgas, V.C., Damasco, O.P. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 77. Sept 2019.

The Philippines has approximately 1,285 sugarcane varieties developed locally or introduced from other countries which are maintained in the field genebanks of Sugar Regulatory Administration (2016) excluding the variety collection from other research institutions or in small and big sugarcane plantations through the country. In vitro conservation of sugarcane offers a means of maintaining valuable genotypes in a small space, free from pests and diseases, with high multiplication potential. For the last two years, a total of 317 sugarcane accessions were successfully introduced in vitro and currently maintained in MS medium with 1 mg/L BAP or MS + 0.2 mg/L BAP + 0.1 mg/L Kinetin (SRA medium) and sub-cultured onto fresh medium every 1-2 months. To prolong culture storage duration, studies on the use of different culture vessel covers to minimize media losses and slow growth medium by addition mannitol were conducted. In vitro parameters such as number of shoots, length of longest shoot, number of roots, length of longest roots, shoot vigor and degree of culture media browning were recorded 60 days after inoculation. Five types of culture vessel cover (rubbers stopper, cotton plug, aluminum foil, polypropylene plastic cap and aluminum foil + cotton plug) were used to determine the optimum culture vessel cover for sugarcane in vitro cultures. Cultures covered with cotton plug showed the lowest shoot growth and proliferation and highest culture media loss. On the other hand, the lowest shoot vigor and relatively high culture media browning, and highest culture contamination were observed on cultures covered with foil + cotton plugs. The lowest media reduction, highest vigor, least culture contamination, and relatively low culture media browning were observed in cultures covered with polypropylene plastic cap. The effects of mannitol (0, 1 and 2%) on shoot growth and vigor were determined using two culture media (MS basal medium and SRA medium. Culture media supplemented with 1 and 2% mannitol showed no significant differences on all in vitro parameters. SRA medium supplemented with 1% mannitol showed the lowest shoot growth and proliferation and highest shoot vigor. On the other hand, cultures with 2% mannitol showed highest culture media browning. The response of different sugarcane accessions to SRA medium + 1% mannitol will be conducted.

SACCHARUM OFFICINARUM; VARIETIES; IN VITRO; RESOURCE CONSERVATION; CULTURE MEDIA; GROWTH; MANNITOL

Association analysis of developed sample sequence repeat (SSR) markers to fungal disease resistance.
Relles, J.M.G., Discaya, D.F.I., Manay-ay, M.Z., Armones, R.T. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 146. Sept 2019.

Seven SSR primers were developed from Phil 93-1601, a cultivar resistant to both sugarcane smut and downy mildew. The putative identities of the sequences were all related to fungal disease resistance Preliminary analyses using seven SSR primers on 52 accessions revealed three alleles associated to sugarcane smut disease (P 0.035). Alleles 75PstI 7 and 125PstI 6 have association to sugarcane smut resistance, and 126PstI 1 to susceptibility. However, none of the primers gave promising results for molecular diagnosis of downy mildew. This study needs to be completed with more markers and more accessions to validate these preliminary results.

SACCHARUM OFFICINARUM; SUGARCANE; GENETIC MARKERS; SMUTS; MILDEWS; DISEASE RESISTANCE

Characterization, phylogenetic analysis and pathogenicity of *Pectobacterium chrysanthemi* pv. *zeae* isolates, the causal organism of maize bacterial stalk rot in the Philippines. **Pinili, M.S., Garcia, M.O.,**

Tumolva, J.A.B. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 81. Sept 2019.

Bacterial stalk rot (BSR) caused by *Pectobacterium chrysanthemi* pv *zeae* (syn. *Erwinia chrysanthemi* pv. *Zeae* (Sabet) Victoria et al.) is one of the most destructive and major diseases in many corn-growing areas in the country. The disease is favoured by high temperature and relative humidity and prevalent in area where heavy rainfall is frequently experienced. High incidence of BSR is also observed where overhead irrigation is being practiced and mostly if water source is from pond, river or slow-moving streams. In this study, comparative analysis on morpho-cultural characteristics, 16S gene sequence and phylogeny of BSR isolates from Ifugao, Isabela, and Laguna were conducted. Pathogenicity of BSR Philippine isolates were also tested on native corn varieties including the susceptible check. Corn plants showing the typical stalk rot symptom were collected, isolated, and characterized using selective media Yeast peptone sucrose agar (YPS) and Tetrazolium agar (TZCA). Isolates from different location have the same morphological characteristics of thick viscous while to yellowish colony on YPS then white with pink to reddish center of TZCA. Bacterial DNAs were extracted and amplified using 16S internal primers and sequenced for phylogenetic analysis. Isolates also expressed virulent reaction on susceptible varieties under field condition.

ZEA MAYS; ROTS; BACTERIA; PHYLOGENY; PATHOGENICITY; DNA; NUCLEOTIDE SEQUENCE; PHILIPPINES

Characterization of non-glyphosate tolerant Philippine white maize landraces: morpho-phenological and agronomic traits. **Laude, T.P., Sanchez, M.A.B., Magdua, L.L., Saldares, R.A.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 43-44. Sept 2019.

Multivariate analysis has become a useful tool for studying the phenotypic diversity of Germplasm accessions, since they make it possible to combine a variety of different information. Genetic diversity of nationwide accessions of white maize landrace populations were evaluated to identify the most suitable populations as base germplasm for a breeding program for functional agronomic traits which are suited for optimum maize environment or stress-prone environment. Cluster analyses using the Euclidean similarity test and average (UPGMA) link clustering method were used to make a dendrogram out of the morphological data. The average taxonomic distance matrix ranged from 0.44 to 15.77. On the basis of general ear appearance, hybridization between WHT68(Region7; white grain color, dent grain type, tapered ear shape, and spiral grain row arrangement) by WHT12(Unknown; yellowish white grain color, flint in grain type, conical in ear shape and an irregular grain arrangement) genotypes with the highest Euclidean distance value to 14.92 would produce desirable segregants in segregating generation with prospect of developing promising breeding materials in advance generation. Likewise, another pair could be WHT16(Region10; white grain color, flint grain type, tapered ear shape, and regular grain row arrangement) by WHT12(Unknown). On the basis of general agronomic and phenological traits, hybridization between WHT52(Region6; yellowish white grain color, flint grain type, conical ear shape, and regular grain row arrangement) by WHT63(Region10; white grain color, flint grain type, tapered ear shape, and regular grain row arrangement) genotypes with the highest Euclidean distance value of 14.68 is a desirable pair. Based on general appearance, hybridization among WHT68(Region7), WHT12(Unknown), WHT52(Region6) and WHT57(Region4.1; white grain color, flint grain type, tapered ear shape, and regular

grain row arrangement) is a desirable selection. This study suggests that studying genetic diversity in maize accessions through morphological characters can yield information for planning the conservation and utilization of these resources for future breeding programs.

ZEA MAYS; MAIZE; LAND VARIETIES; GENOTYPES; GERMPLASM; GENETIC VARIATION; AGRONOMIC CHARACTERS; PHILIPPINES

Chinese high-yielding cultivation of PhilSCAT hybrid rice in Tarlac and Pampanga [Philippines] during dry season 2019. Flores, E.A.C., Frediles, E.C., Mina, F.E., Hongbo, W., Wendong, M., Bin L., Sanchez, A.C., Garcia, V.C., Abon, C.C.Jr., Carbonel, R.B., Sicat, E.V. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 81-82. Sept 2019.

A Chinese high-yielding cultivation method of four PhilSCAT-developed hybrid rice (M38, M82, P8, and P12) was performed during the 2018 dry season on selected two-hectare sites in Tarlac and Pampanga [Philippines] to determine their location specificity. Agronomic and yield components data were gathered from ten replicate samples, and analyzed using STAR software for site-variety interaction. All characteristics except productive tillers are influenced by site. Across sites, plant heights of the latter three varieties are significantly higher in Pampanga. Within Tarlac, the heights of the varieties are statistically equal. Across sites, panicle lengths are site-independent for M38, M82 and P8 are longer in Tarlac, while P12 is longer in Pampanga. Number of spikelets are site-independent for M38 and P8, but higher for M82 in Tarlac and for P12 in Pampanga. Comparing sites, filled grains of M82 planted in Tarlac are significantly higher; the rest are site-independent. Within both sites, P12 has the most filled grains, followed by M82 in Tarlac. Spikelet fertilities across sites are equal for M38 and P8, but are significantly higher for M82 and P12 in Tarlac and within both sites. Productive tillers are equally higher for all varieties than P12. One-thousand grain weights and crop cuts from 1.0 m² portions per area were used to project yield. Yields for M82 (10.3 t/ha) and P12 (9.8 t/ha) in Pampanga conforms to the statistics; further supported by Spearman correlation, which shows that filled grains and spikelet numbers are highly correlated ($p=0.8404$)-characteristics in which these two varieties are dominant. The projected yield for Tarlac does not conform to the statistics due to the non-parametric data. Statistical data, however, overall indicates that M38 and P8 are site-independent, while M82 and P12 perform better in Tarlac during dry season. Parametric data for identified non-parametric characteristics are required to improve this research further.

ORYZA SATIVA; HYBRIDS; AGRONOMIC CHARACTERS; DRY SEASON; CROP YIELD; GRAIN; CROP MANAGEMENT; TECHNOLOGY; DIFFUSION OF INFORMATION; PHILIPPINES

Collection, morphological characterization and diversity analyses of sweet potato (*Ipomoea batatas* (L.) Lam.) landraces in Agusan del Norte (Philippines). Borines, N.O.M., Anunciado, C.J.S., Inting, R.C., Ramo, K.J.D. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 144. Sept 2019.

Genetic resources of sweet potato have long been ignored in the province of Agusan del Norte [Philippines]. Historically, no related studies were made and no formal conservation efforts were done leaving the local sweet potato gene pool dependent on farmers' variety preferences. To address this

problem, this study was conducted to i)collect local sweet potato landraces in different areas in the province of Agusan del Norte; ii)characterize the accessions collected based on morphological descriptors, and iii)assess the diversity of the collected sweet potato accessions using Shannon-Weaver's diversity index and cluster analysis using Ward's method. A total of 33 sweet potato accessions were collected in five cities/municipalities of the province from December 2018 to January 2019. Collection sites were marked using a Global Positioning System and passport data of accessions were gathered using the germplasm collecting form of the National Plant Genetic Resources Laboratory (NPGRL). Provisional ex situ conservation for the collections was established at the Caraga State University Organic Agriculture field for morphological characterization, Eighteen stem and leaf, 3 inflorescence, and 6 storage root characteristics were recorded for each accession and were subjected to diversity analyses. Shannon-Weaver's diversity index showed 21 out of 27 phenotypic traits are highly diverse. Cluster analysis using Ward's method revealed two major groupings, wherein only three accessions belong to group A, while the remaining 30 belongs to group B. At least four accessions were identified to be promising in terms of storage root characteristics, namely, Acc. 5, Acc. 16, Acc. 17, and Acc. 21. The data generated from this study will be useful for subsequent genetic studies and the accessions will be used as primary gene pool for sweet potato varietal improvement.

IPOMOEA BATATAS; SWEET POTATOES; LAND VARIETIES; GERMPLASM COLLECTIONS; AGRONOMIC CHARACTERS; GENETIC RESOURCES; PHENOTYPES; GENETIC VARIATION; PHILIPPINES

Diversity and utilization of indigenous vegetables in 10 provinces in the Philippines. **de Chavez, H.D., Altoveros, N.C., Borromeo, T.H., Aguilar, C.H.M., Sister, L.E., dela Cruz, N.J., Bautista, N.J.L., Robillos, C.D., Barrion, D.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 50-51. Sept 2019.

Indigenous vegetables (IVs) lend themselves perfectly to the burgeoning trend towards naturally sourced nutritional supplements, organic agriculture, paleo diet, health and wellness. They are the main inexpensive and natural sources of minerals, vitamins, fiber, and in some cases proteins, that staple foods cannot adequately provide. Despite this, IVs have remained underutilized and under-researched owing to the lack of information about their potential uses and importance. There is, instead preferential emphasis on this production, marketing and consumption of high-value vegetables at the expense of indigenous vegetables which are considered by consumers as inferior to the former. This study was conducted from January to December 2018. It documented the diversity and utilization of indigenous vegetables in 10 provinces (Ilocos Norte, Ilocos Sur, La Union, Camarines Sur, Quezon, Iloilo, Capiz, South Cotabato, Davao del Sur, and Bohol [Philippines]) using focus group discussion, ocular and market surveys and actual cooking of native dishes utilizing these IVs. The ten most utilized IVs were: *Basella alba*, *Cajanus cajan*, *Corchorus olitorius*, *Ipomoea batatas*, *Ipomoea aquatica*, *Manihot esculenta*, *Moringa oleifera*, *Musa* spp., *Psophocarpus tetragonolobus* and *Bambusa* spp. Some lesser known yet notable IVs are *Allium cepa* cv *aggregatum*, *Allium sativum*, *Amorphophallus* spp., *Annona muricata*, *Cocos nucifera*, *Crassocephalum crepidioides*, *Gnetum gnemon*, *Gliricidia sepium*, *Lablab purpureus*, *Mangifera* spp, *Mollugo verticillata*, *Momordica cochinchinensis*, *Nusturtium officinale*, *Solanum aethiopicum* and *Telosma procumbens*. The most common cooking preparations documented were *dinengdeng* (clear soup) or its variants, *ginataan* (cooked with coconut milk), *ensalada* (salad), *pakbet* or its variants and *ginisa* (stir fry). These IVs offer vitamins A and C, calcium and phosphorus in amounts that can potentially meet the average daily

requirement of a 10-to 12-year-old child, thereby offering a healthier, more readily available and less costly alternative to high value vegetables sold in commercial markets.

VEGETABLES; INDIGENOUS ORGANISMS; GENETIC VARIATION; FOOD TECHNOLOGY; COOKING; FOOD ADDITIVES; USES; PHILIPPINES

Diversity assessment of local ginger germplasm using morphological and chemical properties. **Villavicencio, M.L.H., Tejano, M.S., Huelgas, V.C., de Chavez, H.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 49. Sept 2019.

The Philippines is fortunate to be endowed with over 1000 species of plants that have medicinal uses. The Department of Health (DOH), Philippines, prioritized and promoted ten medicinal plants for use in traditional herbal medicine and alternative health care. Included in the list is the ginger, *Zingiber officinale* Roscoe, or locally known as luya. The National Plant Genetic Resources Laboratory (NPGRL) holds at least 40 local collections of ginger from different provinces of the Philippines. Passport information and phenotypic data of these accessions were gathered, encoded and documented for enhanced utilization for research and crop improvement studies. Regeneration, characterization, conservation and chemical analysis of ginger germplasm were performed at the Institute of Plant Breeding (IPB). Forty-five ginger accessions were characterized while yield and post-harvest data were obtained from 27 regenerated accessions. Characterization was done from vegetative to post-harvest stage. Morphological diversity was using the Shannon-Weaver Index (H') and Pecetti index for qualitative and quantitative traits, respectively. Based on the diversity analysis, thirteen morphological traits appropriately describe the high diversity of the germplasm collection. Intensity of green color on leaves, density of adventitious root on the rhizome, rhizome texture, easiness of peeling of the skin, plant height, pseudostem diameter, number of leaves per plant, leaf length, number of rhizome per plant, weight of rhizomes per plant, number of internodes in the rhizome, and rhizome length and diameter obtained high H' values. Chemical analysis was done on selected ginger accessions which included proximate composition and nutraceutical properties like antioxidant activity, flavonoid content and total phenolics. Promising accessions of ginger were identified and selected from the diverse collection based on desired morphological traits and outstanding chemical properties.

ZINGIBER OFFICINALE; GINGER; GERMPLASM; BIODIVERSITY; DRUG PLANTS; CHEMICOPHYSICAL PROPERTIES

Evaluation of four plant DNA barcoding regions for varietal identification of abaca (*Musa textilis* Nees). **Pasquil, J.I.I., Bangcal, D.C., Vilela, J.A., Laluzin, A.G., Laurena, A.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 123. Sept 2019.

Abaca is one of the most important crops in the country. Being the center of origin of the crop, Philippines have as much as 200 varieties and about 20 cultivars. However, names of its varieties are usually given according to the place where it was cultivated which may result to redundant and inconsistent identification. DNA barcoding was performed to distinguish significant molecular variations to properly

determine abaca samples. Four barcoding regions namely, ITS2, rbcL, matK, and psbA-trnH, were used as candidate genes to differentiate 18 accessions of 10 putative abaca varieties obtained from Camarines Norte. Combinations of barcoding regions (ITS2 + psbA-trnH, ITS2 + rbcL, ITS2 + matK, rbcL + matK) were also evaluated according to their discriminatory power. The variety of the samples were further authenticated by comparing its putative sequences with the identified varieties from the UPLB abaca genebank. Among the four DNA barcodes, internal transcribed spacer 2 (ITS2) successfully allowed us to differentiate abaca varieties, making it a candidate DNA barcode for abaca. This study established an initial barcoding dataset that can be used for authenticating abaca varieties for future molecular studies.

MUSA TEXTILIS; ABACA; VARIETIES; DNA; MOLECULAR GENETICS; IDENTIFICATION

Exploring Aus germplasm for breeding high zinc rice varieties. **Inabangan-Asilo, M., Descalsota, G.I.L., Nha, C.T., Calayugan, M.I., Panalog, A., Sue, Z.M., Arocena, E.C., Amparade, A., Tesoro, F., Marfori-Wazarea, C.M., Reinke, R., Swamy, M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 124-125. Sept 2019.

Rice is one of the major staple cereal crops that feed half of the world's population. However, most of the popular high yielding rice varieties are low in essential micronutrients such as iron and zinc in their polished form. Improving the bioavailable Fe and Zn in the polished rice is a feasible and cost effective approach to address the global problem of micronutrient deficiencies or hidden hunger. Among different subgroups of rice germplasm, Aus accessions showed wider variations for grain micronutrients. Aus is closest to indica varieties but belongs to a distinct genetic group and has many promising traits including biotic, abiotic stress tolerance and grain quality traits. At IRRI [International Rice Research Institute], 224 Aus accessions were evaluated for agronomic and grain nutritional traits for 3 seasons (2017DS, 2017WS and 2018DS). The highest yielding Aus accession has 8.6t/ha while grain Zn was 40ppm. Multi-location trials across the Philippines revealed two promising accessions, Kaliboro and Jamir as the most stable and best performing accessions having yield of 3 tons/ha and Zn levels of 35 ppm based on BLUP estimates. These two accessions were used as donor parents in developing recombinant inbred lines (RILs) mapping population for detecting QTLs for grain Zn content. Mapping studies using these RILs identified several candidate genes from the ZIP family like OsZIP5, OsZIP9, and OsZIP2 found in chromosomes 5 and 3, which are said to be involved in Zn transport in rice. Large effect QTLs for grain Zn content can be used in marker-assisted breeding (MAB) to develop high Zn rice varieties. Aus accessions are valuable source of novel genes not only for stress tolerance but also biofortification traits in breeding programs.

ORYZA SATIVA; VARIETIES; GERMPLASM; INBRED LINES; CROP YIELD; ZINC; FOOD ENRICHMENT

Exploiting traditional rice varieties on developing climate smart-ready breeding lines. **Desamero, N.V., Conception, J.S., Valida, G.D., Marcelo, V.A.C., Tecman, H.T., Bagarra, J.C., Orpilla, J.O.V., Banting, M.D.M., Niones, J.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 124. Sept 2019.

Climate Smart Agriculture aims to mitigate the effects of climate change in vulnerable areas with high yielding, Abiotic stress tolerant varieties. Climate smart-ready rice breeding lines tolerant to abiotic stresses were developed using traditional rice varieties (TRVs) and derivatives as genetic resource for stress tolerance. An anther culture-derived doubled haploid line from salt tolerant TRV Pokkali was mutated through seed irradiation with gamma rays from ⁶⁰Co, yielding an elite line, PR34350-4-Pokkali-AC-24-M5R-10 (DrS 88), registered as NSIC 2013 Rc346 (Sahod Ulan 11) and released for commercial cultivation in drought-prone rainfed lowland. Hybridizing NSIC 2013 Rc346 with PSB Rc 18-Sub1, tolerant to complete submergence, generated breeding line PR42167-B-B-9-1-3-2-1. This line exhibited a 31% yield advantage over IR64-Sub1 (NSIC Rc 194) under non-stress irrigated condition, and 12% higher yield under submergence managed stress. Further, this line has tolerance to drought at reproductive stage, registering 11% yield advantage over NSIC Rc 222 under intermittent drought. A second line developed from mutated doubled haploid Pokkali-derived line, PR34363-4-Pokkali-AC-45-M5R-19 (DrS 97), registered as NSIC 2011 Rc272 (Sahod Ulan 2), was likewise crossed with PSB Rc 18-Sub-1 yielding line PR42151-B-19-1-1-2-2-1. This line had 48% yield advantage over IR64-Sub1 under submergence stress field conditions. The drought tolerant, upland TRV Azucena hybridized with IR64-Sub1 generated elite line PR42188-B-25-3-Sub1-1-1-2, with recorded 24% yield advantage over IR64-Sub1 under submergence, and 20% higher yield than NSIC Rc 192 (Sahod Ulan1) under intermittent drought. The developed climate smart-ready elite lines with tolerance to submergence and drought stress were nominated to National Cooperative Testing for 2019 wet season trial.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; ANTHER CULTURE; MUTATION; DROUGHT; WATER TOLERANCE

Farm-level impact of the International Rice Genebank (IRG) on improved rice varieties: evidence from Eastern India. Villanueva, D.B., Capilit, G.L.S., Smale, M., Jamora, N.V., Sackville-Hamilton, R. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 56. Sept 2019.

The International Rice Genebank (IRG) is an important source of rice germplasm for crop improvement and India is the top country recipient of plant genetic materials from IRG. This paper investigates the impact of rice genetic resources through varietal improvement on the rice productivity of farmers in Eastern India. Pedigree analyses are conducted to construct indicators of the genetic contribution of ancestors maintained by the International Rice Genebank (IRG) to cultivated rice varieties. The countries of origin of the IRG progenitors were examined and three of the most popular IRG progenitors were characterized. Results show that 45-77% of the genetic composition of improved rice varieties came from the genes of IRG accessions. Employing data collected from almost 9000 farmers in Eastern India, we empirically test the relationship of ancestry to productivity changes while controlling for the effects of other farm inputs and environmental factors. The preferred translog model indicates that a 10% increase in the genetic contribution of IRG accession on an improved rice variety increases the yield by an estimate of 27%. The Coefficient of Parentage (COP) was computed to determine the level of diversity among the 10 most adopted improved rice varieties. The average COP of all pairwise combinations of 10 most adopted varieties is 0.0973, which implies high diversity. High diversity among these varieties is likely a result of crossing germplasm received from 19 countries of origin. The latent diversity measured by the COP may also translate into multiple, functional trait combinations in a released variety. This study demonstrates the contribution of IRG's genetic resources in the development of improved rice varieties.

ORYZA SATIVA; VARIETIES; GENETIC RESOURCES; GENE BANKS; YIELDS; PRODUCTIVITY; INDIA

Finding natural resistance from native white corn accessions against Asian corn borer (ACB). **Marfori, Y.C., Laude, T.P., Lit, M.C., Caoili, B.L., Reyes, M.E.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 42-43. Sept 2019.

One hundred nineteen native white corn accessions from different regions in the Philippines were evaluated for corn borer resistance. The study was conducted in the Institute of Plant Breeding and laid out in a Randomized Complete Block Design (RCBD) with four check varieties (IPB Var. 6, and 13; Bt hybrid and CGUARDN84 Malagkit Salt) in three replications. Preliminary quantitative detection of Cry1Ab toxin was done. Laboratory bioassays such as leaf assay (LA) and stalk feeding assay (SFA) were conducted to assess the efficacy of corn against the Asian corn borer. Plant resistance indices such as larval mortality and stalk damage at 27 DAP and 46 DAP were observed, respectively, results showed that among the native corn accessions evaluated, 41 accessions were susceptible, 76 were intermediate and only 2 native white corn were resistant. Mean larval mortality ranged from 3%-100% and mean tunnel length ranged from 3-34cm. It also revealed that Bt hybrid along with the native check (CGUARDN84) and the two native white corn accessions were resistant with highest larval mortality (100%) at 5 days after infestation. Native corn accessions with comparably high larval mortality need further evaluation on biochemical and molecular attributes for their underlying sources of natural resistance. There is also a need to utilize and improve the available native corn population for possible breeding material for Asian corn borer resistance.

ZEA MAYS; MAIZE; VARIETIES; INDIGENOUS ORGANISMS; PEST RESISTANCE; OSTRINIA FURNACALIS; BIOASSAYS

Functional genomics to functional cacao production and varietal improvement. **Barlaan, E.A., Laurena, A.C., Sales, E.K.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 125. Sept 2019.

Functional genomics involves studies on how genes and intergenic regions of the genome contribute to different biological processes. This is translated to the development of gene-associated molecular markers for utility in cacao production and breeding. Through functional genomics and bioinformatics, molecular markers were generated using a)genome filtering utilizing methylation-sensitive restriction enzymes and b)gene mining from cacao genome sequence database. In genome filtering, genomic DNAs of different cacao cultivars were digested with methylation-sensitive restriction enzymes for ligation, amplification, cloning, sequencing and bioinformatics analysis. In gene mining, genome sequences were downloaded from the database for bioinformatics analysis. Sequences were analyzed for simple sequence repeat (SSR) loci prediction, dereplication, primer development, annotation, homology and gene ontology. Genome filtering produced 551 perfect SSRs while gene mining generated 3,423 perfect SSRs. Ontology analysis revealed that these were involved in molecular functions, cellular components or biological processes. SSR markers generated from the two approaches were validated for various utilities. First, SSR markers were identified with unique fingerprint specific to each of the 12 National Seed Industry Council recommended cacao varieties. This provides molecular identity of each variety for certification since seedlings of different

varieties could not be differentiated morphologically in commercial nurseries. Second, the identity of true Criollo type, the most favored cacao variety for its fine flavor and aroma, has been resolved through fingerprinting and cluster analysis of prospective Criollo and non-Criollo varieties. Third, SSR markers provided phylogenetic structure of 100 cacao accessions, which give information for parental selection in cacao breeding. Fourth, association mapping analysis of different cacao accessions identified SSR markers associated with resistance to major cacao pathogens *Lasiodiplodia theobromae* and *Phytophthora palmivora*. Hence, the generated molecular markers are effective in differentiating cacao varieties, which could be used not only in the Philippines but also in other cacao growing countries worldwide.

THEOBROMA CACAO; GENES; GENETIC MARKERS; GENOMES; VARIETIES; BREEDING METHODS

Gene editing in eggplant (*Solanum melongena* L.): progress and prospects. **Sagarbarria, M.G.S., Lipio, P.G., Masanga, A.P.L., Hautea, D.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 125-126. Sept 2019.

Gene editing tools have the power to produce changes in the genome ranging from small insertions, deletions, base edits, gene replacements and controlling gene expression. Targeted mutagenesis via gene editing is a powerful tool in plant breeding, which can harness the potential of a plant's native genome and hasten the breeding process. Authors report progress in establishing a gene editing system in eggplant, specifically in Philippine variety Dumaguete Long Purple (DLP). As a foundation for an initial gene editing system, authors chose to target economically important traits which are relatively easy to assess and phenotype. Polyphenol oxidases (PPOs) are enzymes that catalyze the oxidation of phenolic compounds, which result in undesirable enzymatic browning of the fruit. Auxin response factor-8 (ARF-8) is a negative regulator of fruit set and is related to parthenocarpy. Utilizing gene editing, we aim for targeted knock-out of these genes which may produce genotypes with increased marketability. Important domains for the function of PPO and ARF-8 genes have been sequenced in DLP. High homology was observed between DLP sequences and that of publicly available eggplant genome. These may be used to design single-guide RNAs (sgRNAs) for use in CRISPR gene editing systems. To produce gene edited plants, a tissue culture system for eggplant should be available. We have observed high frequencies for callus induction in leaf and cotyledon explants of DLP, but very low shoot regeneration. Optimization of the regeneration process for eggplant is vital in order to successfully conduct gene editing. In addition to this, future work will have to include the construction of a gene editing vector to be used in *Agrobacterium* transformation.

SOLANUM MELONGENA; GENES; GENOMES; GENE EXPRESSION; AUXINS; ENZYMES

Gene expression analysis of ATL31 in yellow corn in response to Philippine downy mildew infection. **Shaikh, M.L., Lantican, D.V., Pascual, C.B., Zaporteza, M.M., Manohar, A.N.C., Pammit, F.K.L., Garcia, M.O., Gardoce, R.R., Nuñez, J.P.P., Aglibot, C.C., Galvez, H.F.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 50. Sept 2019.

Philippine downy mildew (PDM) caused by the obligate oomycete *Peronosclerospora philippinensis* (Weston) Shaw is one of the most destructive pathogens of corn in the Philippines. Through the years of

using metalaxyl as seed treatment and foliar spray to mitigate the spread of the disease, metalaxyl-resistant downy mildew strains have evolved leaving host resistance as the most effective and efficient control measure. Previous fine-mapping effort has identified a major QTL region for corn PDM resistance and characterized to have high homology with corn ATL31 E3 ubiquitin ligase. To validate the role of ATL31 in the host resistance mechanism of corn to PDM, differential gene expression (DGE) analysis of ATL31 using qRT-PCR was performed between resistant and susceptible genotypes across two different time points (before and during PDM exposure). Selection of the resistant and susceptible genotypes for DGE was based on host resistance (HR) screening via spreader row technique. Result showed that the resistant genotype has a significant decline in the ATL31 gene expression as compared to that of the susceptible genotype, two weeks after PDM exposure. This is the first report of the rapid and transient expression of ATL31 and its possible role in basal immunity of yellow corn exhibiting resistance response to PDM, as previously observed in Arabidopsis. Such information on the ATL31 gene expression provides a glimpse on the complex host-pathogen interaction during PDM disease progression in corn. Thus, this study will provide a platform to design DNA marker tags for downstream marker-assisted plant breeding application towards development of outstanding and PDM-resistant corn varieties.

ZEA MAYS; VARIETIES; GENE EXPRESSION; LOCI; MILDEWS; DISEASE RESISTANCE; INFECTION

Gene sequencing and molecular characterization of phytoene synthase (psy) in sugod-sugod (Momordica cochinchinensis). **Dela Cruz, D.C.DM., Manohar, A.N.C., Mateo, J.M.C., Gardoce, R.C., Galvez, H.F.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 125. Sept 2019.

This study reports the gene sequencing of the phytoene synthase (psy) in sugod-sugod (Momordica cochinchinensis) and characterization of its nucleotide and predicted protein sequences. Sugod-sugod, also known as balbas-bakiro and buyok-buyok in some provinces in the Philippines, is known to have higher concentration of lycopene and B-carotene as compared to the primary sources of these carotenoids, tomato and carrot, but is not fully utilized due to the lack of existing studies. The psy gene of sugod-sugod was sequenced based on homology with the psy gene in tomato as the reference gene sequence, carrot, and other crops belonging in the family Cucurbitaceae. Gene-specific primers were designed to amplify through PCR the psy gene sequence. The amplified gene was sequenced and characterized for both the nucleotide and predicted protein sequences. Outputs from multiple sequence alignments of nucleotide and protein sequences were used to generate the phylogenetic relationship and ontology of the psy genes among the gene sequence of sugod-sugod against the gene sequences of tomato, carrots, and other related cucurbits. The orthologous protein sequences, structural analogs, predicted function and molecular structure of the phytoene synthase gene were determined through bioinformatics analysis using BLASTp, TM-Align, and COACH through the I-TASSER server. The gene has a predicted total gene sequence of 1465 base pairs, with its Open Reading Frame found from the 670th to the 1239th base pair. Preliminary structural annotation has also validated its isoprenoid synthase domain and catalytic activity specifically in the carotenoid biosynthesis.

MOMORDICA; SPECIES; GENES; NUCLEOTIDE SEQUENCE; MOLECULAR GENETICS; LYCOPENE; CAROTENOIDS

Genetic architecture of grain zinc concentration in a rice (*Oryza sativa* L.) diversity panel. **Descalsota-Empleo, G.I., Inabangan-Asilo, M.A., Amparado, A., Reinke, R., Swamy, B.P.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 127. Sept 2019.

Zinc (Zn) malnutrition is a global health problem that can be addressed through a cost-effective and sustainable approach of developing micronutrient-biofortified staple crops such as high Zn rice. Understanding the genetic complexity of grain Zn accumulation and identification of new high Zn donors are basic requirements in the development of rice varieties with micronutrient-dense grains. We carried out a genome-wide association study (GWAS) for grain Zn concentration using a rice diversity panel consisting of 290 aus accessions. The diversity panel was genotyped using Next Generation Sequencing, 397,599 SNPs were identified and the population was evaluated in six environments (season by location combinations). Grain Zn was measured using X-ray fluorescence scanning technique. Best linear unbiased estimates (BLUEs) were computed separately for dry season [DS] and wet season (WS). Grain Zn approached normal distribution around a mean of 18.92 ppm and ranged from 13.25 ppm to 31.69 ppm in DS while it approximated normal distribution around a mean of 19.42 ppm and ranged from 13.03 ppm to 39.00 ppm in WS. GWAS using rank-based transformed BLUEs identified five loci for Zn represented by 66 marker-trait associations on chromosomes 5, 7, and 9. The locus on chromosome 5 was identified in both seasons. Meanwhile, two loci and chromosomes 5 and 7 co-located with genes involved in heavy metal transport particularly the Zn transporters OsZIP5 and OsZIP9. We also identified high Zn rice accessions that are valuable sources of alleles for high grain Zn for direct use in biofortification breeding.

ORYZA SATIVA; RICE; VARIETIES; GENETIC MARKERS; GENES; CHROMOSOMES; ZINC; FOOD ENRICHMENT

Genetic characterization of bacterial leaf blight causal agent: *Xanthomonas oryzae* pv. *oryzae* isolates from selected rice growing areas in the Philippines. **Manangkil, J.M., Enriquez, J.O.S., Caquiat, J.P., Waing, F.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 127-128. (Sept 2019).

Xanthomonas oryzae pv. *Oryzae* (Xoo) is one of the major bacterial diseases of rice across Asia. Host resistance has been the most effective approach to control disease. Knowledge on existing population of pathogen and determining its diversity is vital for suitable cultivar deployment. This study aimed to characterize the genetic and pathotypic diversity of Xoo collected in selected rice growing areas in the Philippines. A total of 220 field isolates were collected in selected areas from 2017DS to 2018WS. These isolates were identified using Xoo specific diagnostic markers. Single Nucleotide Polymorphism (SNP) genotyping using IRRI SNP panel was done to determine the population identity for each isolates. PCR amplification using primers to amplify 16s-23s rDNA spacer region, *tnpA* gene and Phage related gene were used for DNA sequence analysis to determine its phylogenetic relationship. Furthermore, representative field isolates from each collection sites were used in virulence assay using Near-Isogenic Lines (NILs) to determine their pathotype grouping. Based on SNP genotyping all field collected isolates have 100% genotypic similarity to Xoo strains from South and Southeast Asia. Phylogenetic relationship of field collected Xoo isolates from 2017DS-2018WS showed low nucleotide diversity. Based on DNA sequences computed Tajima's D value were not significant (-10.5833 P0.10). DNA sequencing analysis for 2018 collections is currently on-going to determine its phylogenetic diversity. The effectiveness of differential

lines carrying R-genes Xa5 and Xa7 against the field isolates is useful for suitable resistant cultivar deployment and cultivar recommendation.

ORYZA SATIVA; LEAVES; GENETIC MARKERS; GENES; NUCLEOTIDE SEQUENCE; BLIGHT; DISEASE RESISTANCE; PHILIPPINES

Genetic diversity and dispersion pattern based on morphological traits among selected farmer-bred pigmented and glutinous maize varieties. **Laude, T.P., Beltran, A.K.M., Saludaes, R.A.G., Magdua, L.L.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 128. Sept 2019.

Domestic cultivation of glutinous and pigmented maize is utilized as an alternative food source. Agro-morphometric data of 100 pigmented and 162 glutinous farmer-bred maize varieties were evaluated to assess their genetic differences across regions to identify germplasm accessions for developing populations and hybrids. Euclidean similarity test and average link clustering method (UPGMA) were used to make dendrogram from the morphological data. The average taxonomic distance matrix ranged from 0.81 to 13.23 and 0.9 to 17.81 for pigmented and glutinous varieties, respectively. Based on general ear appearance, Euclidean distance data showed highest dissimilarity between CLRD7(CAR) and CLRD82(Region6) accessions, and GLUT43(Region6) and GLUT158(Region2) accessions for pigmented and glutinous varieties, respectively. For general agronomic and phenological appearance, Euclidean distance showed highest dissimilarity between CLRD35(Region6) and CLRD83(Region7) accessions, while GLUT5(Region2) and GLUT121(Region6) for pigmented and glutinous accessions, respectively. For the overall phenotype, Euclidean distance data showed highest dissimilarity between CLRD29(Region6) and CLRD85(Region7), and GLUT43(Region6) and GLUT156(Region2) accessions for pigmented and glutinous accessions, respectively. Crosses between the highly dissimilar accessions are more likely to produce desirable segregants. For instance, principal component analysis revealed dispersion pattern for pigmented accessions between group 1a ((CLRD7(Car), CLRD86(Region13)) by group 2a ((CLRD29(Region6), CLRD30(Region6), CLRD61(Region6), CLRD94(Region2))). For the glutinous accessions, dispersion pattern were observed between GLUT8(CAR) and GLUT124(Region1); GLUT124(Region1) by any of the GLUT158(Region 2) and GLUT139(Region10) aggregate; and among GLUT32(Region4.1) by the aggregate of GLUT4(Region2) and GLUT29(Region4.1). This study suggested that assessment of maize genetic diversity through morphological characters yields baseline information for germplasm resource conservation and utilization for future breeding programs.

ZEA MAYS; MAIZE; VARIETIES; AGRONOMIC CHARACTERS; GENETIC VARIATION; PLANT ANATOMY

Genetic variation and detection of gR16.1 associated to root development in PhilRice Germplasm collections. **Niones, J.M., Mananghaya, T.E., Banting, M., Manangkil, J., Castillo, M.P., Obara, M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 128-129. Sept 2019.

Efficient and active root system is an important trait for improving of water and nutrients uptake that are essential for enhancing grain yield. In this study, we attempted to understand variation in the root development traits (maximum root length) of 1200 traditional rice germplasm in the Philippines, seedlings

were hydroponically grown under nitrogen (NH₄⁺) deficient (5uM) and sufficient (500uM) concentrations. Reliable growth conditions for estimating the root length were first established to renew nutrient solutions daily and supply NH₄⁺ as a single nitrogen source. Wide distribution was observed in root development traits of 1200 traditional rice germplasm. Twenty-five of rice germplasm mostly are traditional rice varieties (TrV) demonstrates longer roots (200mm) of which Aringay traditional variety showed the longest maximum root length with 283mm. Furthermore, out of 1200 TrV germplasm, 137 TrVs were randomly selected and subjected for DNA analysis. A total of 15 polymorphic microsatellite flanking markers located in the same region of qRL6.1 allele from Kasalath. And also cleaved amplified polymorphic sequences (CAPS) markers that specific to qRL6.1 gene. Two fragments were observed using CAPS with the aid of DdeI restriction enzymes. 310bp for IR64 and 150/160bp for Kasalath. In DNA analysis, most of the TrVs showed similar fragment of IR64 allele than Kasalath allele. On the contrary, some of the TrVs particularly the Aringay variety have a longer roots compare to Kasalath variety. This results may implied that might new genes for root elongation and can utilized in breeding program.

ORYZA SATIVA; GENES; GENETIC VARIATION; GERMPLASM; ROOT SYSTEMS; ROOTS; GROWTH; PHILIPPINES

Genotype x environment interaction of hybrid rice lines. **Banting, M.D.M., Padolina, T.F., Manangkil, O.E.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 129-130. Sept 2019.

The stability of yield performance is one of the most desirable characters of a genotype to be released as a variety, which allows the developed varieties to be adapted in a large area. Genotype adaptation is across environments. Field performance trials have been conducted across different test locations as part of the National Cooperative Test (NCT) to evaluate elite hybrid rice lines before release to identify potential varieties with wide or specific adaptation. Data on yield of 18 hybrid genotypes grouped into two based on maturity during 2017 wet season to 2018 wet season across 18 test sites was analyzed using the Additive Main Effect and Multiplicative Interaction (AMMI) and Genotype and Genotype x Environment Interaction (GGE). Results showed that G10 is the most ideal genotype in Group 1 with mean yield of 6.7 t/ha, potential yield of 11.2 t/ha recorded in Bohol (2018WS), and AMMI Stability Value (ASV) of 78.87, respectively. While in Group 2, the most ideal genotype is G6 with mean yield of 6 t/ha, potential yield of 9.13 t/ha in Maligaya (2019DS), and ASV of 4.91. highly stable and adaptive genotypes can improve the productivity of wide areas and may be recommended national or location specific. Additional information from the statistical models can be positively utilized in varietal development for different locations.

ORYZA SATIVA; HYBRIDS; GENOTYPES; GENOTYPE ENVIRONMENT INTERACTION; CROP YIELD; EXPERIMENTATION

Gene-specific marker characterization of Philippine traditional rice varieties. **Alvarino, J.B., Mananghaya, T., Noines, J.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 126-127. (Sept 2019).

Molecular characterization is a significant tool in mining of valuable traits in rice germplasm gene pool. Molecular markers are associated with specific genes and functions. These markers act as 'signposts' with

those genes that gives a visual direction to crop improvement program. Also, it creates molecular profiles of the germplasm, and identify potential novel and economically important traits. Gene-specific trait molecular characterization through microsatellites has been routinely done in PhilRice [Philippine Rice Institute]. Isolated genomic DNA of 1,400 Traditional Rice Varieties (TRVs) accessions from PhilRice-Gene bank was characterized using functional markers on the following: xa5 marker for bacterial leaf blight; RM6152 and RM6403 markers for detection of Rice Tungro Virus resistance gene, ART5 and SC3 markers for submergence; RM511 for drought tolerance, RM8094 and RM10793 for saline resistance and; BADH2 and Bradbury multiplex markers for fragrance gene on aromatic trait. Most of the gene specific trait markers are detected and analyzed based on presence and absence of those genes. We identified rice varieties from the currently available 5,000 accessions in Genebank which poses a multiple genes or associated to above traits.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; GENES; AGRONOMIC CHARACTERS; STRESS; DISEASE RESISTANCE; GENETIC MARKERS

Genome-wide association (GWA) mapping for root plasticity in selected Philippine Rice Germplasm. **Lipio, P.G., Niones, J.M., Suralta, R.R., Cabral, M.C.J., Cruz, A.S., Caguiat, X.G.I.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 129. Sept 2019

Root system development is an important target for enhancing grain yield through active and efficient uptake of water and nutrients in rice. This is especially true in environments where soil moisture stress is an expected factor in yield reduction. In this study, genome-wide association analysis was conducted on a selected panel of traditional varieties previously characterized for root morphology under soil moisture fluctuation stress. ,has identified a novel, promising root plasticity allele that can be utilized in future breeding programs for climate change-resistant rice. The initial result showed that 17 SNPs located on chromosomes 2, 5, 7, 9 and 12 were related to root growth under water deficit conditions. Through root box phenotyping, further validation of the accessions displaying promising root plasticity traits relating to a region located in chromosome 2 was performed. This region was found to be involved in the induction of L-type lateral roots in response to fluctuating soil moisture stress. During the validation setup, the accession Baksalan Kawalwal displayed a 99.0% increase in L-type lateral root length under fluctuating soil moisture conditions, relative to continuously waterlogged conditions. Moreover, ANOVA results found the effect of genotype and treatment interaction of L-type lateral root length to be highly significant compared to the other root traits. A domain search on the QTL identifies in chromosome 2 identified a member of PYR_PYL_RCAR_like protein family. Members of this protein family are involved in lateral root growth and drought tolerance in *Arabidopsis thaliana*, and whose orthologues in rice are involved in both drought and cold tolerance.

ORYZA SATIVA; GENES; GENETIC MAPS; ROOT SYSTEMS; ROOTS; ROOTING; GERMPLASM

Genome-wide association (GWA) mapping for root plasticity in selected Philippine rice germplasm. **Lipio, P.G., Niones, J.M., Suralta, R.R., Cabral, M.C.J., Cruz, A.S., Caguiat, X.G.I.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 44-45. Sept 2019.

Root system development is an important target for enhancing grain yield through active and efficient uptake of water and nutrients in rice. This is especially true in environments where soil moisture stress is an expected factor in yield reduction. In this study, genome-wide association analysis was conducted on a selected panel of traditional varieties previously characterized for root morphology, under soil moisture fluctuation stress. From the results, we have identified a novel, promising root plasticity allele that can be utilized in future breeding programs for climate change-resistant rice. The initial result showed that 17 SNPs located on chromosomes 2, 5, 7, 9 and 12 were related to root growth under water deficit conditions. Through root box phenotyping, further validation of the accessions displaying promising root plasticity traits relating to a region located in chromosome 2 was performed. This region was found to be involved in the induction of L-type lateral roots in response to fluctuating soil moisture stress. During the validation setup, the accession Baksalan Kawalwal displayed a 99.0% increase in L-type lateral root length under fluctuating soil moisture conditions, relative to continuously waterlogged conditions. Moreover, ANOVA results found the effect of genotype and treatment interaction on L-type lateral root length to be highly significant compared to the other root traits. A domain search on the QTL identified in chromosome 2 identified a member of PYR_PYL_RCAR_like protein family. Members of this protein family are involved in lateral root growth and drought tolerance in *Arabidopsis thaliana*, and whose orthologues in rice are involved in both drought and cold tolerance.

ORYZA SATIVA; GERMPLASM; GENES; ROOT HAIRS; ROOTING; GROWTH; DROUGHT RESISTANCE; PHILIPPINES

Germplasm diversity in cassava collections for special traits. **Villavicencio, M.L.H., Naredo, J.F.B., Descalotea, J.C., Endonela, L.E., Mateo, J.M.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 48. Sept 2019.

Cassava is considered a staple for million of people in marginalized regions of the world. It is an important crop in the global market and is one of the most significant root crops in area and production in the Philippines. Germplasm conservation and assessment of the morphological diversity of the collections are important in the preliminary selection and breeding of cassava to identify accessions with special traits. The purpose of this study is to characterize, access the diversity and identify accessions with special traits of cassava. Fifty-six accessions were planted in 2018 at the experimental field D1-East Tranca of IPB, UPLB [Inst. of Plant Breeding, University of the Philippines Los Baños, Laguna, Philippines] for morphological characterization and chemical evaluation. Data for 34 parameters including plant body and root data descriptors and measurements were taken 9 months after planting. Analysis of data collected revealed high diversity indexes with the highest ones being the parameters prominence of leaf scars ($H = 0.94$), plant form ($H_1 = 0.93$), and ease of root cortex peeling ($H_1 = 0.98$). Storage root traits indicative of yield, such as of storage roots per plant ($H_1 = 0.81$) and fresh weight of storage roots ($H_1 = 0.79$) also showed high diversity. Analysis of nutraceutical properties of storage roots of 48 identified promising accessions with high starch (85.13%-90.99%) and energy contents (379.92 kcal/100g-417.65 kcal/100g), superior protein (0.96%-1.80%) and low hydrogen cyanide content (8.12ppm-164.93ppm: anti-nutrient). Considering the selection criteria of the plant breeders such as erect, non-branching growth habit, high fresh root yield, high values of root dry matter, starch content and root carotenoid, low root HCN, 27 accessions were

selected as very promising. This wide genetic variability in the germplasm collection of cassava is important in developing superior varieties with special traits.

MANIHOT ESCULENTA; CASSAVA; AGRONOMIC CHARACTERS; GERMPLASM; BIODIVERSITY; RESOURCE CONSERVATION

Growth phase-base agro-morphological characterization of pigmented rice accessions in PhilRice genebank. **Alfonso, D.O., Caguiat, X.G.I., Rañeses, M.A.M., Duldulao, M.D., Santiago, J.C., Nombere, J.M., Castro, J.R., Ferrer, M.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 145. (Sept 2019).

Vast rice accessions serve as source of genes to widen rice genepool. In order to assess levels of diversity, currently, 58 traits are being used as descriptor to obtain fundamental data needed for identification of promising accessions for breeding. This include descriptors for both qualitative and quantitative data from all growth stages, however, the use of these traits is time consuming. Thus, this study was designed to assess the genetic diversity using only 39 qualitative agro-morphological characters to shorten the time for data generation. This was done at three different growth phases of a rice plant namely vegetative, reproductive and post-harvest stages using 260 pigmented rice accessions. Results showed the presence if ligule and ligule shaped showed no variation among test genotypes. All 260 genotypes produced two-cleft types. Absence of anthocyanin coloration was observed in most of the rice germplasm tested. Light green to dark green was the color observed in the basal leaf sheath, auricle, collar and leaf blade while wide range of color variability was observed in lemma/palea and including that of apiculus. Cluster analysis using UPGMA revealed that overall similarity observed using all the 39 qualitative characters was 57% with 37 cluster at 0.64 similarity coefficient. However, different level of diversity was observed among the three-growth phases. Vegetative stage showed 57% diversity, reproductive stage gave 64% and post-harvest had the highest level of diversity amounting to 74%. This result showed that the level of diversity score of pigmented rice germplasm varies from rice development stage. This signifies that these germplasm may possess exclusive variability and unique features that can be used to help identify and develop germplasm that may be useful in rice varietal improvement.

ORYZA SATIVA; VARIETIES; GENETIC VARIATION; GENOTYPES; GENE BANKS; GERMPLASM; GROWTH; AGRONOMIC CHARACTERS

Identification and selection of potential restorer lines for three-line hybrid development. **Memam, M.A.C., Santiago, J., Ablaza, M.S.F., Rillon, J.P., Bandonill, E.H., Caguiat, J.D., Gramaje, L.V., Desamero, N.V., Waing, F.B.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 130. (Sept 2019).

Development of restorer lines with good restoring ability coupled with other good agronomic factors have been one of the challenges for three-line system. This study aimed to evaluate performance of advanced breeding lines based on morpho-agronomic traits, grain quality and pest and disease resistance. Field performance, grain quality and reaction to major insect pest and diseases of 93 advanced breeding lines

were evaluated. Based on marker genotyping, 65% of the lines have presence of at least one Rf gene (Rf3 and Rf4). Spikelet fertility ranged from 57.16 to 95.19%. Predicted grain yield based on BLUPs ranged from 5.51 to 7.23 t/ha with an average of 6.29 t/ha in DS, and 3.28 to 4.66 t/ha with an average of 3.90 t/ha in WS, as compared to the grain yield of the best performing checks NSIC Rc 402 with 7.02 t/ha in DS and NSIC Rc222 with 4.13 t/ha in WS. For the grain quality traits, the brown rice (%) ranged from 73.58 (poor) to 79.64 (fair), total milled rice (%) with 63.83 (Grade 2) to 72.26 (Premium) recovery, head rice (%) of 38.72 (Grade 3) to 64.98 (Premium), percent chalkiness of 2.05 (Premium) to 77.26 (aa), amylose content (AC) ranged from 13.57 (Low) to 26.22 (High) and gelatinization temperature ranged from 2.0 (High intermediate) to 7.0 (Low). In terms of disease resistance, majority of the lines have intermediate to resistant reaction to leaf blast, intermediate reaction to BLB (PXO79 race 3) and sheath blight. Finally, identified potential restorer lines will be nominated as pollen parent lines to the hybrid source nursery for the development of testcrosses.

ORYZA SATIVA; HYBRIDS; PROGENY; SELECTION; GENETIC MARKERS; AGRONOMIC CHARACTERS; GRAIN; YIELDS

Identification and validation of citrus varieties through DNA fingerprinting using simple sequence repeat (SSR) markers. **Vera, S.V.I., Rama, R.A.B., Espino, M.R.M., Espino, R.R.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 130-131. (Sept 2019).

Varietal identification is crucial prerequisite for successful crop production. The most popular method of identification is based on morphological characters which requires the grower's expertise in recognizing and differentiating one variety from another. However, visual identification has become less reliable and precise as plant's morphology is easily influenced by environmental and climatic factors leading to mislabeling. To address the potential risks of erroneous identification, DNA fingerprinting using simple sequence repeat (SSR) markers were employed. This study aims to identify six mandarin (*Citrus reticulata*), four pummel (*Citrus grandis*), four sweet orange (*Citrus sinensis*) varieties and Calamansi (x *Citrofortunella microcarpa*). Out of these aforementioned fifteen (15) varieties were twelve (12) NSIC-registered and three (3) non-NSIC registered varieties. Fourteen (14) SSR markers were screened on these varieties. Two (2) markers, SS18 and Cagg9, were able to classify varieties according to their respective species. DNA barcodes were then used to validate plant samples collected from accredited and non-accredited nurseries in the country by comparing their DNA profiles to their respective reference varieties which were from BPI-Bagui National Crop Research Development and Production Support Center. Collection of Calamansi, 'Magallanes', 'Siamese Abulug', 'Gayunan', 'Szinkom', and 'Washington Navel' from various locations have already been identified and validated using this technology. There were several planting materials found to differ in their variety name based on the identify given by the nurserymen/grower.

CITRUS; SPECIES; IDENTIFICATION; GENETIC MARKERS; DNA; DNA FINGERPRINTING; GENES; PLANT VIRUSES

Identification and validation of mango varieties in the Philippines using Simple Sequence Repeats (SSRs). **Rama, R.A.B., Vera, S.V.I., Espino, M.R.M., Espino, R.R.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View

Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 131. (Sept 2019).

Mango (*Mangifera indica* L.) is the third most important fruit crop in the Philippines. Among the different varieties present in the country, 'Carabao' is the most important. It accounts for the majority of hectareage and production in the country and backbone of our mango export. A major issue challenging the industry is access to quality planting materials including its varietal true identify being sold by various nurseries in the country. In addition, the Bureau of Plant Industry through the National Seed Quality Control Services (NSQCS) is mandated to undertake a plant material certification program. The use of molecular markers for varietal identification can facilitate plant varietal certification by authenticating the variety being sold by these nurseries to interested buyers. In these study, twenty (20) SSR markers were screened across major varieties in the Philippines ('Carabao', 'Pico', 'Paho', and 'Kachamita'). Five (5) markers, namely Min256, Min346, MishRS39, MillHR30, and LMMA09, can successfully fingerprint these varieties. Furthermore, these markers were able to discriminate 'Corcino' and 'Prima' from other NSIC-registered 'carabao' mango strains. Planting materials from accredited and non-accredited nurseries were compared to reference variety obtained from foundation trees of BPI National Mango Research Development and Production Support Center. Results show that in some cases the identify of planting materials as per declaration of nurserymen do not conform with the DNA fingerprints of the reference variety. This was on some seedlings of 'Carabao' strains claimed to be 'Corcino', 'Prima', 'Lamao No. 1' and 'GES77', all are NSIC-registered varieties.

MANGIFERA INDICA; VARIETIES; IDENTIFICATION; GENETIC MARKERS; GENES; PROPAGATION MATERIALS; PHILIPPINES

Identification of parent lines and cross combination using text cross variance in three-line experimental hybrids. **Luciano, V.P., Gramaje, L.V., Waing, F.P., Caquiat, J.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 131. (Sept 2019).

In this study, the performance of hybrids generated from 15 restorer lines and four CMS lines was evaluated using the line x tester mating design. It specifically aimed to (1)quantify the level of heterosis of the generated hybrids, (2)identify male parent with high test cross performance, and (3)determine the best CMS tester. The top three hybrids namely; TCN-154 (PR29Ax PR39908-H006-2-1-3-3-1-3), TCN-1 (PR27A x G103-1-1-3), TCN-6 (PR27A x G102-3-1-1) with yield of 10259.02 kg/ha, 9483 kg/ha and 9172.77 kg/ha respectively had yield advantage ranged from 36.66% to 52.85% over NSIC Rc222 inbred check and 16.59% to 30-39% yield advantage over Mestiso 20 as hybrid check. Among the restorer line tested, G102-3-1-1 obtained the highest the mean of 8445.55 kg/ha, this could be attributed to its high test cross mean to the four testers. Furthermore, performance of the four CMS testers varies across restorer lines used. It was observed that PR29A attained the highest tester mean of 5533.06 kg/ha followed by PR27A with tester mean of 5392.32 kg/ha. It also showed that lines that did not show its high per se performance to all the traits can also be a good combiner. Also, the CMS lines used had direct effect to the paired restorer lines. Utilizing more diverse parent lines has more changes of identifying best parents in generating heterotic experimental hybrids.

ORYZA SATIVA; HYBRIDS; PROGENY; IDENTIFICATION; BREEDING METHODS; CROP YIELD; CROP PERFORMANCE

Identity of unregistered rice variety revealed through DNA fingerprinting. **Caguiat, J.D., Enriquez, J.O.S., Caquiat, X.G., Cantilla, A., Abdula, S.E.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 132. (Sept 2019).

Unregistered rice varieties (URV) have been observed in field and used by farmers over a period of time due to its unique and outstanding traits. Characterization of these URV is important in order to determine its precise identify. This study aims to analyze the genetic identify of unregistered rice varieties collected across rice growing environments. A total of 304 URV including ten famous released varieties as checks (IR64, PSB Rc10, PSB Rc82, NSIC Rc216, NSIC Rc218, NSIC Rc222, NSIC Rc224, NSIC Rc240, NSIC Rc302, NSIC Rc308) were genotyped using 7k Infinium SNP distributed across the whole rice genome. Low levels of genetic diversity were observed between the lines ranging from 0-0.578 with an average of 0.167 which coincides with the results for marker diversity. Relationship coefficients of the lines ranged from 0.422-1.000 with an average of 0.83 indicating high levels of relatedness between entry. Close relationship among inbred checks was also observed. Overall, 181 out 294 URV had at least 90% similarity coefficient with the inbred check varieties. A total of 47 lines have at least 90% similarity coefficient with NSIC Rc222, 26 entries with NSIC Rc218, 168 lines with PSB Rc 10, and 15 lines with IR64. Genotypic identify of URV and similarity with the famous inbred varieties was established. This is helpful in determining proliferated seeds' identify and authenticity thereby farmers to have the best quality varieties.

ORYZA SATIVA; VARIETIES; GENETIC MARKERS; GENOTYPES; DNA FINGERPRINTING

Important genomic regions zinc, grain, yield, and agronomic traits in rice (Oryza sativa L.) unveiled using connected populations. **Palanog, A.D., Nha, C.T., Descalota-Empelo, G.I.L., Calayugan, M.I., Swe, Z.M., Amparado, A., Inabangan-Asilo, M.A., Reinke, R., Swany, B.P.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 49-50. (Sept 2019).

Micronutrient mainutrition is a serious nutritional problem that affects billions of people around the world. Breeding for rice varieties with increased micronutrient content is one of the sustainable approaches to address micronutrient malnutrition. Hence, developing rice with high Zn and Fe content along with desirable agronomic characters are the main targets in biofortification breeding. In this study, we tested four connected recombinant inbred populations derived from the crosses of Kaliboro (donor parent) with IR14M141, IR14M110, IR14M125, and IR95044:8-B-5-22-19-GBS (recipient parents) to detect QTL affecting grain Zn content, Fe content, grain yield, and agronomic traits. The multi-cross QTL analysis using the connected populations effectively identified 156 QTL with two major QTL (plant height and grain Zn content) for agronomic and biofortification traits distributed in all 12 chromosomes where some of them have overlapping genomic regions. Fourteen and 27 QTL were detected for grain Fe and grain Zn, respectively that were located across 12 chromosomes. A major QTL (qZn sub 5.1) for grain Zn content that accounted for 13% of phenotypic variation was detected using MC-QTL analysis and was verified by genome wide association analysis mapping in multiple populations and inclusive interval mapping of

individual populations. Genomic region of qZn sub 5.1 was studied through in-silico candidate gene analysis, gene prediction, and cis-regulatory analysis. A number primary putative genes OsZIP5, OsZIP9, and LOC_OS50G40490 were found harboring this important genomic region, OsZIP5, OsZIP9, LOC-O50G40490 showed also functional SNP polymorphisms when the genome of the parents were compared. These predicted genes were further analyzed for cis-regulatory elements found in their promoter and coding regions. Results revealed a robust number of regulatory elements involve in seed storage, photoperoidism, light-regulation, alpha-amylase expression and disease resistance. Findings suggest the possible association of genes involve in Zn uptake and transport with other physiological functions. The information of QTL affecting agronomic traits and qZn5.1 can provide the genetic basis and would be useful in marker-aided breeding for rice with high Zn coupled with desirable agronomic characteristics. Major QTL qZn sub 5.1 can be used for marker-aided breeding for high grain Zn content in rice.

ORYZA SATIVA; RICE; GENES; AGRONOMIC CHARACTERS; GENOMES; IRON; ZINC; FOOD ENRICHMENT

Improve tolerance of elite mutation derived rice breeding lines to vegetative stage submergence stress under field condition. **Buluran, R.D., Conception, J.S., Desamero, N.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 132. (Sept 2019).

Addressing the emerging concerns of climate-change aggravated risks of flash-flooding in submergence prone areas, fast-paced development of tolerant varieties Jepun, Y Dam Do, and popular rice variety NSIC Rc 222 to increase yield, improve agronomic traits, improve eating quality and improve abiotic stress tolerance. A total of 34 elite mutation derived breeding lines, and its progenitors Jepun, Y Dam Do, and NSIC Rc222 were developed, and evaluated for tolerance to submergence stress at vegetative stage Lines were completely submerged under murky irrigation water for 7 days at an average of 83 cm, pH 9.10, 27 deg C water temperature, and 121.19 mV oxidative reduction potential. All the thirteen elite NSIC Rc 222-derived mutant lines showed higher percent plant survival compared to its progenitor (43%) by 7 - 36%. Similarly, all of the five Y Dam Do-derived mutant lines had higher percent survival than its progenitor (8%) by 7% to 43%. However, the lines were phenotyped as susceptible. Of the 16 Jepun-derived mutant lines, five (31%) had higher percent plant survival than its progenitor (63%) by 2 - 16%. Overall, the mutant lines had an average percent plant survival of 53%. Eight mutant lines derived from Japun and NSIC Rc 222 were phenotyped as moderately tolerant to submergence stress at vegetative stage based on comparative survival with tolerant check FR13A (92% survival). Excellent seedling vigor and growth response was observed in the mutant lines in terms of tiller number and plant height, with significant correlation with increasing plant survival percentage. Identified tolerant lines are potential new sources of tolerance to submergence stress for rice varietal improvement. The lines warrant field performance trial under submergence stress to validate performance of identified tolerant lines.

ORYZA SATIVA; VARIETIES; PROGENY; INDUCED MUTATION; FLOODING; TOLERANCE; WATER TOLERANCE

Mangoes with red-blushed fruits can now be identified at an early seedling stage using SNP markers developed from genotyping-by-sequencing data. **Lachica, J.A.P., Elec, A.J.L., Abuan, B.F., Ocampo, E.T.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 47. (Sept 2019).

'Carabao' mango is the export variety of the Philippines, known as the sweetest mango in the world. Although superior in taste, the 'Carabao' mango cannot fully reach its export potential due to color preference of other countries to red-blushed varieties. Conventionally, crop improvement of mango involves hybridization of selected 'Carabao' strains crossed with red varieties which produces hybrids that takes 5-8 years to reach maturity and bear fruit. Early identification of hybrids with red blush based on morphological evaluation is difficult and subjective while molecular markers such as single nucleotide polymorphisms (SNPs) offer a more sensitive and discriminating means to distinguish and identify individuals' certain genetic traits. In this study, DNA samples of 341 mango genotypes were subjected to genotyping-by-sequencing (GBS), resulting in the identification of 15,604 SNPs from the reduced genome of mango. SNPs for gene homologs, as well as their trans regulatory elements, involved in the anthocyanin and carotenoid biosynthesis pathways were identified and selected for screening. Out of 30 potential primers that were designed, synthesized and utilized in PCR, fifteen showed polymorphisms in the PCR products for red and yellow peel color in 100 different accessions. Sequence analysis of PCR bands produced in several yellow and red accessions showed the presence of multiple SNPs conferring changes in codons, and hence affects functionality of proteins involved in peel color development. The SNP-based markers were able to differentiate the color of the mango peels based on their genotypes. These polymorphic markers can be used for early screening of hybrids and unknown genotypes for mango peel color.

MANGIFERA INDICA; MANGOES; VARIETIES; BREEDING METHODS; GENETIC MARKERS; GENOTYPES; NUCLEOTIDES; GENETIC POLYMORPHISM

Marker assisted introgression of provitamin A trait into popular rice varieties. **Amparado, A.F., Samia, M.Q., Fabro, A.M., Delos Reyes, K.A.B., Inabangan, M.E.S., Dimaculangan, C.A., Punzalan, J.D., Morales, G.M., Estonilo, R.C., Micoso, F.R., Bautista, A.M., Boncodin, R.M., Reinke, R., Swamy, B.P.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 133. (Sept 2019).

Hidden hunger in the form of vitamin-A deficiency (VAD) is prevalent in developing countries worldwide. Around 2.1 million children are suffering from this deficiency in the Philippines. The development of golden rice is seen as a possible intervention in mitigating this problem. Introgression of the golden rice gene (GR2E) into Philippine rice varieties would ensure its successful adoption and consumption by the target population in the Philippines. With the use of market-assisted backcrossing, introgression of GR2E into PSBRc82 was carried out at IRRI-HQ. A series of back crossing of GR2E trait resulted in a successful introgression of GR2E gene into PSBRc82 that generated advanced progenies with carotenoid content ranging from 5.0-7.0ppm and phenotypic, yield and yield component traits comparable with the recipient parent PSBRc82. Five promising lines were identified for further evaluation in multi-environment trials in the Philippines. Using the same method, additional popular Philippine rice varieties namely PSBRc18, NSICRc222, NSICRc238, NSICRc302 and NSICRc356 were successfully converted into GR2E golden rice. Each of these materials is in advanced stages of breeding and ready for field testing.

ORYZA SATIVA; VARIETIES; RICE; GENETIC MARKERS; INTROGRESSION; RETINOL; CAROTENOIDS

Markers linked to Thermosensitive genic male sterility (TGMS) for two Philippine hybrid parent lines (TG101 and TG102) identified. **Guittap, E.J.M., Miranda, R., Besas, I., Tapic, R.T., Undan, J.R., Manigbas, N.L.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 133. (Sept 2019).

In plant breeding, there are traits that are hard to select phenotypically in the field. One of these traits is Thermosensitive Genic Male Sterility (TGMS) in hybrid rice parental. Due to the TGMS genes, any sudden decrease in temperature that reaches critical fertility points can trigger self pollination which can hinder production of pure hybrid seeds. Molecular markers are essential tools to fast track selection for these traits. A study to identify the best molecular marker appropriate for the public TGMS line (TG101 and TG102) was set up. It aimed to establish the market system for developing TGMS lines for two-line hybrid rice breeding activities. Specifically, the study aimed to identify a marker that could flag TGMS genes in hybrid rice parental and to confirm phenotypically the efficiency of the marker. There were 12 markers evaluated. After leaf the collection and DNA extraction using the CTAB protocol, the collected samples were subjected to polymerase chain reaction to amplify the segments of the DNA that the markers flag. Only one marker was selected as it was the only one that gave polymorphic banding pattern. C365-1 marker has a high potential to be used as TGMS marker. This marker gave a double banding pattern for sterile entries and a single banding pattern for non-sterile entries. It has an efficiency of 80.85%.

ORYZA SATIVA; HYBRIDS; GENETIC MARKERS; PHENOTYPES; BREEDING METHODS

Meyer lemon: very juicy, but no seeds! **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 39. (Mar 2020).

LEMONS; SEEDLESS VARIETIES; AGRONOMIC CHARACTERS; PLANTING; FRUITING; FRUITS; GRAFTING

Mining natural sequence and carotenoid variation in tomato to design sgRNA towards CRISPR/Cas9 gene-editing. **Guevarra, P.R., Gardoce, R.R., Soyong, M., Mateo, J.M.C., Aglibot, C.C., Galvez, H.F.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 45-46. (Sept 2019).

Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR-associated protein (CRISPR/Cas9) technology is rapidly gaining adoption in crop breeding primarily due to its speed and accuracy. The editing process eliminates the randomness, unpredictability and long screening process of finding useful mutants by mutation breeding as well as generations of backcrossing required to introgress a gene from wild type to elite varieties. Using cultivar VB-15, the study characterized SNPs for tomato lycopene genes based on alignment against the SolGenomics data sequence of *Solanum lycopersicum* cultivar Heinz 1706 (<https://solgenomics.net/>). A number of natural SNPs were found in the lycopene beta-cyclase gene (CrtL-b), beta-carotene gene (CrtR-b), lycopene epsilon-cyclase gene (CrtL-e), and lycopene beta-cyclase gene 2 (CrtL-b2). Subsequently, four sgRNAs were designed using sequences flanking the natural SNPs specific for CRISPR/Cas9 genome editing application. The 20bp sgRNA primers were designed 5' upstream of the NGG PAM sequence with optimum percent GC content of 40-50%. Two sgRNAs were designed within the single exon of CrtL-b gene. Genetic populations segregating for the target phenotype alteration were also developed and analyzed for genetic linkage to any of these tomato lycopene SNPs. Other genomic regions

of tomato that potentially confer or regulate the phenotype were also analyzed for genetic linkage particularly the loci in the vicinity of NGG PAM sequences. To demonstrate the range of phenotypic variation, lycopene was extracted using hexane:acetone and quantified using differential wavelength scanning in a UV-Vis spectrophotometer. Results will validate design of sgRNA for successful gene-edit to induce the desired mutation. This study presents the pioneer characterization of natural SNPs in caretonoid genes between tomato cultivars VB-15 and Heinz 1706.

LYCOPERSICON ESCULENTUM; TOMATOES; BREEDING METHODS; GENES; GENOMES; NUCLEOTIDE SEQUENCE; LYCOPENE; RNA

Molecular characterization and grain quality analysis of high iron transgenic IR64 events over expressing OSNAS2 and Soyterlt2 genes. **Duenas, C.N.Jr., Trijatmiko, K.K., Ramos, S., Malabanan, P.R., Manzanilla, M.C., Laurena, A., Tecson-Mendoza, E.M., Slamet-Loedin, I.H.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 135-136. (Sept 2019).

Events from two constructs with simultaneous constitutive expression of Nicotianamine synthase 2 gene controlled by CaMV35s promoter and Soybean ferritin gene controlled either by, Globulin-B1 (IRS493) or Glutelin-A2 (IRS495) were screened for candidate events based on high iron and single T-DNA insertion. Based on screening, homozygous lines IR64-IRS493-112-1 and IR64-IRS495-301-7 were selected from events with more than 8 ppm and 28 ppm for iron and zinc concentrations in polished grains respectively. Flanking sequence analysis showed disruption in the promoter region of BGOIOSGA009311 in Chromosome 2 for IR64-IRS495-301-7 of which may have caused yield penalty. IR64-IRS493-112-1 had disruption in the promoter region of BGIOSG4A14560 in Chromosome 4 but might be compensated by 4 alternative genes with conserved Aminotransferase IV motif found in BGIOSG4A14560. Iron and zinc levels in T3 homozygous polished seeds from IR64-IRS495-301-7 reached 14ppm and 58ppm respectively whereas 10ppm and 39ppm for IR64-IRS493-112-1. Range of the values among the grain quality traits showed no substantial change in IR64 qualities in both lines. IR64-IRS493-112-1 is a very promising candidate based on results of this study. This line needs to be further characterized to assess the qualification for deregulation as a product that will aid in alleviation of iron and zinc deficiency which have been identified to be prevalent in developing countries.

ORYZA SATIVA; TRANSGENIC PLANTS; MOLECULAR GENETICS; GENE EXPRESSION; IRON; ANAEMIA; GRAIN; QUALITY

Molecular characterization of sugarcane (Saccharum officinarum L.) using Silico-DArT and SNP markers. **Rasco, J.L.S., Banganan, J.C., Abustan, M.A.M., Mendoza, M.R.DR., Lalusin, A.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 134. (Sept 2019).

Sugarcane is one of the main sources of sugar and bioethanol globally. To sustain its availability, efforts in the development of new varieties with high yield and resistance to biotic and abiotic stresses are being done. One consideration in the evaluation and selection of parental for hybridization rely on the knowledge of relationships between individuals in a germplasm. However, sugarcane's complex genome poses

challenges on genomics-assisted breeding of the crop. In this study, 180 sugarcane accessions from different provinces of the Philippines were analyzed thru genotyping-by-sequencing using Diversity Array Technology (DART). Single nucleotide polymorphism (SNP) and Silico-DART markers were developed using DARTseq. The technology employs genome complexity reduction method using methylation-sensitive restriction enzymes and Next-Generation Sequencing (NGS). Thousands of SNP and Silico-DART markers were developed that can easily cover higher genome coverage for genetic diversity analysis. Dendrogram for each marker system was constructed which shows genetic variation between accessions. Generated dendrograms can be used as basis for parental selection. Genetically variable individuals are preferred as breeding stocks in minimizing inbreeding depression. The use of DART-seq high-throughput genotyping can be a useful tool to evaluate breeding materials for development of varieties with improved characters.

SACCHARUM OFFICINARUM; SUGARCANE; GENOTYPES; GENETIC MARKERS; NUCLEOTIDES; GENETIC POLYMORPHISM; BREEDING METHODS

Molecular genetic characterization of golden rice event GR2-E. **Cueto-Reaño, M.F., Oliva, N., Salcedo, M.J., Trijakmiko, K.R., Slamet-Leoolin, I., Mackinzie, D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 134. (Sept 2019).

All commercialized genetically engineered crops undergo safety assessment and regulatory review before deployment, to ensure that they are as safe as their conventional counterparts. Molecular genetic characterization is an important component of the safety assessment, and provides an understanding of the nature of the genetic modification. Southern hybridization characterization showed that provitamin A biofortified rice event GR2E contained a single, intact, copy of the T-DNA integrated at a single site within the rice genome. The introduced DNA in GR2E rice did not contain any sequences derived from the plasmid backbone region, and was stably inherited across multiple generations of GR2E rice in three different germplasm backgrounds. Nucleotide sequencing of the inserted without modifications, except for small truncations at the 5' and 3' termini. There were no new novel open reading frames created as a consequence of the DNA insertion that would have the potential to encode a protein with any significant amino acid sequence similarity to known and putative toxins or allergens. Overall, there were no indications that the genetic modification present in GR2E rice was likely to result in any unexpected unintended changes to rice.

ORYZA SATIVA; MOLECULAR GENETICS; DNA; RICE; ALLERGENS; TOXINS; FOOD SAFETY

Molecular, phenotypic and grain quality evaluation of popular traditional rice varieties in selected areas of the Philippines. **Arceo, D.R., Bequeja, D.F.Jr., Muñoz, N.M.M., Bastante, E.P., Alaijos, O.E., Alvariño, J.B., Mananghaya, T.E., Noines, J.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 135. (Sept 2019).

Traditional Rice Varieties (TRVs) are known for its good grain quality and potential source of important traits for crop improvement. This study aims to characterize the following traits; grain quality, submergence tolerance, root elongation using molecular markers and standard evaluation system for

phenotyping. High genetic diversity of 23 TRV was observed using 48 polymorphic simple sequence repeats (SSR) markers distributed in rice genome. Analysis on grain quality, presence of aroma, submergence tolerance and root elongation ability was evaluated using the standard evaluated method. Molecular markers analysis showed that 14 TRVs possessed multiple important traits, which are Palawan 12850 and Malagaya 11035. In grain quality screening showed that all TRVs passed the physical attributes and physiochemical properties standards for rice. On the other hand, three out of 23 TRVs demonstrated aromatic trait using the KOH analysis and two entries might have good root elongation ability.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; MOLECULAR GENETICS; GENETIC VARIATION; PHENOTYPES; GRAIN; QUALITY; PHILIPPINES

Molecular screening of Southeast Asian rice varieties for diversity and pre-breeding germplasm selection.

Rañeses, M.A.M., Caguiat, X.G.I., Ferrer, M.C., Duldulao, M.D., Alfonso, D.O., Santiago, J.C., Nombere, J.M., Castro, J.R., Vilayheuang, K., Kamaruzaman, R., Lestari, P., Sabran, M., Mulya, K. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 45. (Sept 2019).

Rice is one of the most important food crops for human and genetic information of this germplasm is a prerequisite in crop breeding programs. The aim of the study was to assess the genetic diversity of 100 rice germplasms from Indonesia, Malaysia, Laos and Philippines through SSR and gene-specific SNP markers. A total of 22 SSR markers and ten SNP markers were used. The number of alleles per locus ranged from two to five, averaging 3.27. Polymorphic information content (PIC) values ranged from 0.18 (RM25934) of 0.71 (RM144) with an average of 0.44. Gene-specific include four biotic, one abiotic, two grain quality and three fertility restorer and cytoplasmic male sterility markers. Results showed that three were 40% resistant to blast, one against RTSV and no entries tolerant to submergence. Twenty and 43% of the entries possess allele for fragrance and chalkiness. Forty-four and 70 entries showed presence of restorer factor 2 and CMS alleles, respectively. The UPGMA cluster analysis showed that 100 varieties grouped into two major clusters A-II and B-VII while varieties from Indonesia and Laos are in clusters A-I, B-IV and B-VI and Malaysian rice varieties were grouped in cluster B-V. Highest similarity (0.97) was observed between 'Widas' (Indo20) and 'Inpari Blas' (Indo22). However, lowest similarity (0.25) was observed in Ria (Mal3) and Telurikan (IndoC2), Alaminos (Phil5) and Naia (Phil15), Ca-Ong white (Phil14) and Dacula (Mal4). The study showed variability of the 100-rice germplasm from selected countries of Southeast Asia that would be useful for varietal improvement. Genetic information at molecular level is suitable to identify, develop and acquire genetically unique germplasm that will benefit the plant breeders.

ORYZA SATIVA; VARIETIES; GERMPLASM; GENETIC MARKERS; SELECTION; GENETIC VARIATION

Morphological characterization and diversity analysis of advanced wide hybridization-derived rice lines.

Malabanan-Bauan, K.B., Sobreviñas, A.E.M., Decena, C.F.L., Briz, C.M., Borromeo, T.H., Hernandez, J.E. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 135. (Sept 2019).

Development of rice varieties mainly uses improved varieties or elite lines that serve as donors of target traits. However, genetic base of most modern crop varieties including rice is narrow. To entrance the

diversity of the UPLB RVIT breeding materials, wide hybridization (WH) using wild rices with the AA genome and utilizing semi-improved lines derived from them were done. This study was the initial step in characterizing the advanced WH-derived lines that were developed by the UPLB RVIT. It aimed to characterize and analyze the diversity of the advanced WH-derived lines in the observational nursery. One hundred twenty nine WH-derived lines were evaluated for this study, sixty nine in 2018 dry season and sixty three during the wet season of the same year. Thirteen qualitative and seven quantitative traits including leaf, culm, and grain characteristics were observed in both seasons. Majority of the traits were polymorphic with the qualitative traits having medium variation and mean H' values of 0.45 and 0.35 for 2018 dry and wet season, respectively. On the other hand, quantitative traits were observed to be highly diverse with average H' values of 0.76 during the dry season and 0.81 in the wet season. These WH-improved lines will be used in our hybridization program in breeding for irrigated and rainfed rice varieties.

ORYZA SATIVA; PROGENY; PLANT ANATOMY; GENETIC VARIATION; HYBRIDIZATION

Morpho-agronomic characterization of selected yellow-kernel farmer-bred varieties of maize (*Zea mays* L.) in the Philippines. **Nuñez, J.P.P., Magdua, L.M., Reaño, C.E., Laude, T.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 44. (Sept 2019).

Farmer-bred varieties of 'landraces' present a pool of unique adaptation traits that may be utilized in crop improvement. A total of 104 yellow-kernel colored farmer-bred varieties collected from nine regions (composing 11 provinces) of the country was planted on 2018 Wet Season for phenotypic characterization using a revised characterization/descriptor list. Majority of categorical (qualitative) variables present no differences while most of scale/continuous (quantitative) variable detect significant differences among entries. Through principal component analysis, we found that 80.46% of the total variation on 22 quantitative variables may be explained by 6 principal components. Around 83.05% of the total variation on 22 quantitative variables may be explained by 6 principal components as well using Gower's distance, cluster analysis reveals apparent similarities and/or relationships(s) between farmer-bred varieties in terms of 22 quantitative variables that may predict yield. Considering these similarities, our results may aid in determining which farmer-bred variety-(ies) can be utilized for maize improvement programs at the Institute of Plant Breeding.

Morphological differentiation between *coffea liberica* var. *liberica* and *c.liberica* var. *Dewevrei*. **Baltazar, M.D., Fabella, J.M.A.O., Villanueva, M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 143-144. (Sept 2019).

Coffea liberica Hiern has two popular variety in the Philippines namely *C. liberica* var. *liberica* known as 'Kapeng Barako' and *C. liberica* var. *dewevrei* commonly known as 'Excelsa' or 'Kapeng Makapal'. In this study, morphological differentiation between the two varieties were evaluated based on 35 morphological traits using fruits and seeds. The descriptors formulated by the International Plant Genetic Resources Institute (IPGRI) 1996 and in combination, the National Coffee Research, Development and Extension Center (NCRDEC) descriptors for *Coffea* were followed. Ten morphological traits were qualitative and 25 were quantitative traits. Out of the 35 traits used, 17 were able to differentiate the *Liberica* and *Excelsa*.

Three clusters were formed using NTSYSpc v2.2. Cluster I comprised of Liberica samples. Cluster II, on the other hand, comprised by mostly of Excelsa samples. Interestingly, 4 accession of liberica formed another cluster. These accessions observed to have higher fruit volume and weight of fruits, than other liberica samples. This result must also be validated. Moreover, other parameters must be considered as it could possibly explain furthermore the clustering. Based on Shannon-Weaver Diversity Index for both qualitative traits and quantitative traits show significant diversity ($H'=0.70$). The level of diversity and similarity index can be used as a baseline for molecular analysis and taxonomy studies.

COFFEA LIBERICA; VARIETIES; GENETIC VARIATION; PLANT ANATOMY

ZEA MAYS; MAIZE; LAND VARIETIES; CROP PERFORMANCE; FARMERS; BREEDING METHODS; AGRONOMIC CHARACTERS; PHILIPPINES

Multi-trait genomic prediction for grain yield and zinc content in rice. **Nha, C.T., Descalsota, G.I.L., Palanog, A., Swe, Z.M., Calayugan, M.I., Amparado, A., Inabangan-Asilo, M.A., Mendioro, M.S., Diaz, M.G.Q., Lalusin, A.G., Reinke, R., Swamy, B.P.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 136. (Sept 2019).

Genomic prediction (GS) is an efficient tool for accelerating genetic gains and reducing the time per cycles in breeding programs. Multi-trait genomic prediction has been widely used in both plant and animal breeding pipelines. In this study, we evaluated the accuracy prediction of single-trait (ST) and multi-trait (MT) models for grain yield (YLD) and zinc (Zn) content traits in six RIL populations using BLUPs. Authors genotyped a total of 1477 lines using 7K SNP rice chip. The scheme or cross-validation 2 (CV2) used for ST-GS and MT-GS models where 70% of the lines used to form the training population and the rest as testing population. Prediction accuracy of ST-GS was estimated as 0.52-0.79 for Zn (ST-BayesB) and 0.22-0.39 for YLD (ST-BayesB), respectively. However, adding both traits in MT-GS showed significant increase in the predicted values for Zn (0.58-0.83) (MT-GK) and YLD (0.24-0.43) (MT-GK) compared with ST-GS model. Moreover, the similar trend of prediction accuracies of all genomic selection models increased significantly with increasing number of markers (50-6000 markers). Therefore, the benefits of MT-GS model may be further useful in combining various important characters encompassing high yield and high-zinc content for rice biofortification breeding programs.

ORYZA SATIVA; RICE; ZINC; GENETIC MARKERS; SELECTION; GENES; GRAIN; YIELDS

Mungbean breeding decisions made. **Araña, R.A., Nas, M., Sajise, A.G., Aquino, G.M., Duque, N., Gregorio, G.B.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 47-48. (Sept 2019).

Breeding data across locations and years are highly unbalanced because: different sets of genotypes which are independently dropped or advanced, plots are lost to pests, diseases or weather, and limited number of seeds. We report alternative analysis methods that can allow combined analysis of different sets of plant breeding data and maximize the estimation of heritability and correlation between location pairs, while

removing the non-genetic effects from the predicted trait value, thereby improving advancement decisions in plant breeding. Five-year mungbean trial data from the National Cooperative Testing for four quantitative traits (yield, seed weight, days to flowering and height), consisting of 30 genotypes, 24 environments and 2,492 plots were re-analyzed using best linear unbiased prediction (BLUP) and Bayesian BLUP. Variance components were estimated using residual maximum likelihood. Bayesian approach with varying prior distributions were also explored in the estimation of random effects. Least squares method (unadjusted means) differ significantly from BLUP and Bayesian BLUP in terms of genotype ranking, $r_s(\text{unadjusted, BLUP})=0.795$, $r_s(\text{BLUP, Bayesian})=0.99$ for yield, indicating that previous analyses and advancement decisions based on unadjusted means were confounded by non-genetic effects. This study demonstrates that BLUP and Bayesian methods increase the accuracy of predicted means particularly among genotypes with very small differences because the BLUP value of a genotype is composed of only the analysis mean and the genotype effect. Improvements in heritability for height (BLUP=0.13, Bayesian=0.87) and yield (BLUP=0.12, Bayesian=0.30) suggest that population structure may have been accounted for in the Bayesian priors. Correlations between pairs of locations also indicate that using BLUP and Bayesian methods isolate GxE effects. We have demonstrated in mungbean that BLUP and Bayesian methods increase the accuracy of decisions, contributing to genetic gain. To deliver similar capabilities to breeders, we have packaged our codes into an R-based user-friendly interface.

VIGNA RADIATA RADIATA; MUNG BEANS; GENOTYPES; BREEDING METHODS; HERITABILITY; GENOTYPE ENVIRONMENT INTERACTION

New rice varieties for saline-prone irrigated lowland. **Balmeo, K.R.P., Ticman, H.T., Bagavra, J.C., Cabusora, C.C., Valida, G.D., Chico, M.V., Niones, J.M., Orbase, M.A.R., Parinas, J.F., Rillon, J.P., Santiago, G.dC., Bandonill, E.H., Desamero, N.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 136-137. (Sept 2019).

On the 0.5 to 0.6 million hectares of saline-prone coastal agricultural area in the Philippines, 0.2 million are considered seriously salt-affected soils (FAO, 2010). Using salt tolerant rice varieties is a viable, economical and sustainable adapting mechanism to enhance rice production and productivity in the marginalized salt-stressed rice areas. Developing new high yielding varieties with tolerance to salinity is continuously done at PhilRice to address the need. Currently two new varieties developed by PhilRice were registered at National Seed Industry Council (NSIC) for commercial release. The new variety NSIC 2018 Rc 528 was line PR38456-B-12-1-1-B derived from the three-way cross IVC 167/NSIC Rc134/NSIC 2015 Rc416 in 2007/WS, followed by a series of evaluation and selection from 2008 to 2012, and entered in the National Cooperative Testing (NCT) for saline-prone environment in 2015. The second variety was line PR38121-B-27-B-B-B derived from the single cross PR30245-IR64-1-4-6/NSIC Rc 128 in 2007DS, evaluated from 2007-2012 and entered in the NCT in 2015 Both lines with salinity tolerance surpassed the check variety, and were recommended to Technical Secretariat in 2017, and finally released for commercial cultivation in 2018. PR38456-B-12-1-1-B has 33.7% and PR38121-B-27-B-B-B has 24.8% yield advantage across seasons over PSB Rc90 with an average yield of 2158 kg. The two lines have grain quality acceptability comparable to IR64. The new NSIC released varieties are now ready for commercialization promotion and dissemination.

ORYZA SATIVA; VARIETIES; SALINE SOILS; SALT TOLERANCE; IRRIGATED LAND; LOWLAND

Okra variety trial for yield, fruit and nutritional quality. Oraye, C.D., Caisip, R.E., Mateo, J.M.C., Maghirang, R.G. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 137. (Sept 2019).

There is a big export market for okra but the expansion is hindered by the high price imported hybrid seeds. Local breeding of five-angled okra will eventually lead to the improvement of the seed system. Seeds will be available locally, hence farmers can have a cheaper source of seeds. Also breeding of this type of okra will produce varieties adapted under local conditions which could further lead to reduction of inputs. Stable lines have been developed and part of the breeding process is the preliminary yield trial (PYT), PYT was conducted on twelve (12) breeding lines of five-angled okra from January to May 2019 at the Institute of Plant Breeding, UP Los Baños. Harvesting of okra pods started 49 DAS (days after sowing) and lasted up to 109 DAS. Harvesting was done every other day and marketable and non-marketable fruits were sorted based on fruit size and physical and/or insect damages. The highest yielders were found to be breeding lines Ok 163404-3-1-0-0, Ok 163408-3-1-0-0 and Ok 163416-1-4-0-0 with potential yield of 21.34 t/ha, 21.49 t/ha, and 20.31 t/ha, respectively. Yield advantage over the control, Ok 173704 'Greenie' F2 with 150%, 138% and 152%, respectively. Based on sensory evaluation, Ok 163403-5-1-0-0 had the highest mean rating in terms of tenderness, taste and overall acceptability and had the least % dislike responses. The analysis on proximate composition, phytochemical profile and antioxidant capacity of both seeds and flesh of okra showed that line Ok 163408-3-3-0-0 had the highest phenolic content (7.14%); line Ok 163406-1-2-0-0 had the highest total flavonoids (2.81%); while line Ok 163416-1-3-0-0 had the highest radical scavenging activity (93.76%). Additional activities on proximate, dietary fiber and Vitamin C and K analyses are yet to be conducted for a more thorough selection and eventually varietal recommendation.

ABELMOSCHUS ESCULENTUS; OKRAS; PROGENY; CROP YIELD; EXPERIMENTATION; PROXIMATE COMPOSITION; CHEMICOPHYSICAL PROPERTIES

Participatory evaluation and selection of heirloom rice varieties in three ethno-communities of Benguet Province [Philippines]. Tad-awan, B.A., Masangcay, T.P., Gayomba, H.C., Chomawat, J.M., Mauting, W.S. 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 101. (Sept 2019).

Heirloom rice varieties are grown by ethno-communities in Benguet [Philippines] as part of their culture. These are valuable genetic resources, thus, communities play a key role in preventing genetic erosion. Participatory selection is an excellent way to select varieties in Benguet. Free prior informed consent (FPIC) consultation was done with the community folks in collaboration with responsible government agencies. Documentation of heirloom rice varieties in three ethno communities was done after the consultation and granting of FPIC. Participatory evaluation of heirloom rice varieties with market potential was conducted with farmer-partners for two cropping seasons: January-July and August-January from 2018-2019 in three locations namely; Bakun (1196 m asl), Kibungan (843-853 m asl) and Kapangan (930-963 m asl). Each that was laid-out in randomized complete block design. The most preferred variety by the farmers was determined with the use of preference score index. Stability analysis was also done. A total of 82 heirloom rice varieties were documented; 26 in Bakun, 37 in Kapangan, and 19 in Kibungan. The yield performance of heirloom rice varieties in the three experimental sites for the two cropping seasons varied. The highest

yielders were Lablabi and Lasbakan in Bakun; Sapaw, Balatinaw and Bongkitan in Kapangan, and in Kibungan were Balatinaw and Bongkitan. The most preferred varieties were Bongkitan and Lablabi in Bakun; Lablabi, Sapaw and Bongkitan in Kapangan, and Lasbakan, Bongkitan and Balatinaw in Kibungan. The reasons cited by the heirloom rice farmers for preferring a variety were; more productive tillers produced, long panicles with full and plump grains, uniform ripening and resistance to lodging. Stability analysis showed that the most stable varieties in Bakun were Lasbakan and Kalipago; Balatinaw and Bongkitan in Kapangan; and Lasbakan and Balatinaw in Kibungan.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; SELECTION; SOCIAL PARTICIPATION; ETHNIC GROUPS

Performance evaluation of improved NSIC Rc 160 and NSIC Rc 222 rice varieties with introgressed QTL for drought tolerance. **Bagarra, J.C., Waing, F.P., Enriquez, J.O.S., Palanog, A.D., Santiago, J.II.C., Millas, R.A., Galapon, J.V., Caguiat, X.G.I., Tabarao, D.A.A., Caguiat, J.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 137-138. (Sept 2019).

Drought can reduce rice production up to 50%. Development of tolerant varieties through introgression of Quantitative Trait Loci (QTL) linked to drought tolerant genes using molecular markers were done in order to mitigate the effect of drought. This study aims to evaluate breeding lines in NSIC Rc 160 and NSIC Rc 222 background with introgressed QTL (qDTY2.2, qDTY2.3, qDTY4.1, and qDTY12.1) for drought tolerance. From 2016 to 2018, eighteen NSIC Rc222 Near Isogenic Lines (NILs) and eighteen NSIC Rc160 NILs previously observed to have tolerance to reproductive drought stress together with Vandana, NSIC Rc 222, IR64 and NSIC Rc 160 as checks were evaluated at PhilRice, CES, Negros and Isabela under favorable and drought stress conditions. Yield of entries under drought stress across location and season ranged from 1.010 (PR47201-A102A-29-72-1) to 2.267 tha⁻¹ (PR47202-A103A-17-122-1) while under irrigated lowland condition grain yield ranged from 1.884 (PR47202-A103A-17-222-1) to 6.858 tha⁻¹ (PR47201-A102A-28-273-1). PR47201-A102A-28-273-1 and PR47201-A102A-29-229-2 were selected five times based on yield under drought stress condition. These entries have yield advantage of 12% and 13% over NSIC Rc 222 and with 14% and 15% over Vandana checks. Using adaptability measure and average effect of genotype, PR47202-A103A-18-106 and PR47202-A103A-17-263 are identified to have wide adaptation. Improvement of high yielding released varieties (NSIC Rc 160 and NSIC Rc 222) in terms of drought tolerance was made possible through introgression of QTL. These lines will be useful to researchers as source of donor genes and consequently to farmers to combat drought stress without yield reduction.

ORYZA SATIVA; VARIETIES; GENES; INTROGRESSION; CROP PERFORMANCE; CROP YIELD; DROUGHT RESISTANCE

Performance of late-maturing rainfed rice lines under different rice growing environments in the Philippines. **Madrid, I.J.W., Embate, M.V.G., Lubigan, J.V.DC., Hernandez, J.E., Borromeo, T.H., Magnaye, A.M.A., Sta. Cruz, P.C., Lalicán, D.J., Bon, S.G., Orbon, C.A., Machica, T.C.B., de Ramos, R.C., Alvarez, A.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 138. (Sept 2019).

Yield trials were conducted in three locations in the Philippines (Los Baños, Laguna; Pili, Camarines Sur; and Tupi, South Cotabato) in 2018 wet season to determine yield performance of 35 late-maturing rainfed rice lines from UPLB, PhilRice and IRRI, and 10 check varieties across three environments: upland in South Cotabato, favorable rainfed lowland in Camarines Sur, and unfavorable rainfed lowland in Laguna. Total rainfall during the cropping season was highest in South Cotabato (7,574.00 mm), followed by Camarines Sur (803.40 mm), and lowest in Laguna (248.30 mm). Even with lesser rainfall than South Cotabato, Camarines Sur had the highest mean yield of 3.79 t ha/per, attributable to the presence of paddy water throughout the trial. Yield range varied greatly across environments: 2.21-7.73 t ha/per for favorable rainfed lowland, 0.59-6.53 t ha/per for upland, and 0.02-2.09 t ha/per for unfavorable rainfed lowland. Across environments, PR41398-ICRL2008WS-PSBRc68-27-2-3 under favorable rainfed lowland was the top yielder among entries (7.73 t ha/per) while the lowest yield (0.02 t ha/per) was from PR40060-YDamDo-IVC2008DS7-2-DRT2 under unfavorable rainfed lowland. Per environment, PR41398-ICRL2008WS-PSBRc68-27-2-3 (7.73 t ha/per) was the top yielder in the favorable rainfed lowland condition while PUR91 was a consistent top yielder in upland and unfavorable rainfed lowland environments with 6.53 t ha/per and 2.09 t ha/per yield, respectively. The study shows that performance of rainfed rice lines is highly influenced by the environment particularly climatic factors, and while this is the case, outstanding lines can be identified across environments.

ORYZA SATIVA; PROGENY; RAINFED FARMING; HIGHLANDS; LOWLAND; CROP YIELD; CROP PERFORMANCE; ENVIRONMENT; PHILIPPINES

Phenotypic diversity of traditional rice varieties in Lake Sebu [Philippines] using post-harvest and agromorphological traits. **Caguiat, X.G.I., Santiago, J.C., Alfonso, D.O., Rañeses, M.A.M., Ferrer, M.C., Dela Cruz, G., Abid, L., Agcopra, V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019.

Traditional rice varieties (TRV) play a crucial role in indigenous communities as main staple and embedded in their culture. Any relevant information that arise with add value and could help establish the identify of such valuable heritage. Phenotyping plays an inexpensive way to establish those identities using standard descriptors. A study was conducted that aims to characterize donated TRV from Lake Sebu using standard descriptors for rice at the post-harvest stage. Overall diversity is at 77% indicating high diversity even in seven post-harvest traits. Unique TRVs were observed: collection numbers: 16846, 16568, and 16939 was observed with straw awn and collection numbers: 16205, 16942, and 16573 had brown awn. Brown apiculus color was uniquely observed to collections 16205 and 16208. UPGMA cluster analysis separated the collected TRV into two major clusters. One cluster consisted of collections with purple apex and gold sterile lemma. Further analysis at 50% similarity coefficient resulted to six sub-clusters with individual to 12 TRV per group. Notably, four groups had 100% similarity: Halay Kaulo (16565) and Hulut Bukay (16574); Hulut Bukay (16564) and Halay Kaulo (16575); Manabang (16847), Kasagpi (16851) and Masagfe Hulo (16944); and Kasagpi (16849), Dinorado (16850)and Dinorado Pula (16940). This high similarity could be attributed to intensive exchange between villages and could be still further supported with socio-demographic data. The study is relevant in providing value-added information and possible protection of these vast TRB in the IP community. The support for propagation and dynamic conservation of these resources should be given priority as shown by their diversity that could also support widening of the genepool of modern rice varieties.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; GENETIC VARIATION; PHENOTYPES; AGRONOMIC CHARACTERS; PHILIPPINES

Phenotypic variability of wildrice (*Oryza rufipogon* Griff.) under drought stress. **Valleser, J.L., Jamago, J.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 43. (Sept 2019).

Utilization of crop wild relatives is imperative in improving crop tolerance against Abiotic stresses. Phenotypic variability of *O. rufipogon* clones from Lakes Apo and Napalit, Bukidnon [Philippines] were assessed under different timing of drought stress imposition. This study was arranged in a 2X4 factorial experiment in RBCD with three replications. Only leaf area was influenced by the interaction of clones and timing of stress imposition after stress termination. Both clones subjected to drought stress at 6 weeks after transplanting (WAT) had comparable means with the well watered seedlings. Whereas, younger seedlings (2WAT) of both clones had smaller leaves. Nonetheless, Lake Napalit clone (LNC) had recovered its leaf size faster than Lake Apo clone (LAC) after a week of recovery period. Regardless of drought stress imposition, LNC had higher shoot elongation and larger leaves than LAC. Further, variable responses of *O. rufipogon* clones under different timing of drought stress were notable. Drought impedes root and shoot growth at 2WAT but not at 4WAT and 6WAT. Tiller production was hindered at 2WAT and 4WAT of drought stress imposition but not a 6WAT. However, more dead tillers were recorded on seedlings stressed at 6WAT. Leaves of seedlings subjected to drought were fully rolled reducing transpiration rate to conserve water. Lastly, leaf area was strongly associated with tiller number ($r=0.70$) and leaf rolling ($r=0.87$) under drought stress.

ORYZA RUFIPOGON; PHENOTYPES; CLONES; DROUGHT STRESS; TIMING; LEAF AREA

Philippine traditional and modern rice varieties as genetically diverse and valuable sources of quality yield related traits. **Enriquez, J.O.S., Badajos, A.T., Tabanao, D.A.A., Caguiat, J.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 143. (Sept 2019).

Numerous Philippine rice accessions are filled with untapped potential that are yet to be fully utilized in breeding programs and genetic mapping studies to increase rice production and quality. In this study, a diversity panel consisting of 400 traditional and modern rice varieties was assembled. The panel was characterized from 2016WS to 2018WS for plant height (Ht), panicle number (Pn), panicle length (Pl), panicle primary (Pb) and secondary branching (Sb), total number of grains per panicle (Tng), fertility (Fert) grain length (Gl), and grain width (Gw). Characterization results were as follows: Ht- 122.7+-28.4; Fert- 71.67+-7.31%; Gl- 9.13+-0.67 mm; Gw-2.39+-0.02 mm. DNA sequence of coding regions of seven yield related genes (WFP, APO1, NAL1, LAX1, GS5, TGW6, and GN1a) were obtained from specific sequencing panels. The panels consist of the top 30 and least 8 varieties for the trait related to the yield gene (e.g. WFP for panicle branching) and checks, PSB Rc82 and NSIC Rc222. Identified polymorphisms for each gene were identified and associated with obtained phenotypic data. We were able to detect beneficial and rare alleles of yield related genes present in the sequencing panel. Overall, Philippine rice varieties with quality yield related traits and characterize yield related genes and alleles were identified which can be used in breeding programs to improve rice yield and production.

ORYZA SATIVA; VARIETIES; INDIGENOUS ORGANISMS; GENES; DNA; NUCLEOTIDE SEQUENCE; BREEDING METHODS; CROP YIELD; AGRONOMIC CHARACTERS; PHILIPPINES

Plant biodiversity associated with corn cropping systems in the Philippines. Gruezo, Wm.Sm. Asia Life Sciences (Philippines). The Asian International Journal of Life Sciences. 0117-3375. v. 26(1) p. 71-169. (Jan-Jun 2017).

A comprehensive inventory and assessment of plant diversity associated with 15 selected representative corn cropping systems in Isabela Province (Luzon, Philippines) showed that a relatively high total plant diversity level exists within the province, with H' value of 4.15 and a species richness of 268. On a per locality/study site basis, the species diversity index of study plots ranged from $H' = 1.91$ to 3.70 and species richness ranging from $S = 16$ to 60 (Table 17). Comparison of these values with those obtained from the border areas of study plots showed that the latter had a much higher species diversity index, ranging from $H' = 1.11$ to 7.20; the highest value being nearly twice the highest value recorded from the study plots. The border areas had species richness ranging from $S = 19$ to 96 which are also much higher than the highest value obtained from the study plots. Using Sorensen's Similarity Index (S.I.) formula, the similarity in species composition per study plot and their border area basis ranged from 6.5 to 100%. On the other hand, a similarity index of 71% was obtained for the entire Isabela Province where 147 species were found common to the study plots and their border areas out of a total of 268 species recorded from the 15 study localities. In terms of taxon composition, the 268 species recorded for the entire Isabela Province belong to 212 genera and 40 families. Of the 40 families, the top 5 families with the highest number of species are Gramineae (37 spp.), Papilionaceae (29 spp.), Euphorbiaceae (16 spp.), Compositae (12 spp.), and Moraceae (11 spp.). The rest of the 35 families had each a species number ranging from 1 to 9. In terms of habit composition, the 268 species were broken down into 37 grasses, 80 herbs, 2 lianas or woody vines, 3 large trees, 6 medium-sized trees, 12 shrubs, 10 small trees, and 13 vines.

ZEA MAYS; BIODIVERSITY; SPECIES; GENERA; PLANT HABIT; CROPPING SYSTEMS; PHILIPPINES

Precise targeted addition of an iron storage gene in rice using transcription activator-like effector nucleases. Sapasap, Ma.V., Laluz, V., Trijatmiko, K.R., Tsakirpaloglou, N., Torrizo, L., Dela Vina, C.B., Mendiore, M.S., Slamet-Loedin, I.H. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. Philippine Journal of Crop Science (Philippines). 0115-463X. v. 44(Supplement no. 1) p. 139. (Sept 2019).

Conventional transgenesis is laborious and time-consuming because hundreds of events need to be generated to be able to select few events that show desired level of trait expression. Here we report the use of transcription activator-like effector nucleases (TALENs) to facilitate the delivery of a donor molecule to the targeted locus that is known to be actively transcribed. We introduced a T-DNA containing TALENs and donor molecule into rice via *Agrobacterium tumefaciens*-mediated transformation. We applied the Obligate Ligation-Gated Recombination (ObLiGaRe) method that exploits the nonhomologous end joining (NHEJ) pathway. PCR amplification and sequencing of the left and the right junctions were used to screen T0 plants. Southern hybridization using DIG Chemiluminescent Technology was conducted to investigate the copy number of T-DNA insertion in T1 generation. A total of 145 events were generated from the transformation of TALEN construct. Most events showed a band of the expected size for the left junction

that further verified by sequencing, but not many events showed the right junction band. One event showing strong bands for the left junction and right junction was advanced to T1 generation. Two to five copies of T-DNA insertion were identified among the T1 plants, and a T1 plant with two copies of insertion was advanced to T2 and T3 generations. Flanking sequence recovery using TAIL-PCR was performed to identify the genomic location of each T-DNA insertion that was further utilized to design the insertion-specific primers. T3 plants with only one T-DNA insertion were identified using insertion-specific primers. Sequencing of the region encompassing flanking and donor DNA in these T3 plants revealed that the precise targeted addition of an iron storage gene at the intended locus was also detected in this generation. These T3 plants will be advanced to the next generation to segregate out the remaining T-DNA insertion.

ORYZA SATIVA; GENES; TRANSGENIC PLANTS; IRON; FOOD ENRICHMENT; BREEDING METHODS; DNA; NUCLEOTIDE SEQUENCE

Probing into why farmers continue to plant unclassified rice lines. **Romero, M.V., Corpuz, G.A., Hulinganga, R.C., Mamucod, H.F.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 104. (Sept 2019).

Despite the massive promotion of certified seeds, a significant number of farmers still plant unclassified rice lines of unknown identity. Since they only have popular names without the standard NSIC code. They are assumed to have not undergone the formal seed system. The possible reasons behind the use of unclassified rice lines could be unique genetic traits, pest and disease resistance, or good grain quality. This was better elucidated when PhilRice [Philippine Rice Institute] conducted a survey among these rice farmers who identified good eating quality as their most common reason why they persistently use unclassified lines. To better understand the likely meaning of 'good eating quality' among the farmers, 150 rice lines were collected from different regions across the Philippines and subjected to a comprehensive grain quality evaluation. Results showed that total milled rice recovery ranged from 65.-75.7%, classified as Grade 1 to Premium. This good milling recovery promotes better marketability. Malagkit Exotic from Region 4-B [Mindoro, Marinduque, Palawan, Philippines] exhibited the highest brown rice, total milled rice, and head rice recoveries. Majority of the rice lines had intermediate amylase content (17.8-22.0%), indicating softer texture and good eating quality. Based on alkali spreading value, most samples had intermediate gelatinization temperature (70-74%), thus, with shorter cooking time. The rice lines had good crude protein content ranging from 5.7-11.4%, with highest values from Bulaw Super 60 from Region 3 [Central Luzon] and Blonde from Region 5 [Bicol region]. This study confirms that grain quality, including milling recovery, texture, and cooking time, play an important role in farmers' selection of rice lines for planting. In combination with DNA fingerprinting and agro-morphological characterization, grain quality evaluation is an effective tool in helping determine the identity of unclassified rice lines. Those lines that matched commercially-released NSIC varieties may be grown using certified seeds for higher and stable yield.

ORYZA SATIVA; PROGENY; DNA FINGERPRINTING; GRAIN; QUALITY; AMYLOSE; AGRONOMIC CHARACTERS; FARMERS; SELECTION

Progress of PhilSCAT new female parent through CMS conversion exploiting Rapid Generation Advance. **Baldedara, L.S., Guerrero, C.S., Fabros, L.W., Camus, D.C.Jr., Abon, C.C.Jr., Sicat, E.V.** 25. Federation of

Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 139-140. (Sept 2019).

PhilSCAT is an agricultural research, development and extension center that promotes mechanized hybrid rice production and biogas technology. The Hybrid Rice Technology Unit (HRTU) under the Technology and Products Development Division (TPDD) is continuously developing excellent hybrid rice varieties through its hybrid rice breeding program. However, development of excellent hybrid requires development of new and exceptional Cytoplasmic Male Sterile (CMS) lines with stable sterility, good combining ability, adaptable to local growing condition and multiple resistance to emerging pest and diseases. Under normal field condition conventional way of CMS conversion generally takes 4-5 years before it can be usable in breeding. This study exploited Rapid Generation Advancement (RGA) technology to increase the efficiency in and shorten the development of CMS conversion. This study aimed to consider the possibility of utilizing RGA in backcross nursery wherein progeny lines were grown in the seedling trays with limiting factors such as space, water and fertilizer primarily to shorten the growth duration resulting to several generations per year. Also, taking advantage of RGA may increase the probability of developing new CMS lines that can be utilized in test crossing the soonest possible. CP00016 and CP00179 has been identified sterile in the Discovery nursery through visual observation coupled with examination under the microscope. Sterile F1 hybrids were backcrossed with the recurrent parents, seeds were formed resulting to BC1F1 lines. Progeny lines were established in the seedling trays along with the male parents in the screen house as an off season trial. Initial results showed that RGA approach can be used as an alternative method to speed up breeding cycle with less field requirement and minimal manpower needed resulting to reduced breeding costs.

ORYZA SATIVA; PROGENY; BREEDING METHODS; GENES

Promising accessions of rice bean (*Vigna umbellata*) (Thunb) Ohwi and Ohashi conserved at the National Repository in the Philippines. **de Chavez, H.D., Borromeo, T.H.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines). *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 140. (Sept 2019).

Rice bean (*Vigna umbellata*) (Thunb) Ohwi and Ohashi) belongs to Family Fabaceae and is considered a native crop in South and Southeast Asia. It is being cultivated and consumed as vegetable in the following regions in the Philippines: Western and Central Visayas, Ilocos, and Southern Tagalog. It is also mixed with rice in some parts of Southern Tagalog. In 2014, 75 accessions of rice bean conserved at the National Plant Genetic Resources Laboratory (NPGRL) were sown at Tranca Experimental Field. Unique characters like leaflet shape were observed among the rice bean accessions at early reproductive stage. Most of the accessions have lobed leaflet shape while few had deltate and lanceolate. Low diversity was noted in inflorescence stage such as calyx color, flower standard color, flower wing color, flower keel color and peduncle length. Low to medium diversity was observed in many of the seedling, vegetative, and reproductive traits. For seed characters, diversity was noted only in seed coat color. Most of the quantitative traits have high diversity. Out of the 75 accessions sown, 4 accessions were identified by vegetable breeders as promising due to its determinate growth habit, early maturity, high vigor and prolificacy. These promising accessions can be used as parental in varietal improvement of rice bean at

parent. Gaps identified in regenerated collections are accessions with leaf pubescence which are important to pest resistance and day-neutral accessions to be able grow rice bean whole year round.

VIGNA UMBELLATA; VARIETIES; GRAIN CROPS; BREEDING METHODS; AGRONOMIC CHARACTERS; PHILIPPINES

Promising pigeonpea (Cajanus cajan L.) genotypes in Ilocos Region, Philippines. **Bernabe, J.A.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 144-145. (Sept 2019).

Eight genotypes of pigeonpea were derived following selection methods from the germplasm collection of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India. These were brought later to the Philippines with legitimate supporting documents as Material Transfer Agreement (MTA) and others by the author. These genotypes are combination of determine and non-determinate growth habit. The purity was maintained through selections made by the author who is a faculty researcher of MMSU [Mariano Marcos State University]. Series of trials in accordance with the regulations of the National Seed Industry Council were done to evaluate and select promising pigeonpea genotypes that are high yielding, disease resistant and acceptable to farmers; get conclusive results as a basis for recommendation to the National Seed Industry Council as regional variety under specific conditions; and improve the yield and other characteristics of pigeonpea suited to local conditions. The genotypes used include ICEAP 00040, ICEAP 00554, ICEAP 00557, ICEAP 00932, ICPL 87091, ICPL 7035, and ICPL 88039.

CAJANUS CAJAN; GENOTYPES; GERMPLASM COLLECTIONS; EXPERIMENTATION; PHILIPPINES

Rapid screening for climate-ready rice (Oryza sativa L.) and elimination of duplicates in the genebank. **Caguiat, X.G., Duldulao, M.D., Rañeses, M.A.M., Ferrer, M.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 48-49. (Sept 2019).

Genebank serve as reservoir of traits that could be mined to produce rice varieties with tolerance and resistance to biotic and abiotic. There is a need for fast and reliable method to determine which among the vast germplasm kept in the Genebank could be used in breeding programs. Gene-specific SNP-marker based offers the possibility of rapid screening, diversity analysis, and possible elimination of duplicates in the Genebank. This study was conducted to: 1) screen two common rice germplasm in the Genebank having same names but with multiple collection, 2) determine if these markers could be used to eliminate duplicates and, 3) examine the level of diversity of entries with same accession name. Total of 123 'Palawan' and 71 'Kamueros' were used in the study. Results showed high levels of variation within and between the entries for 'Palawan' and 'Kamueros'. 'Palawan' entries have higher resistance to blast (49%) and more tolerant to submergence (1%). Overall diversity was slightly higher for 'Kamueros' (72%) than 'Palawan' (70%) however combined diversity at 67%. Some entries overlapped between the two accession, cluster analysis resulted to single entry to eight entries per subclustered in 'Kamueros' while 'Palawan' has as high as 18 entries per sub-cluster. The results could infer more duplicates in 'Palawan' than in 'Kamueros' and gene-specific markers could be used as rapid screening method for vast collection in the Genebank. Duplicate elimination could save more resources in germplasm management whereas molecular markers

could fast-track the discovery of donor germplasm for developing climate-ready rice varieties. This study underscores the need for rapid screening of germplasm in the Genebank and elimination of their duplicates.

ORYZA SATIVA; BIODIVERSITY; GERMPLASM; GENETIC MARKERS; TESTING; GENE BANKS

Reasons to plant Musang King durian. **Pamplona, P.P.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 54-55. (Jan 2020).

DURIO ZIBETHINUS; VARIETIES; ADAPTABILITY; CROP MANAGEMENT; OFF SEASON CULTIVATION; OUT OF SEASON PRODUCTS; FRUITS; QUALITY; PROCESSED PLANT PRODUCTS; PRODUCTS; FOOD TECHNOLOGY

Regulatory process towards the delivery of beta-carotene-enhanced golden rice to help improve nutritional status in the Philippines. **Swamy, B.P.M., Ordonio, R.L., Marundan, S., Jr., Samia, M., Rebong, D.B., Miranda, R.T., Apongol, Ma.A.T., Alibuyog, A.Y., Suralta, R.R., Reinke, R.F., Bancodin, R., Mackenzie, D.J.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 41-42. (Sept 2019).

Golden Rice (GR) is a new type of rice produced through modern biotechnology that is biofortified with beta carotene (vitamin A precursor), GR is intended to complement other vitamin A sources in the diet, and is viewed as a potential intervention to address vitamin A deficiency in rice-consuming countries. It is estimated that such deficiency affects about 2.1 million children in the Philippines. From 2015 wet season to 2016 dry season, PhilRice [Philippine Rice Research Inst., Nueva Ecija, Philippines] and IRRI [International Rice Research Inst., Metro Manila, Philippines] have conducted two seasons of confined field testing (CFT) of Golden Rice event E (GR2E) lines in the garlic background of PSB Rc 82. Here authors present the selection of the best-performing PSB Rc 82 GR2E introgression lines and the result of the compositional analysis in GR2E, both in the context of biosafety regulatory compliance. Based on yield and agro-morphological performance, authors selected five promising PSB Rc 82 GR2E lines. These lines showed comparable yield, agro-morphological characteristics, and pest and disease response to the original recipient variety (PSB Rc 82). As of the compositional analysis of bulked Golden Rice grains, it was found that PSB Rc 82 GR2E was similar in terms of chemical composition with ordinary rice, except for the intended bioavailability of beta-carotene. This provides clear initial evidence as to the safety of GR2E based on the principle of substantial equivalence. All the five promising introgression lines, along with the control, will be further tested under field trial conditions in two sites in the Philippines in 2019, will bring us closer to releasing safe and nutritious Golden Rice to improve the nutritional status of Filipino populations at risk of vitamin A deficiency.

ORYZA SATIVA; RICE; SELECTION; TESTING; INTROGRESSION; CAROTENOIDS; CROP PERFORMANCE; NUTRITIONAL STATUS; PHILIPPINES

Rice antenna panel: a sensor of changing climatic conditions and better adaptation. **Bonifacio, J.B., Jubay-Baer, M.L., Leung, H.T., Swamy, B.P.M., Singh, R.K.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 140-141. (Sept 2019).

With the rapid growth of the human population, demand for rice will continue to increase in the coming decades. However, sustaining rice production with the adverse effects of climate is a major challenge. Increasing productivity despite climate change requires understanding of the complexity of interactions between genotype (G) x environment (E) x crop management (M), Global Rice Array (GRA) consisting of Antenna and Reference panel are being evaluated under varied climatic and soil conditions across several locations worldwide. The Antenna panel is composed of seventy three rice genotypes with known traits, nominated by different research institutes and breeding programs that will act as sensors for environmental changes. The preliminary analysis conducted using the first season data from three locations in the Philippines: Los Baños (Normal), Iloilo (Salt-affected) and Bukidnon (Iron toxicity), results showed that IR 93340: 14-B-21-17-12-1RGA-2RGA-1-B-B obtained the highest average yield of 4.5 t/ha followed by two of its parents Fedearroz 50 (4.3 t/ha) and IR77298-14-1-2-10 (4.1 t/ha); and one high yielding variety IRRI154 (3.9 t/ha). Moreover, the multi-environment analysis using GGE Biplots showed that Los Baños is an environment good for selecting generally adapted genotypes while Iloilo is good for selecting specifically adapted genotypes to salinity. IR 93340:14-B-21-17-12-1RGA-2RGA-1-B-B, Fedearroz 50, IR77298-14-1-2-10, IRRI154 and UPLR17::IRTP9897-C1 are some of the highest performing and stable genotypes. Currently, 25 field laboratories have been established across the world to sense the climate change effects through G x E x M interactions. The knowledge on G x E x M is important for identification of combinations of genes and traits are adaptive to changing climatic conditions.

ORYZA SATIVA; RICE; CLIMATIC CHANGE; GENES; GENOTYPES; GENOTYPE ENVIRONMENT INTERACTION; SELECTION; ADAPTATION

Seedling development of selected medicinal plants in the Philippines. **Cejalvo, R.D., Altoveros, N.C., Borromeo, T.H., Bartolome, M.C.B., Gentallan, R.P.Jr., Timog, E.B.S., Villavicencio, M.L.H.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 141. (Sept 2019).

The Philippine medicinal plants can also be propagated through seeds; however, the seed germination patterns of these medicinal plants are not yet established. The study aimed to elucidate the seedling developmental patterns of lagundi (*Vitex negundo* L.), niyog-niyogan (*Combretum indicum* L.), pansit-pansitan (*Peperomia pellucida* (L.) Kunth), sambong (*Blumea balsamifera* (L.) DC.), tsaang gubat (*Ehretia microphylla* Lam.), serpentine (*Andrographis paniculata* (Burm.f.) Nees) and pandakaki (*Tabernaemontana pandacaqui* Lam.) based on the extended Biologische Bundesanstalt, Bundessirtenamt and Chemical industry (BBCH) scale. Thirty seeds per species were germinated, and observed for growth and developmental changes until the first true leaf emerged. Epigeal phanerocotylar type of germination with foliaceous cotyledons was observed in lagundi, pandakaki, pansit-pansitan, sambong, serpentine, and tsaang gubat while niyon-niyogan showed hypogeal cryptocotylar type of germination with reserve storage cotyledons. During emergence, niyog-niyogan, pansit-pansitan, sambong and tsaang gubat were observed to characteristically bear a single first true leaf, whereas the rest of the species bore two. Another distinct and non-plastic feature was also observed during the radical emergence (BBCH 05) at the stylar end of tsaang gubat and niyog-niyogan, and at the peduncle end in lagundi. Information about the growth and development of the seeds can enhance propagation, diversification and conservation of these medically important crop species.

DRUG PLANTS; SEEDLINGS; GENETIC RESOURCES; RESOURCE CONSERVATION; GERMINATION; SEEDS; PHILIPPINES

Sylvia, a new green lettuce variety. **Ancheta, A.V.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 20-22. (Mar 2020).

LACTUCA SATIVA; VARIETIES; PLANTING; AGRONOMIC CHARACTERS; PRICES; DEMAND

Upgraded PhilRice GEMS [Germplasm Management System] Database for Digital Object Identifier (DOI) implementation. **Duldulao, M.D., Ferrer, M.C., Newingham, M.C.V., Noines, J.M., Caguiat, X.G.I., Perez, L.M., Romero, G.O.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 141-142. (Sept 2019).

Access to genetic resources and information held at genebanks are essential for current and future needs of rice improvement programs. Thus, upgrading of the current Germplasm Management System (GEMS) of the PhilRice Genebank is pursued to develop new systems' functions and to support the implementation of Digital Object Identifier under the Global Information System of ITPGRFA. The old Germplasm Management System (GEMS) was revamped using a cross-platform relational database - FileMaker Pro12 Advanced with improvements on user interface, scripts, and security. The new GEMS v2.0 was developed through redesigning its whole system architecture in synchronization with the required descriptors by GLIS. Three significant improvement of the system were made: i)data validation and automation, ii)barcoding technology, and iii)DOI assignation. This paper presents the significant impact of system upgrade from the perspective of genebank's operational efficiency in providing accurate, up-to-date, and quality information to breeders, researchers and other stakeholders.

ORYZA SATIVA; GERMPLASM; GERMPLASM CONSERVATION; GENE BANKS; GENETIC RESOURCES; DATABASES

Validation of dehydration avoidance root plasticity traits of selected germplasm collection under soil moisture deficit. **Castelo, R.G.M., Suralta, R.R., Untalan, J.R., Kalaw, S.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 142. (Sept 2019).

Percentage of drought affected rice areas has approximately doubled from the past years and thus, further reduced the potential rice production. Under such condition, roots play an important role in maintaining plant productivity through the maintenance of higher soil water uptake from the drying soils to support higher transpiration and photosynthesis and consequently, above ground dry matter production. One of the methods for rapid screening of drought resistance is using Line Source sprinkler system (LSS). Using the LSS, germplasm collections were identified as drought resistant (based on the ability to maintain dry matter production) in response to different intensities of drought. The drought resistance of these selected germplasm, however, need to be further studied to validate the contribution of dehydration avoidance root traits to drought resistance and a selected germplasm with validated dehydration avoidance root traits can be recommended for use as a parent for breeding high yielding varieties adapted to drought

prone environments. Seven selected rice germplasms from the LSS system were grown under two water treatments such as CWL (continuously waterlogged for 39 days) and PDR (progressive drought, first waterlogged for 14 days and subsequently subjected to progressive soil drying conditions at 10% SMC until 39 days after sowing). Arranged in split plot design (treatments as main plot and genotypes as subplots) with three replications. Statistical analysis showed that there was significant interaction between genotype and water treatments on shoot dry matter production. The shoot dry matter production was significantly reduced by PDR regardless of genotypes. Correlation analyses showed that water use was positively and significantly contributed the higher maintenance of shoot dry matter production during PDR. Among the selected rice germplasms, Belibod showed the ability for greater tolerance to drought based on its less reduction of its shoot drought during progressive soil drying conditions.

ORYZA SATIVA; GERMPLASM; GERMPLASM COLLECTIONS; TESTING; ROOTS; DROUGHT STRESS

Variability assessment in eggplant relation (CWR) at seedling and vegetative growth stages. **Huelgas, V.C., Caraan, J.A.M., Banganan, J.C., Hermoso, R.T., Masanga, A.P.L., Lipio, P., Hautea, D.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 142-143. (Sept 2019).

Seedling and vegetative morphological characterization was performed based on the Bioversity International descriptor list. Descriptive statistical analysis disclosed varied means and ranges in quantitative traits of the different accessions of cultivated eggplant (*Solanum melongena* L., 111) and its wild relatives (*S. aethiopicum* (5); *S. aculeatissima* (2); *S. linociera* (3); *S. parkinsonii* (1); *S. ferox* (1), *S. sysimbriifolium* (1) and *S. mammosum* (1)). In terms of qualitative attributes, variability in modes and ranges of values were also noted. Quantitative features (9) of the accessions at seedling (4) and vegetative (5) had high variability as indicated by the Shannon-Weaver diversity index. Among the traits, leaf length at the seedling and vegetative stages had the highest value (0.90) while the lowest value was that of days to germination (0.63). *Solanum melongena* accessions alone expressed high variability in quantitative seedling and vegetative traits with the highest index of 0.91 (plant height) and the lowest 0.64 (days to germination). Qualitative features (14) of eggplant accessions, including the wild relatives, also generated differences as reported by the diversity values that ranged from low (0.07, leaf blade tip angle) to high (0.98, stem anthocyanin color intensity). Intermediate variability in eggplant and its wild relatives was indicated by leaf prickles (0.51). The different accessions were segregated in different groups according the cluster analyses. Simple matching and Euclidean distance coefficients were used in the analyses employed qualitative and quantitative morphological data, respectively. Analysis of variance for an alpha-lattice design was used to determine the variability among eggplant accessions and their wild relatives compared to two variety checks using quantitative traits.

SOLANUM MELONGENA; GERMPLASM; PLANT ANATOMY; GENETIC VARIATION; AGRONOMIC CHARACTERS; SEEDLINGS; VEGETATIVE PERIOD

Yield improvement of white quality protein maize cultivars in the Philippines. **Saldares, R.A.G., Reyes, A.C., Sanchez, Ma.A.B., Laude, T.P., Salazar, A.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 42. (Sept 2019).

IPB Var 6 is an open pollinated variety (OPV), and the only quality protein maize (QPM) cultivar accredited by National Seed Industry Council (NSIC). Since maize hybrids are preferred over OPVs for their yield, development of the first QPM hybrid was initiated. Development of inbred lines were done using IPB Var 6 (Pop63) and Pop62 since these were known to have heterotic patterns. A total of 450 S sub 5 lines from both populations were advanced until S sub 6 generation. Outstanding S6 lines from Pop62 (9 lines) and Pop63 (8 lines) were used to develop S sub 6 x S sub 6 crosses between the two population. A total of 35 crosses and six checks (Pop62, Pop63, Pop62 x Pop63, Pop63 x Pop62, IPB Var 8, and Evogene 805W) were subjected to yield trial under two locations (CMU [Central Mndanao University, Bukidnon, Philippines] and UPLB [university of the Philippines Los Baños, Laguna, Philippines]). ANOVA revealed that environment, genotype, and genotype x environment interaction (GEI) were highly significant for the maturity related characteristics (days to anthesis, days to silking, and anthesis-silking interval) and plant height. Yield of the 41 entries were significantly affected by the genotype indicating the different performance of genotypes across environments. Evogene 805W, the hybrid check variety had the highest yield (8.49 t/ha) but has no significant difference on five other entries: (Pop62)51 x (Pop63)18, (Pop62)128 x (Pop63)132, (Pop62)128 x (Pop63)124, (Pop62)120 x (Pop63)130, and (Pop62)61 x (Pop63)124. Six crosses were selected based on yield and maturity related characteristics. Parental seeds of the selected crosses were increased then hybrid seed increase will follow. Further evaluation of the promising hybrids with outstanding yield performance and quality protein will be done and will be subjected to National Cooperative Testing.

ZEA MAYS; MAIZE; VARIETIES; CROP YIELD; INBRED LINES; GENOTYPE ENVIRONMENT INTERACTION; PHILIPPINES

F40 Plant ecology

Azolla Program: reviving its commitment to research and development in UPLB [University of the Philippines Los Baños]. Aguilar, E.A., Ocampo, E.T.M., Aspuria, E.T., Perdiguerra, K.N.C., Reaño, S.S. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 78. (Sept 2019).

The commitment to research, development and innovation on the study of Azolla and its nutritional and economic values is now being revitalized through the Azolla Program of the Institute of Crop Science, College of Agriculture and Food Science, University of the Philippines Los Baños, a take-off from the past, long-term program of the 1980's. Its germplasm collection from the International Rice Research Institute, the world's largest collection of its kind, was transferred to UPLB and presently housed in PhilRice Los Baños branch, becoming an intergral component of an R and D [Research and Development] Program with studies such as In vitro Propagation and Conservation of Different Azolla Species; Morphological and Molecular Characterization; Utilization of Azolla as Potting Mix and Fertilizer; Optimization in Pond Culture; and Developing Small and Commercial Models of Azolla-based Systems, Promotion and Income Generation Projects. The prgram's banner title of '4 F + P', aims to intervene on its strengthened comeback not only on Azolla research as fertilizer (1F) and livestock feed (2F), taking note of its invasive ability, but looking on its benefits from a different perspective such as alternative protein (25% -30% content) and nutrient source for human consumption (food, 3F), as fuel (4F), and as material for Phytoremediation (P), leading to its conservation, utilization and availability for instruction, research and socio-economic projects in the future by value-chain development and product value-adding. A pteridophyte and regarded as 'super plant', with

the capacity to double in size and number over a period under optimum conditions, Azolla grows in bodies of water in almost all known environments, having a symbiotic relationship with the nitrogen-fixing, blue-green alga *Anabaena azollae*. In ancient times, it has contributed to the reduction by about half the then prevailing high CO₂ levels estimated at 1500-1600 ppm in earth's atmospheric composition.

AZOLLA; SPECIES; ANABAENA; NITROGEN; PROTEINS; FOODS; BIOREMEDIATION; RESEARCH; GERMPLASM; IN VITRO

F50 Plant structure

Developing image processing techniques for estimating eggplant trichome density. **Porca, A.A., Madrid, V.R.M., Taylo, L.D., Cainday, J.T., Hautea, D.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 59-60. (Sept 2019).

Eggplant leaf trichomes have been documented to be an insect resistance factor especially for sucking insects. Trichomes serves as a mechanical barrier that impede feeding and oviposition of leafhopper. Characterization of trichomes of eggplant germplasm is labor-intensive and prone to bias. This study explored the implementation of a digital solution using computer vision to automatically count the density of leaf trichomes and the trichome images used were taken at the Institute of Plant Breeding on February 2019. The automation was divided into four parts: (1)image acquisition, (2)image enhancement, (3)image binarization, and (4)trichome cluster detection and counting via its central disk. First, the leaf images were acquired using a stereo zoom trinocular microscope with 20x magnification. Second, the images were enhanced by using a sharpening and histogram equalization techniques. Third, the enhanced images were then subjected to grayscale morphology opening operation to bring out the central disks of the trichomes. Then the images were binarized using intensity slicing and adaptive thresholding to isolate the central disks of trichomes. Finally, each cluster of trichome was detected and counted if they were found inside the leaf structure in the image. The computer vision approach developed was able to provide estimate with 85% degree of precision. Although only stellate trichomes were analyzed in this study, the technique used can be easily modified to detect other types of trichomes in other crops as well.

AUBERGINES; SOLANUM MELONGENA; LEAVES; TRICHOMES; PLANT HAIRS; IMAGE PROCESSING; IMAGE ANALYSIS; IMAGERY

F60 Plant physiology and biochemistry

Genetic variation and detection of gR16.1 associated to root development in PhilRice Germplasm collections. **Niones, J.M., Mananghaya, T.E., Banting, M., Manangkil, J., Castillo, M.P., Obara, M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 128-129. (Sept 2019).

Efficient and active root system is an important trait for improving of water and nutrients uptake that are essential for enhancing grain yield. In this study, we attempted to understand variation in the root development traits (maximum root length) of 1200 traditional rice germplasm in the Philippines, seedlings

were hydroponically grown under nitrogen (NH₄⁺) deficient (5uM) and sufficient (500uM) concentrations. Reliable growth conditions for estimating the root length were first established to renew nutrient solutions daily and supply NH₄⁺ as a single nitrogen source. Wide distribution was observed in root development traits of 1200 traditional rice germplasm. Twenty-five of rice germplasm mostly are traditional rice varieties (TrV) demonstrates longer roots (200mm) of which Aringay traditional variety showed the longest maximum root length with 283mm. Furthermore, out of 1200 TrV germplasm, 137 TrVs were randomly selected and subjected for DNA analysis. A total of 15 polymorphic microsatellite flanking markers located in the same region of qRL6.1 allele from Kasalath. And also cleaved amplified polymorphic sequences (CAPS) markers that specific to qRL6.1 gene. Two fragments were observed using CAPS with the aid of DdeI restriction enzymes. 310bp for IR64 and 150/160bp for Kasalath. In DNA analysis, most of the TrVs showed similar fragment of IR64 allele than Kasalath allele. On the contrary, some of the TrVs particularly the Aringay variety have a longer roots compare to Kasalath variety. This results may implied that might new genes for root elongation and can utilized in breeding program.

ORYZA SATIVA; GENES; GENETIC VARIATION; GERMPLASM; ROOT SYSTEMS; ROOTS; GROWTH; PHILIPPINES

F61 Plant physiology - Nutrition

Development and evaluation of an android-based mobile application version of the leaf color chart or LCC [leaf color chart] App. **Capistrano, A.O.V., Hernandez, J.E.G., Auñgon, J.J.E., Ramos, J.U.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 38. (Sept 2019).

This paper presents the development an android-based mobile application simulating a rice chlorophyll meter for determining real-time nitrogen (N) requirement and evaluated its performance as a recommending tool for topdressing. At present, chlorophyll meters are commercially available but are too expensive for ordinary farmers. Hence, PhilRice [Philippine Rice Research Inst., Nueva Ecija, Philippines], in the past, developed the leaf color chart (LCC), a cheap but effective alternative to chlorophyll meters capable of diagnosing and recommending N requirements in real-time. However, farmers adoption rate of the LCC despite years of techno-promotion, was not so significant. With the current access to digital platforms, the underlying principle/process of the LCC was developed into an android-based mobile application to revive the useful tool. Initially, a conversion process for digital leaf images into dark green color index (DGCI) was developed, coded into a computer program and then used to identify the DGCI to the original 6-panel LCC to establish its correlation. Similarly, the correlation between the 6-panel LCC and SPAD readings were also established to finally determine a connection between DGCI and SPAD values by merging the two correlations. A prototype android-based mobile application (LCC App) was therefore developed with the merged correlation embedded that made use of smartphone's built-in cameras to capture rice leaf images, process it into DGCI and generate N-topdressing rates. Comparison between the DGCI against actual SPAD values showed strong correlation in both DS2017 and WS2018 field assessments. However, N-content of rice leaves sampled in DS2017 were found better correlated with DGCI than actual SPAD values. While yield evaluation trails using NSIC Rc216 with 5 treatments and 4 replications showed a very comparable yield performance between LCC and LCC App during WS2018 with the agronomic efficiency of applied N (AEn) under LCC App better than other treatments except one. However in DS2019, grain yield under LCC App surpassed all treatments but its AE sub N was now only better than LCC.

ORYZA SATIVA; LEAVES; COLOUR; CHLOROPHYLLS; NITROGEN; COMPUTER SOFTWARE; EVALUATION; CROP YIELD; YIELD INCREASES

F62 Plant physiology - Growth and development

Callus induction and plant regeneration in tomato (*Solanum lycopersicum* L.) as affected by genotype, explant, and plant growth regulators. **Maravilla, A.M.B., Valle-Descalsota, M.L.S., Damasco, D.P., Laurena, A.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 147. (Sept 2019).

In plant transformation, the success is dependent on tissue culture and regeneration-from producing good, embryogenic, and friable calli to regenerating whole and healthy plants. In this study, it is of interest to find the best explants and the optimum concentration of plant growth regulators suitable for the production of desired callus and plant regeneration. Fourteen (14) tomato genotypes were tested across 12 callus induction treatments with varying concentrations of 1-Naphthaleneacetic acid (NAA; 0 ppm, 0.5 ppm, 1 ppm, and 2 ppm) and 6-benzylaminopurine (BAP; 0 ppm, 1 ppm, and 2 ppm) using two types of explants (cotyledon and hypocotyl). Cultures were observed for percent callus formation, type of callus formed, callus size, color, and texture. Statistical analysis showed significant differences in percent callus formation and callus size across the treatments tested. The most number of calli formed was observed in the medium containing 0.5 ppm NAA and 1 ppm BAP with percent callus formation of 86.57% while the largest calli were observed in cultures with 1 ppm BAP. Plant regeneration was also observed in some cultures with 2 ppm BAP. Genotypes and type of explants have no significant effect on percent callus formation and callus size. Results showed that the concentration of plant growth regulators in the medium highly affects the ability of the plant to produce callus, regardless of tomato genotype to be cultured or type of explants used.

TOMATOES; FRUIT VEGETABLES; CALLUS; TISSUE CULTURE; GENOTYPES; EXPLANTS; PLANT GROWTH SUBSTANCES

Characterization of cacao (*Theobroma cacao* L.) phenology under Type III climate. **Protacio, C.M., Lagrimas, A.J.M., Del Rio, S.P., Salazar, B.M., Gonzaga, A.B.Jr., Cena, R.B., Sarausa, D.N., Cantil, D.M.N.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 80-81. (Sept 2019).

Smart agriculture calls for location-specific data of weather parameters vis-a-vis growth responses. The study aims to characterize the annual production cycle of cacao, from flowering to harvesting, to become strong bases in recommending specific practices ahead of time, given a climate outlook. Phenology was characterized using the Biologische Bundesanstalt Bundassorternamt Chemische Industrie (BBCH) scale for cacao. Flowers (BBCH 51-69), cherelles (BBCH 70-75), pods (BBCH 76-89) and leaf flushing intensity per tree were monitored monthly in different locations under Type III Climate, from October, 2018 to May During the dry months, January to March, flowering intensity was low. UPLB in Los Baños, Laguna [Philippines], where the average rainfall was 15.33 mm, had an average of 78.7 flowers monthly. Kabacan, North Cotabato, represented by USM, maintained higher number of flowers with 521.3 despite having received the lowest rainfall. During this time was also a low leaf flushing intensity. Since there were low number of

flowers during the dry months, low number of cherelles were observed in the following months in all sites. Therefore, low to no harvest is likely 5 to 6 months after. In April, when rainfall started to increase, flowering also intensified. UPLB [University of the Philippines Los Baños] and USM [University of Southern Mindanao] had more than 1,100 flowers per tree. In May, number of flowers in UPLB jumped to 2,400 corresponding to an increase in rainfall from 32.8 mm in April to 160 mm. High number of flowers in April was followed by higher number of cherelles in May. The data, so far, suggest that climate controls the scheduling of harvesting peaks by affecting the intensity of flowering and sustenance of fruit development.

THEOBROMA CACAO; PLANT PRODUCTION; FLOWERING; HARVESTING; GROWTH; PRODUCTION LOCATION; CLIMATE; PHENOLOGY

F63 Plant physiology - Reproduction

Berry morphometrics and simple regression analysis for prediction of harvesting schedule in four coffee (coffea spp.) species. **Marajan, M.H., Salazar, B.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 146-147. (Sept 2019).

A study was conducted in Los Baños, Laguna [Philippines] from August to November 2019 to describe berry morphometrics (berry color, shape, size, and weight) of Robusta, Arabica, Excelsa, and Liberica coffee species at different BBCH phenological stages, and to use these information for the development of simple species-specific prediction model for berry harvest schedule. The bean shape, size and percent dry matter of Liberica coffee were also characterized at different phenophases. During berry development, coffee fruits changed in color from green to deep red, bright red, or peach red depending on species. On the other hand, berry sphericity changed from ovoid to round depending on species, while bean shape changed from prolate to ovoid upon ripening. Berry growth in terms of frontal surface area assumed a sigmoid curve following this trend: Liberica Excelsa Arabica Robusta. Increase in berry weight followed the same trend, although a double sigmoid was recorded. In Liberica coffee, both bean weight and size increased in a double sigmoid pattern. Using simple regression analysis, a cubic equation derived from fresh berry weight and berry thermal unit requirements at different phenophases was developed and presented for each species to estimate the remaining days needed to reach the red-ripe harvest-ready stage.

COFFEA; SPECIES; FRUIT; HARVESTING; TIMING; FORECASTING

F70 Plant taxonomy and geography

Hopea loherniana Gutierrez and Foxworthy, a new Philippine dipterocarp species. **Gutierrez, H.G., Foxworthy, F.W.** *Asia Life Sciences (Philippines)*. *The Asian International Journal of Life Sciences*. 0117-3375. v. 20(1) p. 1-6. (Jan-Jun 2017).

A new species of the Philippine family Dipterocarpaceae is here described: *Hopea loheriana* Gutierrez and Foxworthy.

HOPEA; SPECIES; TIMBER TREES; BIOSYSTEMATICS; PHILIPPINES

Re-evaluation of the identity of Shorea polita vidal. **Gutierrez, H.G.** *Asia Life Sciences (Philippines)*. 0117-3375. v. 20(1) p. 15-19. (Jan-Jun 2017).

The identity of the species, Shorea polita Vidal, described in 1887, in which Vidal stated that the flower has not been seen, is hereby discussed.

SHOREA; SPECIES; BIOSYSTEMATICS; FRUITS; LEAVES; FLOWERS; IDENTIFICATION

Shorea Kathleeniana Gutierrez, another new Philippine dipterocarp. **Gutierrez, H.G.** *Asia Life Sciences (Philippines). The Asian International Journal of Life Sciences*. 0117-3375. v. 26(1) p. 7-14. (Jan-Jun 2017).

A new species, Shorea kathleeniana Gutierrez, of the Philippine Family Dipterocarpaceae, is hereby described.

SHOREA; SPECIES; TIMBER TREES; LEAVES; FLOWERS; PLANT ANATOMY; BIOSYSTEMATICS; PHILIPPINES

Validation of the 'estam. pasan de treinta' of Hopea plagata (Blanco) Vidal. **Gutierrez, H.G.** *Asia Life Sciences (Philippines). The Asian International Journal of Life Sciences*. 0117-3375. v. 26(1) p. 21-27. (Jan-Jun 2017).

The preconceived determinations by Merrill and Foxworthy of Hopea plagata (Blanco) Vidal having only 15 stamens is hereby elucidated with collections of two specimens made by D.P. Miranda, in Mindanao, District of Zamboanga, in 1914 and H.G. Gutierrez, in Luzon, in the Sierra Madre Mountains, Isabela, San Mariano, Disulap, April-May, 1961; in buds (Merrill 1923), and in flower, respectively. Foxworthy (1938) described a specimen, collected by Loher, with 15 stamens ('Blanco says 30') and tomentose ovary, and designated it to represent Blanco's species. While Merrill says, Blanco's 'is just a figment of the old man's imagination.' The more than 30 stamens of Blanco is right! The predeterminations of Merrill and Foxworthy, as having only 15 stamens, are absurd! A neotype of Hopea plagata (Blanco) Vidal is herewith designated which is H.G. Gutierrez 61-224 (PNH78186!), Philippines, Luzon, Isabela Province, San Mariano, Bo. Disulap, Sierra Madre mountains, April-May 1961, in flower.

HOPEA; SPECIES; BIOSYSTEMATICS; FLOWERS; LEAVES; FRUITS; PHILIPPINES

H. PLANT PROTECTION

H10 Pests of plants

Banana flower thrips pest of Cavendish banana in Panabo, Davao Del Norte [Philippines]. **Jumamoy, M.C., Reyes, C.P., Corcolo, B.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 40. (Sept 2019).

Authors report the infestation and control practices of banana flower thrips, Thrips hawaiiensis (Morgan) on Cavendish banana (Musa acuminate spp.), a table type cultivar that is commercially grown for export, in TADECO's plantation in Panabo, Davao del Norte [Philippines]. These small, piercing-sucking insects feed on

leaves, flowers and fruits and their feeding and oviposition injury on banana appear as dark brown to black scar on the surface of the flower buds and young fruits which significantly affect quality and marketability of fresh produce. Adults and larvae are usually found under banana bracts or inside the flowers. *T. hawaiiensis* are polymorphic and believed to be parthenogenetic. Adults of *T. hawaiiensis* are distinctly colored orange and dark brown. In the plantation, *T. hawaiiensis* are managed by peeping bud bagging, removal of the male flower or 'bell' where adult thrips move after all hands are exposed, and by the use of insecticides for bud spraying, bud injection, bunch spraying and butt spraying. Since many studies conducted elsewhere showed that the use of chemicals to control insect pests in fruit crops result in residue, resistance and resurgence, and phytotoxicity problems, the need to look for alternatives to synthetic toxicant insecticides for banana flower thrips such as the manipulation of adult thrips behavior by using semichemicals is urgent. *T. hawaiiensis* are also pest of pomelo and mango in Ato Belen's Farm in San Pablo, Laguna (Bagaoisan, Kho, Macawadib and Reyes, 2019). In addition, *T. hawaiiensis* is morphologically similar to *Thrips florium* Schumtz (Reyes, 1994) and published information relating to the distribution, host range and biology of these two species of flower thrips may be confounded. Thus, cytochrome c oxidase submit 1 (CO1) analysis to confirm the identify of banana flower thrips is recommended.

MUSA (BANANAS); VARIETIES; FLOWERS; THRIPS (GENUS); INFESTATION; PEST CONTROL; PHILIPPINES

Community structure of herbivores in peanut and corn intercropping system. **Lauron, Ma.R.B., Ibisate, M.T., Guarino, E.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 82. (Sept 2019).

The abundance and diversity of herbivores in peanut and corn intercropping system applied with varying levels (0, 20, 40 and 60 kg/20 sq m) of vermicopost (VC) were studied. The community structure of herbivores was analyzed using Shannon-Weiner Index (SWI). Results revealed that five functional groups of arthropods were identified such as predators, pollinators, parasitoids, decomposers and herbivores. These arthropods were collected during maturity stage. It was observed that grasshoppers and crickets (orthoptera) were dominated in plants applied with 60 kg VC kg/20 sq m. Also, collembola (springtail) was collected in plots treated with 20-60 VC kg/20 sq m indicating that mixture of substrates like VC added into the soil serves as food for the collembola. Although, the SWI ranged from 1.16 (20 kg VC/20 sq m) to 0.31 (60 kg VC20 sq m) the natural enemies (neuroptera) increases. The fresh marketable seed yield (3.71 kg/20 sq m) was significantly higher than the control (2.48 kg/20 sq m).

ARACHIS HYPOGAEA; ZEA MAYS; INTERCROPPING; HERBIVORES; PLANT ANIMAL RELATIONS; POPULATION STRUCTURE; OLIGOCHAETA; COMPOSTING; COMPOSTS

Describing the rice pest situation in Western Visayas [Philippines] through Philippine Rice Information System (PRISM). **Bello, G.E., Caro, R.H., Tayson, C.E., De Dios, J.L., Quilang, E.J.P., Mondejar, C.L.C., Seville, C.U.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 84. (Sept 2019).

Western Visayas ranked 3rd as the highest rice producing region in the Philippines. Despite of its high total production, the region only produced an average yield of 3.58 tons/ha. Low yield was the result of many yield-reducing factors including pest. Pest problems become visible only when there are outbreaks, and its significance in causing low yield was usually unnoticed. In order to help farmers better, extension services should answer their existing problems. Thus, PRISM project was developed to provide timely, reliable and location-specific rice information including pest situation to help the Department of Agriculture in delivering appropriate services for the farmers. Standard procedure and smartphone-based survey forms were used to document pest incidence and farmer's pest management. Data in Western Visayas during 2015 1st semester to 2018 2nd semester was described. Predominant insect pest injuries observed were whorl maggot, leaffolder, rice bug, stemborer and other defoliators. Among these insect pests, rice bug had the highest incidence recorded with 23.6% at Dingle and Passi City. Diseases observed include leaf blast, brown spot, bacterial leaf blight and narrow brown spot for leaf diseases, and neck blast, dirty panicle, sheath blight and sheath rot for tiller and panicle diseases. Brown spot with 37% incidence was the only disease attained the economic threshold level, with high occurrence observed in Passi City. Weed cover observed was below 10% with *Fimbristylis miliacea*, *Oryza sativa* and *Ludwigia* sp. as the top three dominant weed species. Generally, pest management data showed an appropriate type of pesticide applications to effectively control the pests. Thus, there is a need for farmers' trainings on proper pest control including Integrated Pest Management (IPM) as specific intervention or extension services to increase rice yield in the region.

ORYZA SATIVA; PEST INSECTS; PLANT DISEASES; PEST CONTROL; PESTICIDES; GEOGRAPHICAL INFORMATION SYSTEMS; PHILIPPINES

Finding natural resistance from native white corn accessions against Asian corn borer (ACB). **Marfori, Y.C., Laude, T.P., Lit, M.C., Caoili, B.L., Reyes, M.E.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 42-43. (Sept 2019).

One hundred nineteen native white corn accessions from different regions in the Philippines were evaluated for corn borer resistance. The study was conducted in the Institute of Plant Breeding and laid out in a Randomized Complete Block Design (RCBD) with four check varieties (IPB Var. 6, and 13; Bt hybrid and CGUARDN84 Malagkit Salt) in three replications. Preliminary quantitative detection of Cry1Ab toxin was done. Laboratory bioassays such as leaf assay (LA) and stalk feeding assay (SFA) were conducted to assess the efficacy of corn against the Asian corn borer. Plant resistance indices such as larval mortality and stalk damage at 27 DAP and 46 DAP were observed, respectively, results showed that among the native corn accessions evaluated, 41 accessions were susceptible, 76 were intermediate and only 2 native white corn were resistant. Mean larval mortality ranged from 3%-100% and mean tunnel length ranged from 3-34cm. It also revealed that Bt hybrid along with the native check (CGUARDN84) and the two native white corn accessions were resistant with highest larval mortality (100%) at 5 days after infestation. Native corn accessions with comparably high larval mortality need further evaluation on biochemical and molecular attributes for their underlying sources of natural resistance. There is also a need to utilize and improve the available native corn population for possible breeding material for Asian corn borer resistance.

ZEA MAYS; MAIZE; VARIETIES; INDIGENOUS ORGANISMS; PEST RESISTANCE; OSTRINIA FURNACALIS; BIOASSAYS

Physico-chemical changes during storage of onion (*Allium cepa* L. var. Superex) bulbs subjected to various preharvest control strategies against armyworm (*Spodoptera exigua* (Hubner) (Nectiidae : Lepidoptera).

Gonzales, D.C.H., Esguerra, E.B., Nate, K.J.R., Dumlao, C.A.P., Cayabyab, B., Alforja, L.M. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 51. (Sept 2019).

The heavy infestation of armyworm in major production areas in Nueva Ecija [Philippines] in 2016 resulted in crop failure despite the heavy of synthetic pesticides. This led to a collaborative integrated pest management program against onion armyworm, one strategy of which is the use of biopesticides (neem oil) and biological control agents (NPV, *B. thuringensis*, *M. anisopliae*). Onions treated with synthetic insecticides were included for comparison. Experiment was laid out in CRD and bulbs were harvested on March 2018 in Bongabon, Nueva Ecija. The postharvest component of the program was aimed at determining the physico-chemical changes during storage of onion bulbs subjected to various preharvest control strategies. Onion bulbs variety Superex (yellow type) were harvested at commercial maturity, cured for one week under ambient condition then stored for 6 mo at 4.6±0.6 deg C and 91.7% RH. Mean pungency of bulbs increased to a range of 3.17 to 3.99 $\mu\text{mole pyruvic acid/g}$ on the 3rd and 4th month of storage, respectively, from 1.67 $\mu\text{mole pyruvic acid/g}$ at harvest. Extending the storage period to 6 months resulted in decreased pungency. Total soluble solids did not vary significantly among treatments and exhibited a slight decrease during storage. In all treatments, sprouting occurred on the 5th month but was evident only when bulbs were cut. External manifestation of sprouting occurred on the 6th month. When bulbs were withdrawn from cold storage on the 4th month and transferred of ambient condition, it took about 2 months for bulbs Preharvest treated with biopesticides and biological control agents to sprout while only about a month for synthetic pesticide. Longer storage period (5 and 6 mo) followed by ambient holding resulted in bulb sprouting in less than 2 weeks in all treatments. Bulb decay was not observed during storage except for onions with preharvest synthetic insecticide spray.

ALLIUM CEPA; VARIETIES; ONIONS; STORAGE; CHEMICOPHYSICAL PROPERTIES; INTEGRATED PEST MANAGEMENT; MICROBIAL PESTICIDES

Pilot testing and technology transfer of improved IPM and INM strategies of mungbean in Region 2 [Cagayan Valley, Philippines].

Aquino, R.M.G., Calderon, V.J.F., Aquino, R.Y., Atalin, V.U., Manaligod, K., Batang, E.F., Jr., Bagunu, J., Francisco, C.O. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 41. (Sept 2019).

This study aims to promote and demonstrate the improved IPM and INM strategies in mungbean for farmers' adoption. Five different treatment (T1 - Farmer's practice or no application; T2 - Carrageenan PGP; T3 - Boron Fertilizer; T4 - Vermi-tea and T5 - Metarhizium) were tested in major mungbean growing areas of Region 2 [Cagayan Valley, Philippines] (rice-based and con-based condition). Results of the trails revealed that the application of Oligo-Carageenan PGP economically increased yield by 546.9 kg/ha or 50.7% under com-based areas and 500 kg/ha or 74% under rice-based areas with additional profit or net income of Php36,145.00 and Php24,065.00, respectively. Based on the observations, UPL Mg 7 (Pagasa 7) variety applied with Carrageenan PGP were found to have more branches; minimal or absence of

Cercospora leaf spot; more flowers that developed into pods; larger and heavier seeds; extended flowering and fruiting prolonging harvest time; number of priming increased from 3 to 6; and has extensive/better root system. On the other hand, spraying of Boron Fertilizer is capable of increasing yield by 333 kg/ha or 30.9% in corn-based and 237.3 kg ha⁻¹ or 35% in rice-based areas with additional net income ranging from PhP 10,315 - PhP14,665.00. Further, application of Vermi-tea is effective in increasing yield of 100-300 kg ha⁻¹ with additional net income or profit of PhP5,000 - PhP13,000.00. All tested foliar fertilizers are generally effective in improving the yield of UPL Mg 7 (Pagasa 7) when applied three times (at 14-15 days interval after 14 DAE).

VIGNA RADIATA RADIATA; MUNG BEANS; FERTILIZER APPLICATION; CROP YIELD; YIELD INCREASES; INTEGRATED PEST MANAGEMENT; NUTRIENT UPTAKE; TECHNOLOGY; TECHNOLOGY TRANSFER; PHILIPPINES

Population dynamics of rice plant hoppers, Nilaparvata lugens (Stal) and Sogatella furcifera (Horvath) in recent years. **Encarnacion, C.C.B., Rillon, G.S., Kwak, H.R.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 103. (Sept 2019).

The rice brown planthopper, Nilaparvata lugens, and whitebacked planthopper, Sogatella furcifera have been reported as potential constraints in rice production in the Philippines. Hence, information was gathered on the population dynamics of these species from 2014 to 2018. Results showed that there was more brown planthopper in 2015 and 2016 as compared in 2014. Initial planthopper population was usually observed during the reproductive stage and continuously increased as the crop matured. The contributing factors favoring the development of planthopper populations could be due to the higher use of inputs such as insecticide and fertilizer, change in usage of variety and increasing intensity of cropping. In the case of whitebacked planthopper, the population was consistently lower as compared to BPH. In 2017, data showed that the planthopper population declined. Moreover, in January to June 2018, relatively low population of planthopper populations was recorded as compared during the previous years of monitoring.

ORYZA SATIVA; SOGATELLA FURCIFERA; NILAPARVATA LUGENS; POPULATION DYNAMICS; MONITORING

Promotion of sustainable integrated pest management practices for an increased production. **Wigan, M.B.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 39-40. (Sept 2019).

A total of ninety-three rice farmers within the three selected barangays [villages] (Gundaway, Sto. Tomas and San Ramon) of Quirino province [Philippines] were trained during the implementation of Farmers' Field School (FFS) Season-long Training on Integrated Pest Management (IPM) for Pigmented Rice. This training was conducted to enhance farmers' knowledge and skills towards sustainable rice farming through community IPM. The IPM method envisions protecting the environment; reducing cost of production; and increasing farmers' net profit, thus uplifting farmers' economic status. On-site learning was followed involving participants in the field activities, data gathering, observations and interpretation of results. Two varieties of pigmented rice (Red rice and Black rice) were established as field trails following the PalayCheck system and IPM. Farmers' variety served as control variable. The experiment was laid out

following RCBD while means were compared using LSD to assess which growth and yield parameter differences between varieties are significant. The growth and yield of these pigmented rice varieties were initially assessed based on the number of days to mature after transplanting, number of tillers, length of panicle (cm), number of grains per panicle and yield (tons/ha). The results of field trails were compared with existing farmers' practice. Across all sites, Red rice was the earliest to mature at 79 DAT, produced the highest number of tillers (18/hill); longest panicles (21.17 cm); and the most number of seeds per panicle (113 grains/panicle). Farmers' variety produced the highest yield among the varieties tested (6.321.60 kg/ha) but insignificantly different to the yield of Red rice (6,282.50 kg/ha). It was observed that adopting IPM could reduce the cost of production by 12.06% compared to farmers' conventional rice farming. The data gathered and other observations can serve as baseline reference for farmers and future researches in promoting effective pest control strategies for pigmented rice in Quirino.

ORYZA SATIVA; RICE; VARIETIES; PEST CONTROL; INTEGRATED PEST MANAGEMENT; DIFFUSION OF INFORMATION; FARMERS

Smarter Pest Identification Technology (SPIDTECH) : digital identification of insect pest and crop disease using convolutional neural networks. **Ebuenga, M.D., Guiam, A.C., Gamba, K.E., de Panis, W.N.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 60-61. (Sept 2019).

Correct insect pest and crop disease identification plays a vital role in crop protection and management as it serves as a factor in determining suitable pest and disease control methods and management practices in farms. This study focuses on building an Android application named Smarter Pest Identification Technology (SPIDTECH) that aims to guide its users through digital identification of insect pest and disease of rice, corn, coffee, cacao, banana, sugarcane, coconut, soybean, and tomato in the Philippines. The system uses Inception-v3, a pre-trained image recognition model, comprised of a feature-extraction layer with convolutional neural network and a classification layer with a fully connected and softmax layer. The model was pre-trained from ImageNet dataset and can classify 1000 object categories. The model was retained, in a process called transfer learning, with insect pest and disease dataset comprised of no less than 500 images of each pest and disease of each crop captured from different sites in the Philippines. The transfer learning process utilizes the feature extraction capability of the pre-trained model to classify input images using new dataset. This study uses a total of 18 models: two models for each of the nine focus crops, one for the pest and one for the disease identification. The model accepts image input and outputs a ranked classification based on accuracy. The model extracts general features from the input image and classifies them based on those features. Along with the identification results, the application also includes a library data comprised of relevant information about each pest and disease such as identification signs, life cycle, and management practice to help its users in correctly managing the pest and disease. Moreover, the application logs data from its users such as GPS location, top results, and image data for tracking and remote monitoring of pest and disease occurrence.

INFORMATION TECHNOLOGY; DIFFUSION OF INFORMATION; PLANT PROTECTION; CROP MANAGEMENT; PEST INSECTS; PLANT DISEASES; MODELS

Thrips and fungal pathogens associated with garlic in MMSU [Mariano Marcos State Univ.]-Batac, Ilocos Norte [Philippines]. **Reyes, C.P., Mintu, C.B., Dalisay, T.U.** 25. Federation of Crop Science Societies of the

Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 39. (Sept 2019).

Thrips known as 'kulisipsip' are small insects that feed on leaves, flowers and fruits of plants by using their piercing and sucking mouthparts. Their feeding and oviposition injury allow bacteria, fungi, and viral pathogens to enter the plant tissues. The study aimed to determine the species of thrips infesting garlic "Ilocos white" and fungal pathogens they harbor in the Experimental Area of Mariano Marcos State University. The study was conducted from January to May 2019. Samples were collected randomly in about 200m plot when plants were at the late vegetative stage by shaking and beating plants on the white board. Specimens were sorted, cleared, mounted on glass slides and identified using light microscope. Findings showed that Thrips tabaci Lindeman, a terebrantian known as vector of onion Iris yellow spot virus, tomato spotted wilt virus, tomato yellow fruit ring virus, and garlic common latent virus in other countries, and Haplothrips gowdeyi Franklin, a known flower dwelling tubuliferan, were infesting garlic plants. Females and larvae of T. tabaci were present in almost all plant samples but no male was found. This implies that T. tabaci is a major pest of garlic and the population was reproducing parthenogenetically. H. gowdeyi were found in low population probably due to absence of flowers. Moreover, the culture and isolation of fungi from selected T. tabaci harbored Fusarium spp., Curvularia spp. and Trichoderma sp. Findings showed that garlic plants in the study area were probably infected with Fusarium garlic bulb rot and Curvularia leaf spots. Trichoderma sp. is probably non-pathogenic. In the light of these findings, monitoring and identification of thrips and fungal pathogens using molecular techniques in garlic farms are recommended.

ALLIUM SATIVUM; THRIPS (GENUS); INFESTATION; PATHOGENS; CURVULARIA; FUSARIUM; TRICHODERMA; PHILIPPINES; ISOLATION TECHNIQUES; DISEASE CONTROL

H2O Plant diseases

Association analysis of developed sample sequence repeat (SSR) markers to fungal disease resistance.

Relles, J.M.G., Discaya, D.F.I., Manay-ay, M.Z., Armones, R.T. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 146. (Sept 2019).

Seven SSR primers were developed from Phil 93-1601, a cultivar resistant to both sugarcane smut and downy mildew. The putative identities of the sequences were all related to fungal disease resistance Preliminary analyses using seven SSR primers on 52 accessions revealed three alleles associated to sugarcane smut disease (P 0.035). Alleles 75PstI 7 and 125PstI 6 have association to sugarcane smut resistance, and 126PstI 1 to susceptibility. However, none of the primers gave promising results for molecular diagnosis of downy mildew. This study needs to be completed with more markers and more accessions to validate these preliminary results.

SACCHARUM OFFICINARUM; SUGARCANE; GENETIC MARKERS; SMUTS; MILDEWS; DISEASE RESISTANCE

Bio-efficacy of Leeanicullium lecanii local isolate against coffee rust (Hemileia vastatrix). **Tad-awan, B.S., Balanban, O.D., Basalong, A.A.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City

(Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 37. (Sept 2019).

Leaf rust due by *Hemileia vastatrix* is the most severe coffee disease resulting in premature flower and fruit fail. Efforts to manage the pathogen, an obligate parasite, usually involves use of systemic fungicides but putting premium on coffee as organic gourmet crop, the use of biological control agents would be more appropriate. A local isolate of *Lecanicillium lecanii*, previously observed parasitizing uredospores of *Hemileia vastatrix*, was tested for efficacy. Various spore concentrations of *L. lecanii* were inoculated one day before, simultaneously and one day after inoculating *Hemileia vastatrix* on detached coffee leaves. The number of lesions and percent infected leaf area were assessed after 21 days of incubation at 23 \pm 3 deg C. The spore size of the isolate of *L. lecanii* ranged from 1.88 to 3.75 μ m and was thus classified as group one strain. Application of conidia of *L. lecanii* reduced the number of rust lesions and infected leaf area. Increasing application starting from 1,400,000 conidia/ml totally controlled rust. Application of *L. lecanii* suspensions 24 hr before introducing *Hemileia vastatrix* uredospore suspension markedly reduced rust lesions and infected leaf area. *L. lecanii* totally prevented rust lesions when introduced starting at 1,400,000 conidia ml/1 24 hr before uredospores of *Hemileia vastatrix* was introduced. Field tests need to be conducted to verify efficacy and effectiveness of the fungus against coffee rust. DNA barcoding of the local isolate of *L. lecanii* need to be performed to establish its identify as an indigenous biological control agent against coffee rust in the Philippines.

COFFEA; LEAVES; RUSTS; HEMILEIA VASTATRIX; PATHOGENS; PARASITES; BIOLOGICAL CONTROL

Characterization, phylogenetic analysis and pathogenicity of *Pectobacterium chrysanthemi* pv. *zeae* isolates, the causal organism of maize bacterial stalk rot in the Philippines. **Pinili, M.S., Garcia, M.O., Tumolva, J.A.B.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 81. (Sept 2019).

Bacterial stalk rot (BSR) caused by *Pectobacterium chrysanthemi* pv *zeae* (syn. *Erwinia chrysanthemi* pv. *Zeae* (Sabet) Victoria et al.) is one of the most destructive and major diseases in many corn-growing areas in the country. The disease is favoured by high temperature and relative humidity and prevalent in area where heavy rainfall is frequently experienced. High incidence of BSR is also observed where overhead irrigation is being practiced and mostly if water source is from pond, river or slow-moving streams. In this study, comparative analysis on morpho-cultural characteristics, 16S gene sequence and phylogeny of BSR isolates from Ifugao, Isabela, and Laguna were conducted. Pathogenicity of BSR Philippine isolates were also tested on native corn varieties including the susceptible check. Corn plants showing the typical stalk rot symptom were collected, isolated, and characterized using selective media Yeast peptone sucrose agar (YPS) and Tetrazolium agar (TZCA). Isolates from different location have the same morphological characteristics of thick viscous while to yellowish colony on YPS then white with pink to reddish center of TZCA. Bacterial DNAs were extracted and amplified using 16S internal primers and sequenced for phylogenetic analysis. Isolates also expressed virulent reaction on susceptible varieties under field condition.

ZEA MAYS; ROTS; BACTERIA; PHYLOGENY; PATHOGENICITY; DNA; NUCLEOTIDE SEQUENCE; PHILIPPINES

Genetic characterization of bacterial leaf blight causal agent: *Xanthomonas oryzae* pv. *oryzae* isolates from selected rice growing areas in the Philippines. **Manangkil, J.M., Enriquez, J.O.S., Caquiat, J.P., Waing, F.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 127-128. (Sept 2019).

Xanthomonas oryzae pv. *Oryzae* (Xoo) is one of the major bacterial diseases of rice across Asia. Host resistance has been the most effective approach to control disease. Knowledge on existing population of pathogen and determining its diversity is vital for suitable cultivar deployment. This study aimed to characterize the genetic and pathotypic diversity of Xoo collected in selected rice growing areas in the Philippines. A total of 220 field isolates were collected in selected areas from 2017DS to 2018WS. These isolates were identified using Xoo specific diagnostic markers. Single Nucleotide Polymorphism (SNP) genotyping using IRRI SNP panel was done to determine the population identity for each isolates. PCR amplification using primers to amplify 16s-23s rDNA spacer region, *tnpA* gene and Phage related gene were used for DNA sequence analysis to determine its phylogenetic relationship. Furthermore, representative field isolates from each collection sites were used in virulence assay using Near-Isogenic Lines (NILs) to determine their pathotype grouping. Based on SNP genotyping all field collected isolates have 100% genotypic similarity to Xoo strains from South and Southeast Asia. Phylogenetic relationship of field collected Xoo isolates from 2017DS-2018WS showed low nucleotide diversity. Based on DNA sequences computed Tajima's D value were not significant (-10.5833 P0.10). DNA sequencing analysis for 2018 collections is currently on-going to determine its phylogenetic diversity. The effectiveness of differential lines carrying R-genes *Xa5* and *Xa7* against the field isolates is useful for suitable resistant cultivar deployment and cultivar recommendation.

ORYZA SATIVA; LEAVES; GENETIC MARKERS; GENES; NUCLEOTIDE SEQUENCE; BLIGHT; DISEASE RESISTANCE; PHILIPPINES

Gene expression analysis of ATL31 in yellow corn in response to Philippine downy mildew infection. **Shaikh, M.L., Lantican, D.V., Pascual, C.B., Zaporteza, M.M., Manohar, A.N.C., Pammit, F.K.L., Garcia, M.O., Gardoce, R.R., Nuñez, J.P.P., Aglibot, C.C., Galvez, H.F.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 50. (Sept 2019).

Philippine downy mildew (PDM) caused by the obligate oomycete *Peronosclerospora philippinensis* (Weston) Shaw is one of the most destructive pathogens of corn in the Philippines. Through the years of using metalaxyl as seed treatment and foliar spray to mitigate the spread of the disease, metalaxyl-resistant downy mildew strains have evolved leaving host resistance as the most effective and efficient control measure. Previous fine-mapping effort has identified a major QTL region for corn PDM resistance and characterized to have high homology with corn ATL31 E3 ubiquitin ligase. To validate the role of ATL31 in the host resistance mechanism of corn to PDM, differential gene expression (DGE) analysis of ATL31 using qRT-PCR was performed between resistant and susceptible genotypes across two different time points (before and during PDM exposure). Selection of the resistant and susceptible genotypes for DGE was based on host resistance (HR) screening via spreader row technique. Result showed that the resistant genotype has a significant decline in the ATL31 gene expression as compared to that of the susceptible genotype, two weeks after PDM exposure. This is the first report of the rapid and transient expression of

ATL31 and its possible role in basal immunity of yellow corn exhibiting resistance response to PDM, as previously observed in Arabidopsis. Such information on the ATL31 gene expression provides a glimpse on the complex host-pathogen interaction during PDM disease progression in corn. Thus, this study will provide a platform to design DNA marker tags for downstream marker-assisted plant breeding application towards development of outstanding and PDM-resistant corn varieties.

ZEA MAYS; VARIETIES; GENE EXPRESSION; LOCI; MILDEWS; DISEASE RESISTANCE; INFECTION

Potential risk of sugarcane to mycotoxicogenic Fusarium. **De Torres, R.L., Laurel, N.R., Mendoza, J.S., Balendres, M.A.O., Dela Cueva, F.M.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 103. (Sept 2019).

Fumonisin is a mycotoxin that is carcinogenic to both humans and animals and is produced by several species of Fusarium. Due to their stability, they are almost impossible to be degraded during most food processing operations, posing a potential threat to food safety. In this study, we examined the presence of FUM1, the largest gene involved in fomonisin production, in Fusarium spp. isolated from diseased sugarcane. Using primer pair TaqFum2FV/VpGen3R, it was found out that 11 out of the 24 confirmed Fusarium harbor the FUM1 gene. Of these 11, eight are F. proliferatum, two are F. verticillioides and one unknown species. This is the first report of possible mycotoxicogenic Fusarium spp. in diseased sugarcane. Its impact on sugarcane harvesting and processing of cane juice should be addressed.

SACCHARUM OFFICINARUM; SUGARCANE; FUSARIUM; FUMONISINS; RISK; POSTHARVEST TECHNOLOGY

Rapid genomic DNA extraction of sugarcane pathogens. **De Torres, R.L., Evallo, E.S., Taguam, J.D.W., Balendres, M.A.O., Dela Cueva, F.M.** 25. Federation of Crop Science Societies of the Philippines, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 105-106. (Sept 2019).

Advances in the field of molecular biology has called for easier and more accurate methods of pathogen detection. Polymerase Chain Reaction (PCR) has been one of the most popular pathogen detection techniques since its conception in 1983. The technique is one of the most powerful tools in molecular biology, enabling scientists to detect and identify pathogens rapidly and accurately. However, PCR usually requires the DNA of the organism(s), and the available DNA extraction techniques are usually time consuming, laborious, costly, and hazardous. In this study, authors optimized a universal protocol for the rapid DNA extraction of Xanthomonas albilineans (bacteria) and Fusarium spp. (fungi) which were isolated from diseased sugarcane. Similarly, the quality of the extracted DNA using the optimized protocol was compared to the quality of those extracted using the existing DNA extraction techniques. Results of this study suggest that the optimized protocol was able to extract the DNA of both organisms. Although relatively lower quantity, the quality of the extracted DNA using the optimized protocol is comparable to those extracted using the existing techniques. In order to confirm whether the extracted DNA were amplifiable, they were used as templates for PCR reaction. Primer pair PGBL1/PGBL2 was used for the detection of Xanthomonas albilineans, while primer pair EF1/EF2 was used to detect the presence of Fusarium spp. Electrophoresis revealed that the extracted DNA are amplifiable, therefore can be used as templates for PCR. This study describes a rapid DNA extraction technique for bacterial and fungal

pathogens of sugarcane. The optimized protocol is rapid, cost-effective and safer, therefore has a huge impact on further researches on pathogen detection and identification.

SACCHARUM OFFICINARUM; SUGARCANE; PATHOGENS; DNA; EXTRACTION; FUSARIUM; XANTHOMONAS ALBILINEANS

Thrips and fungal pathogens associated with garlic in MMSU [Mariano Marcos State Univ.]-Batac, Ilocos Norte [Philippines]. Reyes, C.P., Mintu, C.B., Dalisay, T.U. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 39. (Sept 2019).

Thrips known as 'kulisipsip' are small insects that feed on leaves, flowers and fruits of plants by using their piercing and sucking mouthparts. Their feeding and oviposition injury allow bacteria, fungi, and viral pathogens to enter the plant tissues. The study aimed to determine the species of thrips infesting garlic "Ilocos white" and fungal pathogens they harbor in the Experimental Area of Mariano Marcos State University. The study was conducted from January to May 2019. Samples were collected randomly in about 200m plot when plants were at the late vegetative stage by shaking and beating plants on the white board. Specimens were sorted, cleared, mounted on glass slides and identified using light microscope. Findings showed that Thrips tabaci Lindeman, a terebrantian known as vector of onion Iris yellow spot virus, tomato spotted wilt virus, tomato yellow fruit ring virus, and garlic common latent virus in other countries, and Haplothrips gowdeyi Franklin, a known flower dwelling tubuliferan, were infesting garlic plants. Females and larvae of T. tabaci were present in almost all plant samples but no male was found. This implies that T. tabaci is a major pest of garlic and the population was reproducing parthenogenetically. H. gowdeyi were found in low population probably due to absence of flowers. Moreover, the culture and isolation of fungi from selected T. tabaci harbored Fusarium spp., Curvularia spp. and Trichoderma sp. Findings showed that garlic plants in the study area were probably infected with Fusarium garlic bulb rot and Curvularia leaf spots. Trichoderma sp. is probably non-pathogenic. In the light of these findings, monitoring and identification of thrips and fungal pathogens using molecular techniques in garlic farms are recommended.

ALLIUM SATIVUM; THRIPS (GENUS); INFESTATION; PATHOGENS; CURVULARIA; FUSARIUM; TRICHODERMA; PHILIPPINES; ISOLATION TECHNIQUES; DISEASE CONTROL

H50 Miscellaneous plant disorders

Improve tolerance of elite mutation derived rice breeding lines to vegetative stage submergence stress under field condition. Buluran, R.D., Conception, J.S., Desamero, N.V. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 132. (Sept 2019).

Addressing the emerging concerns of climate-change aggravated risks of flash-flooding in submergence prone areas, fast-paced development of tolerant varieties Jepun, Y Dam Do, and popular rice variety NSIC Rc 222 to increase yield, improve agronomic traits, improve eating quality and improve abiotic stress tolerance. A total of 34 elite mutation derived breeding lines, and its progenitors Jepun, Y Dam Do, and NSIC Rc222 were developed, and evaluated for tolerance to submergence stress at vegetative stage Lines

were completely submerged under murky irrigation water for 7 days at an average of 83 cm, pH 9.10, 27 deg C water temperature, and 121.19 mV oxidative reduction potential. All the thirteen elite NSIC Rc 222-derived mutant lines showed higher percent plant survival compared to its progenitor (43%) by 7 - 36%. Similarly, all of the five Y Dam Do-derived mutant lines had higher percent survival than its progenitor (8%) by 7% to 43%. However, the lines were phenotyped as susceptible. Of the 16 Jepun-derived mutant lines, five (31%) had higher percent plant survival than its progenitor (63%) by 2 - 16%. Overall, the mutant lines had an average percent plant survival of 53%. Eight mutant lines derived from Japonica and NSIC Rc 222 were phenotyped as moderately tolerant to submergence stress at vegetative stage based on comparative survival with tolerant check FR13A (92% survival). Excellent seedling vigor and growth response was observed in the mutant lines in terms of tiller number and plant height, with significant correlation with increasing plant survival percentage. Identified tolerant lines are potential new sources of tolerance to submergence stress for rice varietal improvement. The lines warrant field performance trial under submergence stress to validate performance of identified tolerant lines.

ORYZA SATIVA; VARIETIES; PROGENY; INDUCED MUTATION; FLOODING; TOLERANCE
WATER TOLERANCE

Performance evaluation of improved NSIC Rc 160 and NSIC Rc 222 rice varieties with introgressed QTL for drought tolerance. **Bagarra, J.C., Waing, F.P., Enriquez, J.O.S., Palanog, A.D., Santiago, J.II.C., Millas, R.A., Galapon, J.V., Caguiat, X.G.I., Tabarao, D.A.A., Caguiat, J.D.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 137-138. (Sept 2019).

Drought can reduce rice production up to 50%. Development of tolerant varieties through introgression of Quantitative Trait Loci (QTL) linked to drought tolerant genes using molecular markers were done in order to mitigate the effect of drought. This study aims to evaluate breeding lines in NSIC Rc 160 and NSIC Rc 222 background with introgressed QTL (qDTY2.2, qDTY2.3, qDTY4.1, and qDTY12.1) for drought tolerance. From 2016 to 2018, eighteen NSIC Rc222 Near Isogenic Lines (NILs) and eighteen NSIC Rc160 NILs previously observed to have tolerance to reproductive drought stress together with Vandana, NSIC Rc 222, IR64 and NSIC Rc 160 as checks were evaluated at PhilRice, CES, Negros and Isabela under favorable and drought stress conditions. Yield of entries under drought stress across location and season ranged from 1.010 (PR47201-A102A-29-72-1) to 2.267 tha⁻¹ (PR47202-A103A-17-122-1) while under irrigated lowland condition grain yield ranged from 1.884 (PR47202-A103A-17-222-1) to 6.858 tha⁻¹ (PR47201-A102A-28-273-1). PR47201-A102A-28-273-1 and PR47201-A102A-29-229-2 were selected five times based on yield under drought stress condition. These entries have yield advantage of 12% and 13% over NSIC Rc 222 and with 14% and 15% over Vandana checks. Using adaptability measure and average effect of genotype, PR47202-A103A-18-106 and PR47202-A103A-17-263 are identified to have wide adaptation. Improvement of high yielding released varieties (NSIC Rc 160 and NSIC Rc 222) in terms of drought tolerance was made possible through introgression of QTL. These lines will be useful to researchers as source of donor genes and consequently to farmers to combat drought stress without yield reduction.

ORYZA SATIVA; VARIETIES; GENES; INTROGRESSION; CROP PERFORMANCE; CROP YIELD; DROUGHT RESISTANCE

Phenotypic variability of wildrice (*Oryza rufipogon* Griff.) under drought stress. **Valleser, J.L., Jamago, J.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 43. (Sept 2019).

Utilization of crop wild relatives is imperative in improving crop tolerance against Abiotic stresses. Phenotypic variability of *O. rufipogon* clones from Lakes Apo and Napalit, Bukidnon [Philippines] were assessed under different timing of drought stress imposition. This study was arranged in a 2X4 factorial experiment in RBCD with three replications. Only leaf area was influenced by the interaction of clones and timing of stress imposition after stress termination. Both clones subjected to drought stress at 6 weeks after transplanting (WAT) had comparable means with the well watered seedlings. Whereas, younger seedlings (2WAT) of both clones had smaller leaves. Nonetheless, Lake Napalit clone (LNC) had recovered its leaf size faster than Lake Apo clone (LAC) after a week of recovery period. Regardless of drought stress imposition, LNC had higher shoot elongation and larger leaves than LAC. Further, variable responses of *O. rufipogon* clones under different timing of drought stress were notable. Drought impedes root and shoot growth at 2WAT but not at 4WAT and 6WAT. Tiller production was hindered at 2WAT and 4WAT of drought stress imposition but not a 6WAT. However, more dead tillers were recorded on seedlings stressed at 6WAT. Leaves of seedlings subjected to drought were fully rolled reducing transpiration rate to conserve water. Lastly, leaf area was strongly associated with tiller number ($r=0.70$) and leaf rolling ($r=0.87$) under drought stress.

ORYZA RUFIPOGON; PHENOTYPES; CLONES; DROUGHT STRESS; TIMING; LEAF AREA

Response of primed rice (*Oryza sativa* L.) seeds to different salt concentrations. **Malayang, J.N., Mercado, M.F.O., De Guzman, L.E.P., Fernandez, P.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 52-53. (Sept 2019).

Salinity is one of the many factors that significantly influences crop production. It is an abiotic stress which negatively affects the growth and development of rice during the seedling stage. One technique that can improve crop adaptation to the adverse effects of salinity is seed priming. An experiment was conducted in the Seed Science and Technology Laboratory, ICrops-CAFS, UPLB [College of Agriculture and Food Sciences, University of the Philippines Los Baños, Laguna, Philippines] to determine the response of primed rice seeds to varying salt concentrations (0, 100, 200 mM NaCl). Treatments included hydro-priming (water), hormonal-priming (50ppm GA), halo-priming (1% KCl), osmo-priming (1% KNO₃), and control. Rice variety used was NSIC Rc222 (Tubigan 18). Results showed that salt stress significantly decreased the viability and vigor of rice seeds, with decreasing trend as the level of salt concentration increases. However, viability and vigor were significantly influenced by seed priming. Higher germination values were observed in primed rice seeds, with increment higher in hydro-and halo-primed rice seeds at 200 mM salt concentration. Seed vigor indices were observed to be higher in hormonal-primed rice seeds across salt concentrations. Seedling length and seedling dry weight decreased with an increase in salt concentration, but primed seeds were found to be less affected by salt stress. These results suggest that rice seeds subjected to different priming methods are better able to withstand salt stress, thus the better performance. Furthermore, among all priming methods and across all salt concentrations, hormonal-priming brought about better performance of rice seedlings.

ORYZA SATIVA; RICE; SEEDS; SALTS; SALINITY CONTROL; PREGERMINATION; ADAPTATION; VIABILITY; SEED CHARACTERISTICS; SEED; VIGOUR

Validation of dehydration avoidance root plasticity traits of selected germplasm collection under soil moisture deficit. **Castelo, R.G.M., Suralta, R.R., Untalan, J.R., Kalaw, S.P.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 142. (Sept 2019).

Percentage of drought affected rice areas has approximately doubled from the past years and thus, further reduced the potential rice production. Under such condition, roots play an important role in maintaining plant productivity through the maintenance of higher soil water uptake from the drying soils to support higher transpiration and photosynthesis and consequently, above ground dry matter production. One of the methods for rapid screening of drought resistance is using Line Source sprinkler system (LSS). Using the LSS, germplasm collections were identified as drought resistant (based on the ability to maintain dry matter production) in response to different intensities of drought. The drought resistance of these selected germplasm, however, need to be further studied to validate the contribution of dehydration avoidance root traits to drought resistance and a selected germplasm with validated dehydration avoidance root traits can be recommended for use as a parent for breeding high yielding varieties adapted to drought prone environments. Seven selected rice germplasms from the LSS system were grown under two water treatments such as CWL (continuously waterlogged for 39 days) and PDR (progressive drought, first waterlogged for 14 days and subsequently subjected to progressive soil drying conditions at 10% SMC until 39 days after sowing). Arranged in split plot design (treatments as main plot and genotypes as subplots) with three replications. Statistical analysis showed that there was significant interaction between genotype and water treatments on shoot dry matter production. The shoot dry matter production was significantly reduced by PDR regardless of genotypes. Correlation analyses showed that water use was positively and significantly contributed the higher maintenance of shoot dry matter production during PDR. Among the selected rice germplasms, Belibod showed the ability for greater tolerance to drought based on its less reduction of its shoot drought during progressive soil drying conditions.

ORYZA SATIVA; GERMPLASM; GERMPLASM COLLECTIONS; TESTING; ROOTS; DROUGHT STRESS

H60 Weeds and weed control

Can purple nutsedge (*Cyperus rotundus* L.) reduce the yield of transplanted rice under flooded condition? **Jimenez, J.J.L., Donayre, D.K.M., Latonio, A.M.L.S., Martir, E.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 79. (Sept 2019).

Purple nutsedge has been reported to reduce yield of many major crops from 6 to 100% by way of competition on nutrients, water, and sunlight. Under upland condition, full competition of the weed reduced the yield of upland rice up to 42%. Its effect on yield of rice under irrigated-lowland condition, however, is still unknown. A screenhouse experiment was conducted at PhilRice CES from Feb to May 2019 to a) determine the effect of purple nutsedge on growth and development of transplanted rice at different

tuber densities, and b) quantify losses on grain yield due to interference of the weed under flooded condition. Eight 21-day old seedlings of NSIC Rc222 were transplanted in plastic boxes (0.54 x 42 cm LW) and allowed to grow with purple nutsedge at 0, 5, 10, 15, and 20 tuber densities. Each box with rice and purple nutsedge was replicated 5 times and arranged in RCBD. Height, no. of leaves and tillers, yield components, and yield rice were gathered. Data were subjected to ANOVA while treatment means were compared through Fisher's LSD at .05 level of significance. Statistical analysis revealed that number of leaves and tillers hill, shoot dry weight, and number of panicles m⁻² of transplanted rice were significantly affected by purple nutsedge particularly when the weed was allowed to compete at initial tuber densities of 10, 15, and 20. Height plant, root dry weight, number of spikelets, percent spikelets, weight of 1000 grains, and grain yield (kg ha⁻¹) were not significantly affected. Despite the insignificant differences, grain yield losses of 2.34, 16.1, 17.3 and 26.7% were still observed due to interference of purple nutsedge at 5, 10, 15, and 20 tuber densities, respectively. The results suggest that purple nutsedge is capable of reducing grain yield of transplanted rice under flooded condition.

ORYZA SATIVA; VARIETIES; TRANSPLANTING; CROP YIELD; CYPERUS ROTUNDUS; FLOODED LAND

J. POSTHARVEST TECHNOLOGY

J11 Handling, transport, storage and protection of plant products

Berry morphometrics and simple regression analysis for prediction of harvesting schedule in four coffee (coffea spp.) species. **Marajan, M.H., Salazar, B.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 146-147. (Sept 2019).

A study was conducted in Los Baños, Laguna [Philippines] from August to November 2019 to describe berry morphometrics (berry color, shape, size, and weight) of Robusta, Arabica, Excelsa, and Liberica coffee species at different BBCH phenological stages, and to use these information for the development of simple species-specific prediction model for berry harvest schedule. The bean shape, size and percent dry matter of Liberica coffee were also characterized at different phenophases. During berry development, coffee fruits changed in color from green to deep red, bright red, or peach red depending on species. On the other hand, berry sphericity changed from ovoid to round depending on species, while bean shape changed from prolate to ovoid upon ripening. Berry growth in terms of frontal surface area assumed a sigmoid curve following this trend: Liberica Excelsa Arabica Robusta. Increase in berry weight followed the same trend, although a double sigmoid was recorded. In Liberica coffee, both bean weight and size increased in a double sigmoid pattern. Using simple regression analysis, a cubic equation derived from fresh berry weight and berry thermal unit requirements at different phenophases was developed and presented for each species to estimate the remaining days needed to reach the red-ripe harvest-ready stage.

COFFEA; SPECIES; FRUIT; HARVESTING; TIMING; FORECASTING

Effect of drying method on physicochemical and functional properties of flour from unpeeled and unripe cavendish banana. **Macaraig, P.B.A., Mendoza, M.B., Alviola, J.N.A., Digal, L.N.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 52. (Sept 2019).

Cavendish banana is extensively grown in the Philippines primarily for export. Tons of bananas, however, do not meet the standard and are considered off-grade or 'rejects'. This study processed flour from off-grade, unpeeled, unripe Cavendish bananas to make use of this produce that otherwise is considered waste. This was conducted at the food science and chemistry laboratories of UP [University of the Philippines] Mindanao, Davao City from November 2018 to April 2019. Specifically, the effect of varying drying methods (oven drying at 50 deg C, 65 deg C, 80 deg C, and freeze-drying) on flour properties were determined. Freeze drying produced significantly lighter colored flour with the least redness, highest water absorption capacity (173.55%), oil absorption capacity (86.05%), and lowest solubility (6.73%) as compared to the three oven-dried flours. It formed a gel that was less firm than the oven-dried flour gets. All the treatments had similar effects on swelling power and syneresis tendency, but the latter increased significantly after 120 h storage of the gels at 4 C. The flours also had comparable resistant starch (77.46 to 82.67 g 100/g) and total starch (88.15 to 93.09 g 100/g) contents. Based on these results, the freeze-drying method is recommended for banana flour production if light color and high absorption capacities are the desired qualities; otherwise, the conventional and less expensive oven drying method can be used. Further studies on the utilization of the banana flours, like substitute for wheat flour in baked products, is recommended, together with the determination of the nutritional profile of the end-products.

MUSA (BANANAS); VARIETIES; CHEMICOPHYSICAL PROPERTIES; DRYING; FOOD TECHNOLOGY; TEMPERATURE; FLOURS

Effect of ethylene-alpha-cyclodextrin inclusion complex powder on the ripening of 'Carabao' mango. **Lacap, A.T., Bayogan E.R.V., Joyce, D.C., Perkins, M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 54-55. (Sept 2019).

The local mango industry in the Philippines uses calcium carbide (CaC sub 2), also known as carburo, to ripen the fruit. However, CaC sub 2 contains harmful residues that could cause potential health risk to humans. Ethylene-alpha-cyclodextrin inclusion complex powder (ethylene-alpha-CD IC) is an innovative ripening agent developed by the University of Queensland, Australia. The effect of ethylene-alpha-CD IC on the ripening of 'Carabao' mango inside bamboo basket was tested in the University of the Philippines Mindanao in May 2019, Mango fruit (26.7% dry matter) harvested at 115 days after flower induction were sanitized with 200 muL/L NaOCl and air-dried. Arranged in a completely randomized design, five kg mango fruit were treated with CaCs (25 g) or ethylene-alpha-CD IC (250 or 500 mg) for 72 h inside bamboo baskets covered with newspapers and secured with polypropylene twine. Fruit weight loss, firmness, total soluble solids (TSS), visual quality, peel and flesh color (subjective index, L*, a*, b*), degree of diseases (stem-end rot and anthracnose) were evaluated at 3, 4, and 7 days after harvest. Results showed that mangoes treated with 500 mg ethylene-alpha-CD IC powder ripened as fast as those treated with CaC sub 2 in terms of peel and flesh color, firmness, and TSS. Further, mangoes treated with ethylene-alpha-CD IC had lower weight loss and better visual quality compared to CaC sub 2-treated mangoes which developed a higher degree of anthracnose infection and blotchiness on the skin. Stem-end rot did not differ among treatments. Mangoes treated with CaC sub 2 or 500 mg ethylene-alpha-CD IC took only 3.6 days to reach saleable stage compared to the control at 5.7 days. Ethylene-alpha-CD IC resulted in mangoes with longer shelf life (9.5 days) compared to CaC sub 2-treated fruit (8 days) after storage at 25 deg C. Ethylene-alpha-CD IC powder, therefore can be a potential alternative ripening agent that is safer than CaC sub 2.

MANGIFERA INDICA; MANGOES; VARIETIES; POSTHARVEST PHYSIOLOGY; ETHYLENE

Effects of irrigation and fertilization on the quality of 'Super Pinoy' onion (*Allium cepa* L.) bulbs. **Lualhati, R.A.O., Gonzales, D.C.H., Esguerra, E.B., Dumlao, C.A.P., Nate, K.J.R., Patricio, M.G., Espino, A.N., Mandac, J.N.R.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 54. (Sept 2019).

Cultural management practices like irrigation and fertilization affect the quality and storage behavior of onion bulbs his study, 'Super Pinoy' onions at a farm Brgy. Sta. Rita, Sto. Domingo, Nueva Ecija from January to March 2019 were subjected to various irrigation regimes (drip irrigation at 3-, 5- and 7-day intervals and flooding every 9 days) from 45 to 97 days after transplanting. Each plot measured 1.4 m by 7 m with 12 rows. Water from elevated reservoir was distributed to six laterals in each plot to emitters with 30-cm spacing with drip of 0.71 L-h⁻¹. Flooding was done at 13.35 L-s⁻¹ for 79 s. On the other hand, two fertilization treatments (90-80-40 based on soil analysis and 114-85-54 based on farmer's practice) were employed. Split plot design with triplicates per treatment was done. Bulbs were harvested at commercial maturity and were cured at ambient condition then profiled using different quality parameters. Higher proportion (31.51%) of large-sized bulbs was obtained in flooded plots compared to those subjected to drip irrigation (14.28-16.78%). Fertilization did not affect bulb size. Flooding appeared to increase the susceptibility of bulbs to insect damage. The incidence of bulbs with wide neck, however, was lowest in flooded plots. Flooding when combined with fertilization using the farmer's practice further increased susceptibility to insect damage. On the other hand, flooding in combination with fertilization regime that was based on soil analysis had more mechanically damaged bulbs. No differences in misshapen, diseased and split bulbs were obtained between treatments. Physico-chemical properties of the bulbs like pungency, total soluble solids, and total phenolic content were almost similar in all treatments. The free-radical scavenging activity of bulbs was higher in plots drip-irrigated at 7-d interval in combination with soil analysis-based fertilization. Mechanical properties (stiffness, boiyield and rupture points) did not vary among treatments.

ALLIUM CEPA; ONIONS; QUALITY; CHEMICOPHYSICAL PROPERTIES; STORAGE; FERTILIZER APPLICATION; IRRIGATION

Physico-chemical changes during storage of onion (*Allium cepa* L. var. Superex) bulbs subjected to various preharvest control strategies against armyworm (*Spodoptera exigua* (Hubner) (Nectiodae : Lepidoptera). **Gonzales, D.C.H., Esguerra, E.B., Nate, K.J.R., Dumlao, C.A.P., Cayabyab, B., Alforja, L.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 51. (Sept 2019).

The heavy infestation of armyworm in major production areas in Nueva Ecija [Philippines] in 2016 resulted in crop failure despite the heavy of synthetic pesticides. This led to a collaborative integrated pest management program against onion armyworm, one strategy of which is the use of biospecticides (neem oil) and biological control agents (NPV, *B. thuringensis*, *M. anisopliae*). Onions treated with synthetic insecticides were included for comparison. Experiment was laid out in CRD and bulbs were harvested on

March 2018 in Bongabon, Nueva Ecija. The postharvest component of the program was aimed at determining the physico-chemical changes during storage of onion bulbs subjected to various preharvest control strategies. Onion bulbs variety Superex (yellow type) were harvested at commercial maturity, cured for one week under ambient condition then stored for 6 mo at 4.6±0.6 deg C and 91.7% RH. Mean pungency of bulbs increased to a range of 3.17 to 3.99 mumole pyruvic acid/g on the 3rd and 4th month of storage, respectively, from 1.67 mumole pyruvic acid/g at harvest. Extending the storage period to 6 months resulted in decreased pungency. Total soluble solids did not vary significantly among treatments and exhibited a slight decrease during storage. In all treatments, sprouting occurred on the 5th month but was evident only when bulbs were cut. External manifestation of sprouting occurred on the 6th month. When bulbs were withdrawn from cold storage on the 4th month and transferred of ambient condition, it took about 2 months for bulbs Preharvest treated with biopesticides and biological control agents to sprout while only about a month for synthetic pesticide. Longer storage period (5 and 6 mo) followed by ambient holding resulted in bulb sprouting in less than 2 weeks in all treatments. Bulb decay was not observed during storage except for onions with preharvest synthetic insecticide spray.

ALLIUM CEPA; VARIETIES; ONIONS; STORAGE; CHEMICOPHYSICAL PROPERTIES; INTEGRATED PEST MANAGEMENT; MICROBIAL PESTICIDES

Postharvest quality of mangosteen (*Garcinia mangostana* L.) at two fruit maturities under ambient and coolbot storage conditions. **Tac-an, M.I.A., Lubaton, C.D.S., Lacap, A.T., Bayogan, E.R.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 52. (Sept 2019).

Marketability of mangos teen fruit is limited by physiological disorders like pericarp hardening that affect fruit quality. This study evaluated the quality of two maturities (reddish purple, dark purple) of mangosteen fruit stored in ambient and CoolBot (10 deg C) conditions for 14 and 42 days, respectively. The research was done in September to November 2018 in Davao City [Philippines]. CoolBot is an electronic gadget attached to a digital air conditioner to adjust the temperature of an insulated room. All sample fruit had at least seven days of shelf life in ambient while 28 days in Coolbot conditions. Peel color was maintained until four days under ambient condition. In both storage conditions, total soluble solids (TSS) and pericarp hardening were higher in dark purple fruit. Reddish purple fruit and higher L* (lightness), a* (green-red scale), b* (blue-yellow scale), chroma, and hue. Fruit in CoolBot storage conditions had better visual and calyx quality, lower weight loss, higher total soluble solids (TSS), delayed onset of pericarp hardening, delayed peel color development, and higher L*, a*, b*. Chilling injury did not vary between fruit maturities stored in CoolBot. TSS, visual and calyx quality of mangosteen fruit at 7 and 14 days were not affected by the interaction of maturity and storage condition. Storage in CoolBot (10 deg C) of reddish purple mangosteen fruit is a potential technique in maintaining fruit quality until 28 days.

GARCINIA MANGOSTANA; FRUIT CROPS; FRUITS; STORAGE; POSTHARVEST PHYSIOLOGY; COOLING

Temperature and fruit quality monitoring of Philippines 'Carabao' mango export from Davao City, Philippines to Shanghai, China. **Secretaria, L.B., Bayogan E.R.V.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 53-54. (Sept 2019).

An international in-transit case study on fresh Philippine 'Carabao' mango was done in the export supply chain from Davao City, Philippines to Shanghai, China to assess and describe fruit quality and transit conditions. The study was conducted from 24 July 2018 to 19 August 2018. A mango quality manual developed by a team of researchers was used to assess and describe fruit quality in the export company (Davao City, Philippines) and import consignment (Shanghai, China). The temperature and quality of mango fruit positioned on top, middle or bottom at different locations (front, center or back) in the container van were monitored. Nine (one box per location and position) out of 18 sample mango boxes (two boxes per location and position) were tagged with temperature data loggers to monitor the temperature of each box. Further, some issues were identified in the export supply chain of 'Carabao' mango. Several temperature fluctuations from the set temperature of 10 deg C were recorded during the transit of fruit from the Philippines to China. The percentage of reject fruit in the exporter's warehouse in Davao City was at 22%. Some common causes of rejection included latex defects, scab and lenticel spotting. Fruit variously positioned in different parts of the container van differed in quality as these were influenced by temperature during shipment. Fruit at the bottom had better quality. Some quality defects were still observed in the import consignment. These included the internal defect 'riciness', shriveling, latex burn, lenticel spotting, bumps and progression of diseases. Weight losses of mango in the import consignment were 8.8 and 15.1% at three and six days from arrival in China, respectively. challenges continue to beset the mango industry particularly in producing and maintaining premium quality of mango for export which results in low volumes for export. The smallholder mango farmers cannot consistently provide premium quality mango, the evidence of which is the 50% fruit rejection recorded by the exporter upon receipt in the parkhouse.

MANGIFERA INDICA; MANGOES; VARIETIES; QUALITY; TEMPERATURE; POSTHARVEST TECHNOLOGY; MONITORING; EXPORTS; PHILIPPINES

Tramline enriches productivity of mountainous areas in Negros [Philippines]. Yap, J.P.Jr. *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 54-55. (Feb 2020).

PRODUCTS; TRANSPORT; TIME; HIGHLANDS; PRODUCTIVITY; FARMERS ASSOCIATIONS; PHILIPPINES

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

Ethnobotanical account of the traditional light houses (TLHs) built for harvest shelters by Loboanos of Verde Island Passage, Batangas Province, Philippines. Caringal, A.M., Arcega, J.D., Lucero, E.D., Panganiban, M.G. *Asia Life Sciences (Philippines)*. *The Asian International Journal of Life Sciences*. 0117-3375. v. 26(1) p. 29-54. (Jan-Jun 2017).

An ethnobotanical study was undertaken to determine the structural features, contents and functions, and functional challenges in traditional light-houses (TLHs) used primarily to shelter farm harvests. We accessed 22 harvest shelters built as early as 1920 up to 2010 by Loboanos – a community of farmers in the municipality of Lobo, along Verde Island Passage, Batangas Province, Philippines. The light houses were made of bamboo, molave and dipterocarp trees and contemporary materials. Elevated thatched huts have an average floor area of 9.43 m²; with triangular extended galvanized roof sheets, 11.44 m². The rectangular partitions made of split bamboo culms range from 6.23 m² to 7.63 m² fortified by four cornered vertical timber posts of 2.69 m high and 0.15 m in diameter supported by several sub-posts

protruding from the ground over the elevated floor. TLHs have three to four stair-steps of 1.35 m long by 1.3 m wide; a door of 2.30 m², and windows of 0.62 m². The elevated floor and partitions generate favorable 'hulab'- adequate cool ventilation throughout while sheltering and prolonging the 'perishables' and 'durables' from mountain swiddens and lowland rice fields. Some 15 major traditional crops ranging from 25 to 2,800 kg are stored synchronically in most shelters depending upon harvesting months. The huts also provide shelter for domestic animals mostly native chickens and goats.

CROPS; INDIGENOUS ORGANISMS; HARVESTING; YIELDS; STORAGE; STORAGE STRUCTURES; FORESTS; ETHNOBOTANY; PHILIPPINES

L. ANIMAL SCIENCE, PRODUCTION AND PROTECTION

L01 Animal husbandry

Cage-free poultry housing an alternative to battery cages. **Dukha, A.B. III.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 58-61. (Jan 2020).

LAYER CHICKENS; POULTRY FARMING; EGG PRODUCTION; ANIMAL HOUSING; CAGES; ANIMAL HUSBANDRY

Going abuzz: how to set up an apiary. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 48-49. (Feb 2020).

APIS MELLIFERA; APICULTURE; HONEY BEES; HIVES; PRODUCTION LOCATION

I will not go into big time turkey production. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 10. (Mar 2020).

TURKEY; ANIMAL HUSBANDRY; ANIMAL FEEDING; FEEDS; PRODUCTION COSTS

Maverick Thai Murrah dairy makes money from milk and fun activities. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 56-57. (Jan 2020).

DAIRY INDUSTRY; RURAL AREAS; TOURISM; INCOME

Silkworms generate income in Negros Occidental [Philippines]. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 47-49. (Jan 2020).

BOMBYX MORI; SILKWORMS; SERICULTURE; MORUS ALBA; SILK; TEXTILE INDUSTRY; FARMERS; COCOONS; QUALITY; TECHNOLOGY; DIFFUSION OF INFORMATION; PHILIPPINES

M. FISHERIES AND AQUACULTURE

M01 Fisheries and aquaculture - General aspects

Exploring utility of formal concept analysis approach to coral reef assessment. **Madrid, V.R.M., Lactuan, L.K., Corral, J.M.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 47-57. (2016).

This study explored the use of formal concept analysis (FCA), a data mining technique, to analyze coral reef transect data (in terms of life forms) and comparing its results to the standard assessment analysis. Utilizing the quadrat-life form as the object- attribute pair, the results derived from the context was analyzed to assess the coral reefs in the study site which consisted of three stations. Data from Station 1 and Station 2 showed the dominance of *Acropora digitate* and *Acropora branching* life forms, respectively. Some life forms were absent from both Stations 1 and 2 but all life forms were present in Station 3 with eight life forms having the highest occurrence. Station 3 had the highest diversity of life forms while Station 2 had the highest live coral cover. This study showed how FCA can be used to generate new knowledge from transect data that can be verified by traditional coral reef assessment results, a possible complement to standard coral reef assessment analytical tools. FCA approach shines when it deals with large data sets from many different sources, which may pave the way for data-driven ecological assessment analysis studies such as those already being done for agriculture.

DATA COLLECTION; IMAGE ANALYSIS; CORAL REEFS; MONITORING; ENVIRONMENTAL IMPACT ASSESSMENT

Second generation FilAm [Ms. Lennie Dicarlo] finds her roots (and makes money) in supporting Philippine sea salt. Tan, Y. Agriculture (Philippines). 0118-857-7. v. 24(3) p. 28-31. (Mar 2020).

MARINE AREAS; SALTS; QUALITY; CONDIMENTS; INDUSTRY; EXPORTS; PHILIPPINES

Supporting Philippine sea salt production helps salt farmers and preserves culture. Tan, Y. Agriculture (Philippines). 0118-857-7. v. 24(3) p. 32-33. (Mar 2020).

MARINE AREAS; SALTS; PRODUCTION; FARMERS; INCOME

Valuing public preferences for Ludong (*Cestraeus plicatilis* Valenciennes 1836) conservation program in Cagayan River Systems, Philippines. Javier, J.M., Rapera, C.L., Rañola, R.F.Jr., Alcantara, A.J. Journal of Environmental Science and Management (Philippines). 0119-1144. Special issue no. 2 p. 30-38. (2016).

Ludong (*Cestraeus plicatilis* Valenciennes 1836) has been declared as an endangered species by the Bureau of Fisheries and Aquatic Resources (BFAR) in the Cagayan River Systems. Thus, BFAR is planning to ban ludong fishing for five years that will be complemented by changes in the current conservation program. This study determined and valued the program features preferred by 282 respondents from eight major ludong fishing and trading sites along the Cagayan River Systems in provinces of Cagayan and Isabela for the BFAR's 5-year proposed revised ludong conservation program using a choice experiment approach. The heterogeneity of the respondent's preferences for these program features was also determined. The respondents had the highest mean willingness to pay (Php 534.07 per year) for a conservation program that has the lowest negative income impacts to them given their heavy reliance to shing as income and food source. This program bans only ludong fishing gears from October to December 15, provides income benefits to them during the 2.5 months seasonal ban for ludong and provides information and education about ludong via a medium that is easily and widely accessible to them. The differences of their willingness to pay for these program features are low.

FISHES; SPECIES; FISHERY RESOURCES; RESOURCE CONSERVATION; ENDANGERED SPECIES; FISHING METHODS; VALUATION; PHILIPPINES

M12 Aquaculture production

Abalone farming. **Guerrero, R.D. III.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 26. (Mar 2020).

HALIOTIS; SPECIES; ABALONES; CAGE CULTURE; ANIMAL FEEDING; GRACILARIA; HARVESTING

Former school teacher [Dr. Rosalind Wee from Jolo, Sulu, Philippines] the biggest seaweed exporting firms in the country. **Tan, Y.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 14-16. (Jan 2020).

EUCHEUMA; CARRAGEENANS; SEAWEEDES; MARINE RESOURCES; CROPPING SYSTEMS; HARVESTING; QUALITY; COOPERATIVES

Giant gourami [Osphronemus gouramy] culture in Indonesia. **Guerrero, R.D. III.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 18. (Jan 2020).

OSPHRONEMUS; SPECIES; FISH CULTURE; FISH CAGES; FISH; PONDS; ANIMAL FEEDING; ANIMAL BREEDING; INDONESIA

Master special skill that can make you rich [lapu-lapu fingerlings culture]. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 51. (Feb 2020).

FISHES; FISH CULTURE; FISH FEEDING; FINGERLINGS; INCOME

M40 Aquatic ecology

Phytoplankton abundance and distribution in selected sites of Boracay Island, Malay, Aklan, Central Philippines. **Limates, V.G., Cuevas, V.C., Tajolosa, M.A.T., Benigno, E.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 1-14. (2016).

This study investigated the impacts of natural and anthropogenic factors on the coastal water quality dynamics in the Island of Boracay, Malay, Aklan, Central Philippines particularly the effects of nutrient pollution on phytoplankton population. The samples were gathered at two month interval for a total of ve samplings by filtering 10 liter buckets of surface water through a net with 25 mum mesh bag. There were 35 identified genera of phytoplankton belonging to four taxonomic groups. Diatoms had 26 genera, cyanophycean and silicoflagellate and dinoflagellates had one and seven genera, respectively. Diatoms were the dominant group with the highest mean density of 1,588 ind.L-l, followed by silico agellate at 399 ind.L-1 represented by Tintinnopsis, cynophycean was represented by Trichodesmium at 204 ind.L-1, while the dinoflagellates had 132 ind.L-l. Genera richness was high when N and P concentrations were relatively lower. Phytoplankton density was highest in Lugotan Cove and Long Beach where nutrients readings were relatively high. This research clearly demonstrated that the growth of Trichodesmium reaching carrying capacity is an indication that the island ecosystem is near its ecological thresholds. The level of nitrate N acts as the limiting nutrient in the coastal water of the island controlling the growth of Trichodesmium and phytoplankton diversity. Changes in phytoplankton assemblages and density in the coastal waters were

associated to variations on intensity and frequency of water mixing along with nutrient loading coming from anthropogenic activities and land uses in the island.

PHYTOPLANKTON; BIODIVERSITY; SPATIAL DISTRIBUTION; ENVIRONMENTAL IMPACT; WATER POLLUTION; PHILIPPINES

N. AGRICULTURAL MACHINERY AND ENGINEERING

N20 Agricultural machinery and equipment

SUCs [State Universities and Colleges] support production of local engine for Agri Machinery. Yap, J.P.Jr. Agriculture (Philippines). 0118-857-7. v. 24(2) p. 52-53. (Feb 2020).

DIESEL ENGINES; DESIGN; EQUIPMENT PERFORMANCE; ENERGY SOURCES; MECHANIZATION

P. NATURAL RESOURCES AND ENVIRONMENT

P01 Nature conservation and land resources

Damage assessment and recovery monitoring of the mangrove forests in Calauit Island [Philippines] affected by Typhoon Yolanda (Haiyan). Malabrigo, P.L.Jr., Umali, A.G.A., Replan, E.L. Journal of Environmental Science and Management (Philippines). 0119-1144. Special issue no. 2 p. 39-46. (2016).

Calauit island is one of the islands in the Calamian Group of Islands in northern Palawan [Philippines]. The island is truly blessed with bountiful mangrove resources which provide the Tagbanuas enormous economic and ecological importance. Not known to many, Calauit island became the exit point of typhoon Yolanda causing tremendous damage to mangrove area. The study assessed the extent of damage and the recovery potential of Calauit mangrove forests from the devastation of Typhoon Yolanda. Ten sampling quadrats were established in areas where trees were observed to be 100% defoliated. Individual trees (greater than or equal to 1cm diameter) inside each quadrat were measured and evaluated based on the assessment matrix developed in this study. Results of our assessment revealed serious damage of mangroves in Calauit island. About 60% of the mangrove forests was severely affected by Typhoon Yolanda. Eight months after the typhoon, 21% of the trees have fully-recovered crown (all branches were able to develop leaves), 70% are still defoliated and 22% were already dead. Four of the 10 quadrats showed high potential for recovery as evidenced by a lot of seedlings (greater than or equal to 25 seedlings) to serve as new regenerations. Conversely, there are four quadrats without any seedling recorded. Three monitoring plots were established for continuous monitoring of the recovery of the mangrove ecosystems. A course of actions was recommended to facilitate the recovery of mangroves in Calauit island, and to bring back the economic benefits from the forest.

MANGROVES; DAMAGE; ENVIRONMENTAL IMPACT; ECOSYSTEMS; MONITORING; CYCLONES; PHILIPPINES

Ecological integrity of Pasonanca Natural Park [Philippines] the sustainability of water supply under a policy of protected areas. Casimiro, J.Ma.P.S., Ramos, M.S.K. Journal of Environmental Science and Management (Philippines). 0119-1144. Special issue no. 2 p. 58-70. (2016).

This study establishes the optimum thresholds and rating scales to evaluate the ecological integrity of Pasonanca Natural Park protected area in Zamboanga City, Philippines. Six indicators representing four key eco-hydrological attributes of sustainable water supply namely vegetation and soil at the riparian buffer zone, the hydrology and water quality of the stream, were assessed. Tree basal area was found to be high ranging from 56.08 m² ha⁻¹ to 65.46 m² ha⁻¹ in undisturbed sites. These values are higher than other tropical forests in Southeast Asia. Total organic carbon and total nitrogen were at critical levels. Mean streamflow was significantly declining at 0.101 m³ s⁻¹ yr⁻¹ (p0.001) suggesting the possibility of diminishing water supply in the coming years. The annual mean water turbidity was significantly increasing at 2.572 NTU yr⁻¹ or 22.48% yr⁻¹ (p0.001) hinting at higher frequency of chemical treatment and increasing risk of exposure to disinfection by-products in drinking water. Annual high turbidity day count occurred more than 90 days from 2007 to 2013 with the highest at 181 days in 2011. The overall ecological integrity rating of Pasonanca Natural Park is poor. The withdrawal of the riparian buffer zone from strict protection status and its reclassification to special use zone to pave the way for active management should be considered.

PROTECTED FORESTS; NATIONAL PARKS; WATER SUPPLY; WATER QUALITY; SUSTAINABILITY; TURBIDITY; ENVIRONMENTAL IMPACT; PHILIPPINES

Environmental sustainability analysis of charcoal production in Mulanay, Quezon, Philippines. **Inzon, M.R.B.Q., Espaldon, M.V.O., Florece, L.M., Rebancos, C.M., Alcantara, A.J.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 93-100. (2016).

Global and historical trends show the re-emergence of woodfuels as alternative sources of energy amid concerns over their environmental impacts. Charcoal production, in particular, remains a significant source of indigenous energy for developing countries like the Philippines, where it is perceived as a cause of deforestation and environmental degradation. This study presents a case where charcoal production can be practiced on a sustainable basis by focusing on aspects that affect the environment, namely, wood source, harvesting strategy and production techniques. Key informant interviews, focus group discussions and a survey among charcoal producers in Mulanay, Quezon [Philippines] revealed a preference on hardwoods that produce slow-burning charcoals and other readily-available, usually invasive, tree species. Harvesting strategies include tree felling and pruning and rotational harvesting to allow stock replenishment. Charcoal producers employ an old but simple production technique called 'binulkan', which has an efficiency rate of 7.7% by weight. The study concludes that an environmentally-sustainable charcoal industry in Mulanay can be achieved by planting and utilizing suitable tree species and improving harvesting systems and production techniques. Further study is recommended to assess the feasibility of establishing wood plantations for charcoal production with regard to its poverty reduction potential and continued benefits to the community.

CHARCOAL; FUELWOOD; PRODUCTION; ENVIRONMENTAL IMPACT; SUSTAINABILITY; PHILIPPINES

Ubod: versatile uniquely Filipino vegetable from diverse plant species. **dela Cruz, N.J., Altoveros, N.C., Borromeo, T.H., de Chavez, H.D., Aguilar, C.H.M., Sister, L.E., Bautista, N.J.L., Robillos, C.D., Barrion, D.C.N., Endonela, L.E., Gentallon, R.P.Jr.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 61. (Sept 2019).

Ubod, the meristematic tissues of several palm species, bamboo and banana, are widely used mostly by rural communities in the Philippines. Usually excised from specific parts of the plant (i.e. young shoots in the inner core of the stem and growing bud of palms and bamboo, and innermost leaf sheath and pith of the banana pseudostem), harvesting of ubod entails the felling of the entire plant. Traditionally, ubod is harvested from felled trees and plants in the aftermath of a typhoon or some other natural calamity but, when used for commercial production, they are felled deliberately. Data on availability, traditional harvesting and processing, culinary preparations and marketing were obtained from household interviews, market visits and focus group discussions in ten provinces from January 2018 to January 2019. This study identified seven palm species, namely niyog (*Cocos nucifera*), pugahan (*Caryota rumphiana*), buri (*Corypha utn*), anahaw (*Livistonia rotundifolia*), kaong (*Arenga pinnata*), sagisi (*Heterospathe elata*), and palasan (*Calamus* spp.); four bamboo species, namely bolo (*Gigantochloa levis*), botong (*Dendrocalamus latiflorus*), bayog (*Bambusa merrilliana*), and kiling (*Bambusa vulgaris*); and saging (*Musa* spp.) as sources of ubod with household utilization reflecting culture-specific differences. Ubod is sold in local markets and presented in different cuts, depending on the plant species and the consumer's preferences. Among the preparations of ubod are ginataan, lumpiang ubod, ginisa and salad. These ubod are also ingredients of various meat dishes like kare-kare, nilaga, tinola, bulalo and dinuguan and the traditional Visayan vegetable dish called laswa. For Filipino diets to be sustainability enriched with ubod vegetables, the destructive harvesting must be tampered by consideration offer the carrying - and regenerative - capacity of the resource base.

BAMBOOS; MUSA (BANANAS); PALMAE; INDIGENOUS ORGANISMS; HARVESTING; RESOURCE CONSERVATION; FOOD PROCESSING; PHILIPPINES; TECHNOLOGY

Valuing public preferences for Ludong (*Cestraeus plicatilis* Valenciennes 1836) conservation program in Cagayan River Systems, Philippines. Javier, J.M., Rapera, C.L., Rañola, R.F.Jr., Alcantara, A.J. *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 30-38. (2016).

Ludong (*Cestraeus plicatilis* Valenciennes 1836) has been declared as an endangered species by the Bureau of Fisheries and Aquatic Resources (BFAR) in the Cagayan River Systems. Thus, BFAR is planning to ban ludong fishing for five years that will be complemented by changes in the current conservation program. This study determined and valued the program features preferred by 282 respondents from eight major ludong fishing and trading sites along the Cagayan River Systems in provinces of Cagayan and Isabela for the BFAR's 5-year proposed revised ludong conservation program using a choice experiment approach. The heterogeneity of the respondent's preferences for these program features was also determined. The respondents had the highest mean willingness to pay (PhP 534.07 per year) for a conservation program that has the lowest negative income impacts to them given their heavy reliance to shing as income and food source. This program bans only ludong fishing gears from October to December 15, provides income benefits to them during the 2.5 months seasonal ban for ludong and provides information and education about ludong via a medium that is easily and widely accessible to them. The differences of their willingness to pay for these program features are low.

FISHES; SPECIES; FISHERY RESOURCES; RESOURCE CONSERVATION; ENDANGERED SPECIES; FISHING METHODS; VALUATION; PHILIPPINES

Who wants to adopt sustainable charcoal production? : Determinants and willingness to adopt sustainable practices among small-scale producers in Quezon Province, Philippines. Espaldon, M.L.O., Sumalde, Z.M.,

Rebancos, C.M., Alcantara, A.J. *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 84-92. (2016).

Charcoal and wood fuel supply energy needs in both urban and rural communities in the world. In the Philippines, charcoal is used in both commercial and residential in the provinces of Southern Tagalog the National Capital Region (NCR). However, charcoal-making is also one of the main threats to the natural resources and environment in the Philippines. Thus, there is a need to develop a sustainable charcoal production process that could meet the demand without decreasing forest and tree cover. This paper describes present charcoal production practices of households and their willingness to adopt sustainable charcoal practices. It surveyed 85 active charcoal producers in the municipality of Mulanay, Quezon Province, Philippines, to elicit response and document the local practice. An ordered logit model was used to analyse factors that could influence willingness to adopt sustainable charcoal practices. Despite the unprofitable and inefficient charcoal practices, the present practice continues. Under the scenario of increased profits realized through minimum capital requirement, respondents were willing to develop and adopt sustainable practice of charcoal production.

CHARCOAL; FUELWOOD; PRODUCTION; FOREST RESOURCES; RESOURCE MANAGEMENT; RESOURCE CONSERVATION; FARMERS; INNOVATION ADOPTION; PHILIPPINES

P06 Renewable energy resources

Environmental sustainability analysis of charcoal production in Mulanay, Quezon, Philippines. Inzon, M.R.B.Q., Espaldon, M.V.O., Florece, L.M., Rebancos, C.M., Alcantara, A.J. *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 93-100. (2016).

Global and historical trends show the re-emergence of woodfuels as alternative sources of energy amid concerns over their environmental impacts. Charcoal production, in particular, remains a significant source of indigenous energy for developing countries like the Philippines, where it is perceived as a cause of deforestation and environmental degradation. This study presents a case where charcoal production can be practiced on a sustainable basis by focusing on aspects that affect the environment, namely, wood source, harvesting strategy and production techniques. Key informant interviews, focus group discussions and a survey among charcoal producers in Mulanay, Quezon [Philippines] revealed a preference on hardwoods that produce slow-burning charcoals and other readily-available, usually invasive, tree species. Harvesting strategies include tree felling and pruning and rotational harvesting to allow stock replenishment. Charcoal producers employ an old but simple production technique called 'binulkan', which has an efficiency rate of 7.7% by weight. The study concludes that an environmentally-sustainable charcoal industry in Mulanay can be achieved by planting and utilizing suitable tree species and improving harvesting systems and production techniques. Further study is recommended to assess the feasibility of establishing wood plantations for charcoal production with regard to its poverty reduction potential and continued benefits to the community.

CHARCOAL; FUELWOOD; PRODUCTION; ENVIRONMENTAL IMPACT; SUSTAINABILITY; PHILIPPINES

Who wants to adopt sustainable charcoal production? : Determinants and willingness to adopt sustainable practices among small-scale producers in Quezon Province, Philippines. Espaldon, M.L.O., Sumalde, Z.M.,

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Charcoal and wood fuel supply energy needs in both urban and rural communities in the world. In the Philippines, charcoal is used in both commercial and residential in the provinces of Southern Tagalog the National Capital Region (NCR). However, charcoal-making is also one of the main threats to the natural resources and environment in the Philippines. Thus, there is a need to develop a sustainable charcoal production process that could meet the demand without decreasing forest and tree cover. This paper describes present charcoal production practices of households and their willingness to adopt sustainable charcoal practices. It surveyed 85 active charcoal producers in the municipality of Mulanay, Quezon Province, Philippines, to elicit response and document the local practice. An ordered logit model was used to analyse factors that could influence willingness to adopt sustainable charcoal practices. Despite the unprofitable and inefficient charcoal practices, the present practice continues. Under the scenario of increased profits realized through minimum capital requirement, respondents were willing to develop and adopt sustainable practice of charcoal production.

CHARCOAL; FUELWOOD; PRODUCTION; FOREST RESOURCES; RESOURCE MANAGEMENT; RESOURCE CONSERVATION; FARMERS; INNOVATION ADOPTION; PHILIPPINES

P10 Water resources and management

Ecological integrity of Pasonanca Natural Park [Philippines] the sustainability of water supply under a policy of protected areas. **Casimiro, J.Ma.P.S., Ramos, M.S.K.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 58-70. (2016).

This study establishes the optimum thresholds and rating scales to evaluate the ecological integrity of Pasonanca Natural Park protected area in Zamboanga City, Philippines. Six indicators representing four key eco-hydrological attributes of sustainable water supply namely vegetation and soil at the riparian buffer zone, the hydrology and water quality of the stream, were assessed. Tree basal area was found to be high ranging from 56.08 m² ha⁻¹ to 65.46 m² ha⁻¹ in undisturbed sites. These values are higher than other tropical forests in Southeast Asia. Total organic carbon and total nitrogen were at critical levels. Mean streamflow was significantly declining at 0.101 m³ s⁻¹ yr⁻¹ (p0.001) suggesting the possibility of diminishing water supply in the coming years. The annual mean water turbidity was significantly increasing at 2.572 NTU yr⁻¹ or 22.48% yr⁻¹ (p0.001) hinting at higher frequency of chemical treatment and increasing risk of exposure to disinfection by-products in drinking water. Annual high turbidity day count occurred more than 90 days from 2007 to 2013 with the highest at 181 days in 2011. The overall ecological integrity rating of Pasonanca Natural Park is poor. The withdrawal of the riparian buffer zone from strict protection status and its reclassification to special use zone to pave the way for active management should be considered.

PROTECTED FORESTS; NATIONAL PARKS; WATER SUPPLY; WATER QUALITY; SUSTAINABILITY; TURBIDITY; ENVIRONMENTAL IMPACT; PHILIPPINES

Water quality and nutrient loading in the coastal waters of Boracay Island, Malay, Aklan, Central Philippines. **Limates, V.G., Cuevas, V.C., Benigno, E.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 15-29. (2016).

This study analyzed the water quality dynamics in the coastal zone of Boracay Island in relation to anthropogenic activities and natural factors. Seven sites were studied where possible sources of nutrient inputs on spatial and temporal basis were identified. Water samples were evaluated using the Philippine Department of Environment and Natural Resources (DENR) regulatory standards. The coastal water quality was generally influenced by nutrient loading coming from untreated and partially treated waste water from households and commercial establishments not connected to the sewerage system of the island. Natural cleansing mechanisms attributed to activities of autotrophs in the coastal water and biogeochemical processes of mangrove swamps are operational. Coastal waters adjacent to mangrove swamp impoverished of mangrove trees showed poor water quality, while coastal water adjacent to mangrove swamp with relatively good mangrove cover exhibited good water quality. The months of February to June with highest number of tourist arrival proved to be the critical periods. Lugotan Cove close to Mangrove Swamp 6 impoverished of trees was the critical area in the Island. Puka Beach close to Mangrove Swamp I with good mangrove cover showed the cleanest water quality, followed by Long Beach with most of the commercial establishments connected in the sewerage system.

WATER QUALITY; COASTAL WATERS; ENVIRONMENTAL DEGRADATION; ENVIRONMENTAL IMPACT; WASTEWATER; PHILIPPINES; WATER POLLUTION

P32 Soil classification and genesis

Comparison of indigenous and scientific knowledge on soil classification among farmers in Imugan, Nueva Viscaya, Philippines. Martin, H.T. *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 71-83. (2016).

This study was conducted to verify the application of indigenous knowledge of Imugan farmers in soil classification in the Imugan watershed of Sta Fe, Nueva Vizcaya [Philippines]. The results were further compared with the scientific knowledge on soil classification. Drawing out the indigenous knowledge was made through the use of participatory rural appraisal techniques such as focus group discussions, key informant interview, and transect walk. Field observation was also done. On the other hand, scientific knowledge included soil profiling, characterization and soil laboratory analysis. Criteria used by Imugan Farmers in soil classification are their experiences supported by their ability to observe attributes of soil resource. This is their way to identify the best use, and appropriate management practices of the soil resource. Scientific soil classification system is a thorough process of soil characterizations that investigates not only the surface soil's properties, its genesis and chemical properties but also subsoil's characteristics. This expensive and rigorous procedure is intended to aid decision making on the land's best use and crop choice. The two systems of soil classification- knowledge that is tested through time combined with knowledge formed from scientific analysis- may have differences, but combining them together in the framework of soil classification will benefit Imugan farmers. The combined system of soil classification provide detail information about nutrient deficiency and attributes of each soil type, the variety of crops suitable for each soil based on farmers' preference and appropriate inputs in raising crops that are less or not suitable in a given soil.

SOIL CLASSIFICATION; SOIL TYPES; WATERSHEDS; FARMERS; INDIGENOUS ORGANISMS; PHILIPPINES

P36 Soil erosion, conservation and reclamation

Protecting soil quality with vetiver grass. **Taculao, P.B.S.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 42-43. (Jan 2020).

VETIVERIA ZIZANIOIDES; EROSION; SOIL DEGRADATION; EROSION CONTROL PLANTS; ROOTS; ENVIRONMENTAL IMPACT

P40 Meteorology and climatology

Caonical correlation analysis for the determination of relationship between weather variables and yield components of selected tall coconut (Cocos nucifera L.) varieties in Zamboanga City [Philippines]. **dela Cruz, C.DV., Crisostomo, S.D., Palis, M.M., Quilloy, R.B., Reaño, C.E.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. 44(Supplement no. 1) p. 78-79. (Sept 2019).

The study aimed to determine the relationship between weather variables [X set - amount of rainfall (RF12), number of dry days (DRY12), maximum temperature (TMAX12), minimum temperature (TMIN12), relative humidity (RH12), solar radiation (SR12) 12 months prior, amount of rainfall (RF24), number of dry days (DRY24), maximum temperature (TMAX24), minimum temperature (TMIN24), relative humidity (RH24), and solar radiation (SR24) 24 months prior] and coconut yield components [Y set - number of leaves (NOL), number of bunches (NOB), number of buttons (BUT), number of tennis-ball sized nut (NTB) and total potential yield (TOTNUT)] through canonical correlation analysis (CCA). The study was conducted in Philippine Coconut Authority - Zamboanga Research Center comprising of selected tall coconut varieties namely Laguna Tall, Baybay Tall, Tagnanan Tall, and Rennel Tall. Thirty palms from each identified block were randomly selected, and variable were observed regularly from 2015 to 2016. On the other hand, daily weather information was obtained from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Canonical correlation coefficients between coconut yield components and weather information during inflorescence opening (12 months prior) and male and female flower development (24 months prior) was done using SAS version 9.4. Results showed that the first canonical correlation coefficient between the first pair of canonical variables was found to be significant at $\alpha=10\%$ ($r=0.9618$, $P=0.0001$). Findings indicate that NOB, TOTNUT, RF24, DRY24, TMIN24 and RH24 had the largest influence for the explanatory capacity of the first canonical variable estimated from yield components and weather variables, respectively (0.9306, 0.7251, -0.8582, 0.9495, -0.6778 and -0.6496, respectively). Hence, high number of bunches and high total potential yield is associated with low amount of rainfall, more dry days, lower minimum temperature and lower relative humidity during male and female flower development.

COCOS NUCIFERA; VARIETIES; CROP YIELD; TEMPERATURE; RELATIVE HUMIDITY; RAIN; SOLAR RADIATION; PHILIPPINES

Cropping advisories of rainfed rice and corn using seasonal climate forecasts. **Dalagan, J.I., Lansigan, F.P., Sta. Cruz, P.C., Hernandez, J.E., Fajardo, A.T.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao

City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 83. (Sept 2019).

The onset of rain is one of the determinants in scheduling the planting of rice and corn. Hence, typical planting for wet season and dry season starts in June and October, respectively. Philippines is among the countries that are most vulnerable to the effects of climate change due to its geographic characteristics and its ability to recover after a calamity. Furthermore, literatures on the country's rainfall distribution and projected climate assert that its weather has become more erratic. A systematic approach in determining the best planting window for rainfed rice and corn using seasonal climate forecasts is being employed in issuing cropping advisories to farmers in selected sites. The approach makes use of knowledge on the crop's required amount of water before sowing for it to have a reasonable yield. Expected dates of flowering and maturity can also be drawn from the identified planting dates. Given this information, interventions on cropping management can be prepared ahead of time.

ZEA MAYS; ORYZA SATIVA; RAINFED FARMING; PLANTING; CROP MANAGEMENT; CLIMATE; WEATHER FORECASTING

Damage assessment and recovery monitoring of the mangrove forests in Calauit Island [Philippines] affected by Typhoon Yolanda (Haiyan). **Malabrigo, P.L.Jr., Umali, A.G.A., Replan, E.L.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 39-46. (2016).

Calauit island is one of the islands in the Calamian Group of Islands in northern Palawan [Philippines]. The island is truly blessed with bountiful mangrove resources which provide the Tagbanuas enormous economic and ecological importance. Not known to many, Calauit island became the exit point of typhoon Yolanda causing tremendous damage to mangrove area. The study assessed the extent of damage and the recovery potential of Calauit mangrove forests from the devastation of Typhoon Yolanda. Ten sampling quadrats were established in areas where trees were observed to be 100% defoliated. Individual trees (greater than or equal to 1cm diameter) inside each quadrat were measured and evaluated based on the assessment matrix developed in this study. Results of our assessment revealed serious damage of mangroves in Calauit island. About 60% of the mangrove forests was severely affected by Typhoon Yolanda. Eight months after the typhoon, 21% of the trees have fully-recovered crown (all branches were able to develop leaves), 70% are still defoliated and 22% were already dead. Four of the 10 quadrats showed high potential for recovery as evidenced by a lot of seedlings (greater than or equal to 25 seedlings) to serve as new regenerations. Conversely, there are four quadrats without any seedling recorded. Three monitoring plots were established for continuous monitoring of the recovery of the mangrove ecosystems. A course of actions was recommended to facilitate the recovery of mangroves in Calauit island, and to bring back the economic benefits from the forest.

MANGROVES; DAMAGE; ENVIRONMENTAL IMPACT; ECOSYSTEMS; MONITORING; CYCLONES; PHILIPPINES

Q. PROCESSING OF AGRICULTURAL PRODUCTS

Q02 Food processing and preservation

Cup quality assessment of Arabica coffee grown under different agroforestry systems in coffee growing areas in Benguet [Philippines]. **Pablo, J.P., Laurean, C.P., Fagyan, A.W., Bao-idang, C.C., Moreno, N.A., Rimas, L.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science

Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 83. (Sept 2019).

Coffee is one of Department of Agriculture's top priority crop in the Cordillera Administrative Region (CAR) such as in Benguet [Philippines]. *Coffea Arabica*, in the province are grown in agroforestry system based or intercropped with other taller plants. These trees and plants serve as shades and are equally important for both cup quality improvement and maintaining sustainable production. The study would like then to assess the cup quality of coffee originating from existing tree and plant shades including open field systems in Benguet. Coffee cherries were harvested from agroforestry system under *Alnus*, Pine, Mango and Chayote shades from five growing areas in Atok. Tublay and La Trinidad, Benguet located at elevations ranging from 1495 to 1648 m asl. The cherries were dried and processed following similar standard methods for all samples. Green beans were roasted and evaluated using procedures described by Specialty Coffee Association (SCA) for sensorial attributes involving olfaction, gustation and mouthfeel sensation by three professional Q Graders/Cuppers. All samples cupped under different agroforestry system including open field were rated Very Good (7.0 - 7.75) for aroma/fragrance, flavor, aftertaste, acidity, body and balance in accordance with SCA's quality scale. However, samples grown under *Alnus* shade (Coroz, Tublay) had scored 8.0 for overall flavor experience by Q Graders or rated Excellent (8.0 - 8.75) based on SCA's quality scale. The same samples under *Alnus* shade obtained the highest total score of 84.63 from the summation of all the attributes. Overall, all cupped samples obtained total scores more than 80, for which all fall under quality. Furthermore, future studies should include proper management practices to achieve excellent cup quality to be able to command the best price of green beans in the market.

COFFEA ARABICA; COFFEE; QUALITY; AGROFORESTRY; ORGANOLEPTIC PROPERTIES; ORGANOLEPTIC ANALYSIS

Diversity and utilization of indigenous vegetables in 10 provinces in the Philippines. **de Chavez, H.D., Altoveros, N.C., Borromeo, T.H., Aguilar, C.H.M., Sister, L.E., dela Cruz, N.J., Bautista, N.J.L., Robillos, C.D., Barrion, D.C.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 50-51. (Sept 2019).

Indigenous vegetables (IVs) lend themselves perfectly to the burgeoning trend towards naturally sourced nutritional supplements, organic agriculture, paleo diet, health and wellness. They are the main inexpensive and natural sources of minerals, vitamins, fiber, and in some cases proteins, that staple foods cannot adequately provide. Despite this, IVs have remained underutilized and under-researched owing to the lack of information about their potential uses and importance. There is, instead preferential emphasis on this production, marketing and consumption of high-value vegetables at the expense of indigenous vegetables which are considered by consumers as inferior to the former. This study was conducted from January to December 2018. It documented the diversity and utilization of indigenous vegetables in 10 provinces (Ilocos Norte, Ilocos Sur, La Union, Camarines Sur, Quezon, Iloilo, Capiz, South Cotabato, Davao del Sur, and Bohol [Philippines]) using focus group discussion, ocular and market surveys and actual cooking of native dishes utilizing these IVs. The ten most utilized IVs were: *Basella alba*, *Cajanus cajan*, *Corchorus olitorius*, *Ipomoea batatas*, *Ipomoea aquatica*, *Manihot esculenta*, *Moringa oleifera*, *Musa* spp., *Psophocarpus tetragonolobus* and *Bambusa* spp. Some lesser known yet notable IVs are *Allium cepa* cv

aggregatum, Allium sativum, Amorphophallus spp., Annona muricata, Cocos nucifera, Crassocephalum crepidioides, Gnetum gnemon, Gliricidia sepium, Lablab purpureus, Mangifera spp, Mollugo verticillata, Momordica cochinchinensis, Nusturtium officinale, Solanum aethiopicum and Telosma procumbens. The most common cooking preparations documented were dinengdeng (clear soup) or its variants, ginataan (cooked with coconut milk), ensalada (salad), pakbet or its variants and ginisa (stir fry). These IVs offer vitamins A and C, calcium and phosphorus in amounts that can potentially meet the average daily requirement of a 10-to 12-year-old child, thereby offering a healthier, more readily available and less costly alternative to high value vegetables sold in commercial markets.

VEGETABLES; INDIGENOUS ORGANISMS; GENETIC VARIATION; FOOD TECHNOLOGY; COOKING; FOOD ADDITIVES; USES; PHILIPPINES

Help for ubi growers and processors available at DMMMSU [Don Mariano Marcos Memorial University, Bacnotan, La Union, Philippines]. **Sarian, Z.B.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 8-9. (Mar 2020).

DIOSCOREA ALATA; YAMS; FOOD PROCESSING; FOODS; PROCESSED PLANT PRODUCTS; ENTERPRISES; CROP MANAGEMENT; PHILIPPINES

Second generation FilAm [Ms. Lennie Dicarlo] finds her roots (and makes money) in supporting Philippine sea salt. **Tan, Y.** *Agriculture (Philippines)*. 0118-857-7. v. 24(3) p. 28-31. (Mar 2020).

MARINE AREAS; SALTS; QUALITY; CONDIMENTS; INDUSTRY; EXPORTS; PHILIPPINES

Small-scale organic muscovado production. **Guerrero, R.D. III.** *Agriculture (Philippines)*. 0118-857-7. v. 24(2) p. 26-27. (Feb 2020).

SUGARCANE; SUGAR; MOLASSES; BOILING; GLUCOSE SYRUPS; PROXIMATE COMPOSITION; MEDICINAL PROPERTIES

Ubod: versatile uniquely Filipino vegetable from diverse plant species. **dela Cruz, N.J., Altoveros, N.C., Borromeo, T.H., de Chavez, H.D., Aguilar, C.H.M., Sister, L.E., Bautista, N.J.L., Robillos, C.D., Barrion, D.C.N., Endonela, L.E., Gentallon, R.P.Jr.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 61. (Sept 2019).

Ubod, the meristematic tissues of several palm species, bamboo and banana, are widely used mostly by rural communities in the Philippines. Usually excised from specific parts of the plant (i.e. young shoots in the inner core of the stem and growing bud of palms and bamboo, and innermost leaf sheath and pith of the banana pseudostem), harvesting of ubod entails the felling of the entire plant. Traditionally, ubod is harvested from felled trees and plants in the aftermath of a typhoon or some other natural calamity but, when used for commercial production, they are felled deliberately. Data on availability, traditional harvesting and processing, culinary preparations and marketing were obtained from household interviews, market visits and focus group discussions in ten provinces from January 2018 to January 2019. This study identified seven palm species, namely niyog (*Cocos nucifera*), pugahan (*Caryota rumphiana*), buri (*Corypha*

utn), anahaw (*Livistonia rotundifolia*), kaong (*Arenga pinnata*), sagisi (*Heterospathe elata*), and palasan (*Calamus* spp.); four bamboo species, namely bolo (*Gigantochloa levis*), botong (*Dendrocalamus latiflorus*), bayog (*Bambusa merrilliana*), and kiling (*Bambusa vulgaris*); and saging (*Musa* spp.) as sources of ubod with household utilization reflecting culture-specific differences. Ubod is sold in local markets and presented in different cuts, depending on the plant species and the consumer's preferences. Among the preparations of ubod are ginataan, lumpiang ubod, ginisa and salad. These ubod are also ingredients of various meat dishes like kare-kare, nilaga, tinola, bulalo and dinuguan and the traditional Visayan vegetable dish called laswa. For Filipino diets to be sustainability enriched with ubod vegetables, the destructive harvesting must be tampered by consideration offer the carrying - and regenerative - capacity of the resource base.

BAMBOOS; MUSA (BANANAS); PALMAE; INDIGENOUS ORGANISMS; HARVESTING; RESOURCE CONSERVATION; FOOD PROCESSING; PHILIPPINES; TECHNOLOGY

Q04 Food composition

Agro-morphological characterization and fragrance evaluation of selected special purpose rice accessions.

Aquino, J.D.C., Alvaran, P.J., Agustin, L.M., Orden, M.E.M. 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 145-146. (Sept 2019).

Special purpose rice (aromatic, pigmented and glutinous) are promising competitive rice group as it possesses special qualities and command higher price in the market. Aroma is an important characteristic of high quality rice because of strong human preferences for fragrance. Thus, this study aimed to evaluate the fragrance and characterize the agro-morphological attributes of 50 special purpose rice accessions. Leaf KOH assay method was used to evaluate the level of aroma and characterization of agro-morphological traits was based on Standard Evaluation System for rice by IRRI [International Rice Research Institute. Cluster analysis for multivariate experiment was carried out using the Statistical Tool for Agricultural Research Software. Four major clusters were formed in each of the agro-morphological attributes (agronomic, morphological, grain quality). On the other hand, 19 and 7 varieties were found out to be moderately and strongly scented, respectively. With the results gathered, a potential parent has been selected for recommendation on variety development, production, and promotion. Further analysis, such as quantification of aroma amylose, anthocyanin and molecular analysis will also be carried out.

ORYZA SATIVA; VARIETIES; AGRONOMIC CHARACTERS; PLANT ANATOMY; EVALUATION

Okra variety trial for yield, fruit and nutritional quality. **Oraye, C.D., Caisip, R.E., Mateo, J.M.C., Maghirang, R.G.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 137. (Sept 2019).

There is a big export market for okra but the expansion is hindered by the high price imported hybrid seeds. Local breeding of five-angled okra will eventually lead to the improvement of the seed system. Seeds will be available locally, hence farmers can have a cheaper source of seeds. Also breeding of this type of okra will produce varieties adapted under local conditions which could further lead to reduction of inputs. Stable lines have been developed and part of the breeding process is the preliminary yield trial

(PYT), PYT was conducted on twelve (12) breeding lines of five-angled okra from January to May 2019 at the Institute of Plant Breeding, UP Los Baños. Harvesting of okra pods started 49 DAS (days after sowing) and lasted up to 109 DAS. Harvesting was done every other day and marketable and non-marketable fruits were sorted based on fruit size and physical and/or insect damages. The highest yielders were found to be breeding lines Ok 163404-3-1-0-0, Ok 163408-3-1-0-0 and Ok 163416-1-4-0-0 with potential yield of 21.34 t/ha, 21.49 t/ha, and 20.31 t/ha, respectively. Yield advantage over the control, Ok 173704 'Greenie' F2 with 150%, 138% and 152%, respectively. Based on sensory evaluation, Ok 163403-5-1-0-0 had the highest mean rating in terms of tenderness, taste and overall acceptability and had the least % dislike responses. The analysis on proximate composition, phytochemical profile and antioxidant capacity of both seeds and flesh of okra showed that line Ok 163408-3-3-0-0 had the highest phenolic content (7.14%); line Ok 163406-1-2-0-0 had the highest total flavonoids (2.81%); while line Ok 163416-1-3-0-0 had the highest radical scavenging activity (93.76%). Additional activities on proximate, dietary fiber and Vitamin C and K analyses are yet to be conducted for a more thorough selection and eventually varietal recommendation.

ABELMOSCHUS ESCULENTUS; OKRAS; PROGENY; CROP YIELD; EXPERIMENTATION; PROXIMATE COMPOSITION; CHEMICOPHYSICAL PROPERTIES

Q70 Processing of agricultural wastes

From waste to wealth : developing new products from onion leaves. **Dela Cruz, R.T.** *Agriculture (Philippines)*. 0118-857-7. v. 24(1) p. 10; 11-12. Jan 2020.

ONIONS; LEAVES; AGRICULTURAL WASTES; PROCESSING; PROCESSED PRODUCTS

T. POLLUTION

T01 Pollution

Water quality and nutrient loading in the coastal waters of Boracay Island, Malay, Aklan, Central Philippines. **Limates, V.G., Cuevas, V.C., Benigno, E.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 15-29. (2016).

This study analyzed the water quality dynamics in the coastal zone of Boracay Island in relation to anthropogenic activities and natural factors. Seven sites were studied where possible sources of nutrient inputs on spatial and temporal basis were identified. Water samples were evaluated using the Philippine Department of Environment and Natural Resources (DENR) regulatory standards. The coastal water quality was generally influenced by nutrient loading coming from untreated and partially treated waste water from households and commercial establishments not connected to the sewerage system of the island. Natural cleansing mechanisms attributed to activities of autotrophs in the coastal water and biogeochemical processes of mangrove swamps are operational. Coastal waters adjacent to mangrove swamp impoverished of mangrove trees showed poor water quality, while coastal water adjacent to mangrove swamp with relatively good mangrove cover exhibited good water quality. The months of February to June with highest number of tourist arrival proved to be the critical periods. Lugotan Cove close to Mangrove Swamp 6 impoverished of trees was the critical area in the Island. Puka Beach close to Mangrove Swamp I with good mangrove cover showed the cleanest water quality, followed by Long Beach with most of the commercial establishments connected in the sewerage system.

WATER QUALITY; COASTAL WATERS; ENVIRONMENTAL DEGRADATION; ENVIRONMENTAL IMPACT; WASTEWATER; PHILIPPINES; WATER POLLUTION

U. METHODOLOGY

U10 Mathematical and statistical methods

Developing image processing techniques for estimating eggplant trichome density. **Porca, A.A., Madrid, V.R.M., Taylo, L.D., Cainday, J.T., Hautea, D.M.** 25. Federation of Crop Science Societies of the Philippines/1. Federation of Plant Science Associations of the Philippines Scientific Conference, , Apo View Hotel, Davao City (Philippines), 16-21 Sept 2019. *Philippine Journal of Crop Science (Philippines)*. 0115-463X. v. 44(Supplement no. 1) p. 59-60. (Sept 2019).

Eggplant leaf trichomes have been documented to be an insect resistance factor especially for sucking insects. Trichomes serves as a mechanical barrier that impede feeding and oviposition of leafhopper. Characterization of trichomes of eggplant germplasm is labor-intensive and prone to bias. This study explored the implementation of a digital solution using computer vision to automatically count the density of leaf trichomes and the trichome images used were taken at the Institute of Plant Breeding on February 2019. The automation was divided into four parts: (1)image acquisition, (2)image enhancement, (3)image binarization, and (4)trichome cluster detection and counting via its central disk. First, the leaf images were acquired using a stereo zoom trinocular microscope with 20x magnification. Second, the images were enhanced by using a sharpening and histogram equalization techniques. Third, the enhanced images were then subjected to grayscale morphology opening operation to bring out the central disks of the trichomes. Then the images were binarized using intensity slicing and adaptive thresholding to isolate the central disks of trichomes. Finally, each cluster of trichome was detected and counted if they were found inside the leaf structure in the image. The computer vision approach developed was able to provide estimate with 85% degree of precision. Although only stellate trichomes were analyzed in this study, the technique used can be easily modified to detect other types of trichomes in other crops as well.

AUBERGINES; SOLANUM MELONGENA; LEAVES; TRICHOMES; PLANT HAIRS; IMAGE PROCESSING; IMAGE ANALYSIS; IMAGERY

Exploring utility of formal concept analysis approach to coral reef assessment. **Madrid, V.R.M., Lactuan, L.K., Corral, J.M.** *Journal of Environmental Science and Management (Philippines)*. 0119-1144. Special issue no. 2 p. 47-57. (2016).

This study explored the use of formal concept analysis (FCA), a data mining technique, to analyze coral reef transect data (in terms of life forms) and comparing its results to the standard assessment analysis. Utilizing the quadrat-life form as the object- attribute pair, the results derived from the context was analyzed to assess the coral reefs in the study site which consisted of three stations. Data from Station 1 and Station 2 showed the dominance of *Acropora digitate* and *Acropora branching* life forms, respectively. Some life forms were absent from both Stations 1 and 2 but all life forms were present in Station 3 with eight life forms having the highest occurrence. Station 3 had the highest diversity of life forms while Station 2 had the highest live coral cover. This study showed how FCA can be used to generate new knowledge from transect data that can be veried by traditional coral reef assessment results, a possible complement to standard coral reef assessment analytical tools. FCA approach shines when it deals with large data sets

from many different sources, which may pave the way for data-driven ecological assessment analysis studies such as those already being done for agriculture.

DATA COLLECTION; IMAGE ANALYSIS; CORAL REEFS; MONITORING; ENVIRONMENTAL IMPACT ASSESSMENT