

AGRICULTURAL SCIENCES

AS-01

ESTIMATION OF GENETIC VARIABILITY IN TWO MAIZE (*Zea mays* L.) POPULATIONS FOR DROUGHT TOLERANCE

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The experiment was conducted to estimate genetic variation in IPB Var 6 and IPB Var 13 using full-sib and S1 families and assess the performance of these two populations to drought stress imposed at flowering stage. Reduction in performance for morphological traits, yield related traits and grain yield itself was an evidence of the effect of water limiting condition to maize plants. However, it causes lengthening effect on days to anthesis and silking, leading to prolonged anthesis-silking interval. IPB Var 6 exhibited more tolerance to drought stress than IPB Var 13. Variance components quantified revealed sufficient variability for almost all traits which is useful in genetic enhancement of both populations. Heritability for yield was lower under drought compared to normal as genetic variance decreased more rapidly than environment variance with the onset of stress. The low rank correlation of the full-sib families for yield between normal and drought conditions suggests the need for separate evaluation under the two contrasting conditions to identify stable genotypes. But using S1 families, the rank correlation was high *i.e.* those good under normal are also good under drought. This suggests the efficiency of S1 testing when breeding for this particular stress.

Keywords: correlation, drought stress, genetic variability, heritability, maize

AS-02

UPLAND RICE LANDRACES AND TRADITIONAL VARIETIES OF BUKIDNON: HOW DIVERSE? HOW VALUABLE?

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Enhancing upland rice production is one of the small solutions to help achieve rice sufficiency in the country. Or, even if to just alleviate poverty in the upland agro-ecosystems. Improved genotypes contribute to this goal at a relatively low cost to farmers. This study determined the availability of upland rice landraces and traditional varieties (URLTVs) in selected areas in Bukidnon, estimated the diversity of available genotypes, and documented their use and importance. Twenty-four barangays from 10 municipalities and 2 cities were surveyed from November 2010 to May 2011. Interviews (n=45), seed sourcing, and evaluation of 13 seed traits were done. A total of 140 URLTVs were collected, of which 66 were from Barangay Matupe, San Fernando. Overall, 82 URLTVs (59%) were sourced from San Fernando, whose peoples were mostly of the Matigsalug tribe. As per ANOVA, lemma and palea color (LPC), caryopsis: pericarp color, and lemma: apiculus color (LAC) were variable among municipalities/cities. However, as per SWDI, 100 seed weight, grain length and width, grain thickness, caryopsis length and width, and LAC showed high diversity ($H' = 0.76$ to 0.88). Thirteen significant associations among seed traits with $r > 0.50$ were noted. The URLTVs were grown for household consumption, church offering, food for special occasions, and to reduce chemical inputs. For the Matigsalugs, their URLTVs serve to strengthen their cultural beliefs and are trademarks for their tribal group. Further collection from other areas of Bukidnon needs to be done to ascertain the available germplasm and the threats to these plant genetic resources.

Keywords: upland rice, *Oryza sativa*, landraces, traditional varieties, Bukidnon, plant genetic resources, food security, genetic diversity

AS-03

SOYBEAN BREEDING AT CENTRAL MINDANAO UNIVERSITY FOR HIGH SEED PROTEIN AND SEED YIELD

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Soybean is largely consumed in the country in various ways but mainly as animal feed but local production is very inadequate. Importation of soybean meal, oil and other products has increased through the years. Currently, there are few outstanding soybean varieties developed in the Philippines and breeding efforts have declined. Availability of high-yielding (HY) and high-protein (HP) cultivars could encourage local production, since on average Philippine varieties have about 33% protein. Soybean breeding at CMU commenced in 2008. Seed yield and protein concentration are generally negatively correlated but Jamago and Nelson's (2007) protocol had been promising in hurdling this breeding bottleneck, and was employed for this study. Using locally available germplasm, 22 F_2 populations were developed in 2009. In 2010, selections were made at the F_2 based on stand, maturity, pods per plant, and overall morphology. A total of 370 F_2 selections were evaluated for yield in 2011 as $F_{2,3}$ families with PSB Sy2 as check. Days to flowering, maturity, plant height, lodging score at maturity, 100 seed weight, seed yield, and crude protein concentration (CPC), among others were measured. Mean CPC of $F_{2,3}$ lines ranged from 34.66% to 47.34% (F_3 NSIC Sy8 x PSB Sy2). PSB Sy2 had 40.77% CPC. All lines with CPC either higher or comparable to PSB Sy2 will be advanced as HP populations from whence lines variable for yield may be selected. Desirable HP and HY lines are hoped to be identified in the F_5 or F_6 generation.

Keywords: soybean, *Glycine max*, soybean breeding, seed protein concentration, seed yield, Central Mindanao University, CMU

AS-04

INDUCED CHLOROPHYLL VARIATION IN PINEAPPLE CV. 'QUEEN' BY GAMMA IRRADIATION (⁶⁰COBALT)

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Irradiation using gamma rays (⁶⁰Cobalt) coupled with *in vitro* culture techniques was undertaken to induce variation or mutation in pineapple. Calli from crown meristem tips of pineapple cv. 'Queen' [*Ananas comosus* (L.) Merr.] were initiated using Murashige and Skoog's basal medium supplemented with 10mg/liter 4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid (Picloram). High percentage of growth and shoot proliferation was observed in basal medium supplemented with 50 µM benzene adenine purine (BAP) and 10 µM gibberrellic acid (GA) after 8 weeks *in vitro*. Regenerants derived from shoots using different doses of gamma rays (0, 5, 10, 15, 20, 25 and 30 Gy) were evaluated under laboratory conditions. Of the different doses, 15 Gy produced the most variegation in young shoots (chlorophyll variants) maintained *in vitro*. The variants appeared to have yellow and green color combinations on the young leaves of pineapple 'Queen' variety. When transplanted inside the greenhouse, high percentage of plantlets survival was observed, ranging from 90-95%. Of the different irradiation doses, variegation in young leaves was observed at 15, 20, 25 and 30 Gy. Further assessment on the effect of irradiation is currently being undertaken under screenhouse conditions. The variants produced could serve as basis for selection of ornamental-type pineapple. In addition, protocols developed on the use of *in vitro* culture techniques could be utilized as a tool for induced mutation breeding in pineapple.

Keywords: chlorophyll variants, *in vitro* culture technique, irradiation, gamma ray, Murashige and Skoog, mutation breeding, pineapple cv. 'Queen'

AS-05

SCALING UP OF SSNM MAIZE TECHNOLOGY FOR WIDER ADOPTION IN THE PHILIPPINES

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The Site-Specific Nutrient Management for Hybrid Maize (SSNM Maize) Technology was developed for the Philippines through collaborative research in 3 key maize areas in 2005-2008. Using the same approach, wider scale on-farm trials (OFT) were conducted in key sites in sixteen regions from 2008 to 2010 with the goal of improving productivity and profitability in wider maize areas in the country. Through OFTs the project was able to a) quantify maize yield gaps, b) quantify attainable yield and yield responses to fertilizer NPK, c) evaluate the agronomic and economic performance of SSNM, and d) estimate the contribution of Bio-N and organic matter application. Results showed that there are significant opportunities for increasing maize production, where the yield gap between farmers' yield and attainable yield is 2.1 t ha⁻¹. Research data showed that the national average yield is lower than that obtained by progressive farmers and that there is a wide range of attainable yield obtained across regions. Field results likewise showed that Bio-N and organic fertilizers can substitute 23 kg N/ha of total N requirement of maize and are more effective when combined with inorganic fertilizer. Farmer participatory evaluation (FPEs) was done in some sites in 2010-2011 dry and 2011 wet season involving more farmers and with bigger plot sizes. The Nutrient Expert for Hybrid Maize™, a decision support software developed by the International Plant Nutrition Institute (IPNI), and the Quick Guides for fertilizing maize in large areas, developed through the project, are two significant outputs of the SSNM Maize activities in the Philippines and are planned for wider dissemination.

Keywords: maize, site-specific nutrient management, SSNM Maize technology, Bio-N, Nutrient Expert for Hybrid Maize™

AS-06

CHEMICAL FERTILIZER REPLACEMENT CAPABILITY OF MYKOVAM BIOFERTILIZER FOR INCREASED GROWTH AND FRUIT YIELD OF OKRA

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Okra (*Abelmoschus esculentus* L. Moench) is one of the Philippines' major fresh vegetable for export. In 2010, 4,500MT of okra was exported to Japan valued at \$15M (about P600M). A field trial was conducted to assess the capability of MYKOVAM biofertilizer (containing mycorrhizal fungi) in replacing chemical fertilizer for increased growth and marketable fruit yield of okra. The experiment was established at the Central Experimental Station, UP Los Baños, Laguna from February to July 2011. Treatments were applied during seed sowing (Mykovam), transplanting (NPK) and two and four weeks (urea) after transplanting. Highest total fruit yield was obtained from those treated with the full Recommended Rate of Chemical (RRC) fertilizer (14-14-14 and 46-0-0) and RRC+Mykovam, with increases of 92 to 94% over the control which had the lowest (5,477g/1m x 5m plot). Fruit yield and number were significantly increased with Mykovam+1/2RRC which were comparable with those treated with RRC and RRC+Mykovam. Moreover, Mykovam+1/2RRC gave comparable height, root collar diameter, and total dry weight with those treated with RRC+Mykovam. Total dry weight was increased by 100% compared with 71% only by the latter. The uninoculated unfertilized control had the lowest height (66cm), root collar diameter (1.63cm) and total dry weight (91.8g/plant). In conclusion, Mykovam can replace half of the recommended NPK fertilizers with growth comparable with those treated with full chemical fertilizer rates. Mykovam treated plants gave more marketable fruits than with chemical fertilizers.

Keywords: *Abelmoschus esculentus*, mycorrhizal fungi, complete fertilizer, urea

AS-07

BIO-FORTIFICATION OF ZINC IN RICE (*Oryza sativa* L.) GRAINS THROUGH SOIL AND WATER MANAGEMENT**Jonathan C. Descalsota¹** and Pearl B. Sanchez²

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Rice is considered as the staple food of most Asian countries however milled rice is mainly carbohydrate and has relatively low concentration of crude protein, crude fat, crude fiber, minerals and vitamins. Efforts are now undertaken to increase the level of minerals (i.e iron, zinc, etc.) in rice grains. In line with this, a pot experiment was conducted to study the influence of chicken manure application and water management on zinc concentration in rice grains. The treatments consist of two soil type (Buguey clay loam and Alimodian silty clay), two rice varieties (MS13 and IR72), two water management (saturated and flooded) and two levels of chicken manure application (0 and 3 t ha⁻¹). The sixteen treatment combinations were replicated three times and laid out in randomized complete block design. Results showed that application of additional chicken manure significantly increased grain yield, straw yield and Zn as well as uptake of other nutrients like N, P, K in grains since chicken manure provided additional source of these nutrients. Flooding combined with chicken manure application resulted in highest grain yield. Zinc concentration and uptake as well as grain yield were higher in varieties grown on Alimodian silty clay. Grain yield and Zn uptake of MS13 was not significantly influenced by water management whereas flooding increased grain yield and Zn uptake of IR72.

Keywords: rice, zinc, bio-fortification, uptake, grains

AS-08

**SINGLE NUCLEOTIDE POLYMORPHISMS IN THE
WATER BUFFALO (*Bubalus bubalis*) LEPTIN GENE
ASSOCIATED WITH HIGH MILK YIELD WITH
IMPLICATIONS TO THE PHILIPPINE CARABAO
CENTER'S DAIRY BUFFALO BREEDING PROGRAM**

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Traditional selection of dairy buffalo cows involves collecting milk performance data for 2-3 lactations and ranking them based on the milk production, taking 6-7 years to identify a good milker. In the case of bulls, milk performance data of daughters are evaluated to identify animals with high genetic merit, taking around 8 years. Using available performance records coupled with single nucleotide polymorphisms (SNPs) associated with milk production traits, identification of good dairy animals can be dramatically shortened while increasing the accuracy of selection. This study aimed to identify potential SNPs of the water buffalo leptin gene that are associated with milk yield and milk component traits. Deoxyribonucleic acid (DNA) samples of buffalo cows with milk performance data were used in the study. Since the buffalo genome has not yet been sequenced, primers used to amplify the coding regions were based on the gene sequence of cattle. Association studies revealed that animals with the 'CC' and 'CT' genotypes have statistically higher milk yield compared with animals carrying the 'TT' genotype. SNPs associated with milk yield and milk component traits will be used as a selection tool in conjunction with Best Linear Unbiased Prediction (BLUP). Pre-selection of young bulls carrying the favourable genotype can reduce the number of bulls entering the progeny testing program, thus, lowering the cost of running the program. Moreover, potentially good replacement heifers can be selected by genotyping even at a young age, thus, shortening the generation interval.

Keywords: water buffalo, milk production, leptin, DNA, SNP, breeding program

AS-09

GROWTH PERFORMANCE OF SHEEP FED WITH FORMULATED RATION AND UREA MOLASSES MINERAL BLOCK

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Aside from the breed of sheep to be raised, roughages or grasses also play an important role in sheep production especially during the dry season wherein grasses are not enough and of low quality for animal nourishment. This study was conducted to determine the growth performance of growing-fattening sheep fed with formulated ration (FR) and Urea Molasses Mineral Block (UMMB). The study was laid-out in Randomized Complete Block Design with four treatments (Napier alone, Napier + FR, Napier + UMMB and Napier + FR + UMMB) and replicated three times. Based on the result, cumulative bi-weekly weight showed that sheep fed with napier + FR + UMMB consistently gained more than those fed with napier alone and napier + FR but comparable to those fed with napier + UMMB. The average daily gain in weight of sheep fed with napier + FR + UMMB gained significantly more per day (57.14g) but comparable to those fed with napier + UMMB (50.79g). Sheep fed with napier alone had the least gained in weight per day (32.80g). The ability to convert feeds into body weight was not significantly affected by the supplementation. However, sheep fed with napier + UMMB required least amount of feed, 13.69 kg feed/kg gain in weight. Sheep fed with napier alone required the greatest amount of feed, 20.26 kg of feeds/kg gain in weight. Sheep fed with napier + FR + UMMB incurred significantly higher expenses (P127.58) as compared to the other treatments. Thus, UMMB supplementation can increase production with lesser expenses.

Keywords: Sheep, Napier, Ration, UMMB, Supplementation

AS-10

**DEVELOPMENTAL COMPETENCE AND MIDKINE
EXPRESSION OF WATER BUFFALO (*Bubalus bubalis* L.)
OOCYTES IN MEDIA SUPPLEMENTED WITH RETINOIC
ACID DURING *IN VITRO* MATURATION**

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Retinoic acid (RA), a vitamin A metabolite, regulates cellular growth, embryonic morphogenesis and differentiation. In this research, two studies were conducted to examine the effects of all-trans RA on the developmental competence of water buffalo oocytes. In Study 1, the desired concentration and effects of all-trans RA was determined by examining its action on cumulus expansion, nuclear maturation, and embryo development and quality after *in vitro* fertilization. In Study 2, the midkine (MK) expression of the cultured oocytes was analyzed to examine its molecular effect. Midkine is a product of a retinoic acid responsive midkine gene (MDK) reported to enhance development of oocytes. Oocytes were retrieved from slaughterhouse derived ovaries and *in vitro* matured in maturation medium containing 0 (vehicle), 1, 3 and 5 μ M all-trans RA. Vehicle used was ethanol. Oocytes matured without vehicle and RA in the maturation medium was used as Control group. Results showed that cumulus expansion, development to Metaphase II, cleavage and blastocysts development as well as blastocysts quality were improved in the presence of all-trans RA in the *in vitro* maturation medium. The presence of all-trans RA improved the MK expression but without all-trans RA, MK expression diminished during *in vitro* culture as evidenced by the faint band observed in the immunoblot and very weak signal detected by immunostaining with FITC in the Control group. The findings demonstrated that all-trans RA enhanced *in vitro* maturation of water buffalo oocytes to positively influence the development of embryos after *in vitro* fertilization.

Keywords: *in vitro* maturation, carbohydrate uptake, midkine expression, water buffalo, retinoic acid

AS-11

**IMMUNE RESPONSE OF *Macrobrachium rosenbergii*
IMMERSED WITH HOT-WATER EXTRACT FROM
Gracilaria edulis CHALLENGED WITH *Vibrio alginolyticus***

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Macrobrachium rosenbergii is the species most favoured for freshwater shrimp farming purposes and remains by far the major subject of cultivation for commercial farming. However, despite their innate immunity, shrimp farms have been experiencing decreased production brought by viral and bacterial disease outbreaks. *Vibrio alginolyticus* is a bacterial pathogen responsible for high mortality of cultured shrimps worldwide. *Gracilaria edulis*, a species that is abundantly distributed all over the country has not yet been tested for its immunostimulant properties. Here we report for the first time the efficiency of hot-water extracts from *G. edulis* as an immunostimulant in *Macrobrachium rosenbergii*. Immune parameters, including total haemocyte count (THC) and phenoloxidase (PO) activity were examined, as well as resistance to *V. alginolyticus* infection. Upon immersion in 0.1g/L of the extract, the shrimps exhibited higher THC and greater PO activity compared to the control group. Shrimps immersed in 0.1g/L dosage, significantly increased percentage survival at the end of the challenge test, highlighting its capability in inducing bacterial resistance particularly against *V. alginolyticus*. Furthermore, it was found that doses larger than 0.1g/L are detrimental to the health of shrimps. The hot-water extract from *G. edulis* has an immuno-stimulatory effect on freshwater shrimp *M. rosenbergii*. Overall, the results demonstrated that exploring the Philippine *Gracilaria* species and their application as immuno-stimulants might pave the way in the development of local feeds for the country's aquaculture industry.

Keywords: *Gracilaria edulis*, *Macrobrachium rosenbergii*, *Vibrio alginolyticus*, total hemocyte count (THC), phenoloxidase (PO)

AS-12

CYTOTOXIC POTENTIAL OF THE INVASIVE WEED SPECIES *Chromolaena odorata* L. IN THE ZAMBOANGA PENINSULA

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Chromolaena odorata is an aggressive invasive plant species that has spread in vast areas of the Philippines including many farmlands in the main island of Mindanao. The species is highly competitive and is known to contain strong allelochemicals, but specific bioactive compounds vary in composition with sampling locality. In this study, ethanol and aqueous crude extracts of *C. odorata* leaves were prepared, and their effects on tomato seed germination and seedling growth and onion root cells mitotic index were investigated. Ethanol crude extracts significantly inhibited germination and seedling growth in tomato, and reduced the mitotic index in onion root tips. The ethanol extract was subjected to column chromatographic elutions and eleven (11) fractions were obtained subjected to bioassay. Results revealed that only fractions 4 and 5 inhibited tomato seed germination at 25% concentration by volume. Phytochemical screening revealed that fractions 4 and 5 are positive for the presence of alkaloids and steroids. These two chemical components were believed to be primarily responsible in inhibiting seed germination and seedling growth in tomato as well as reducing the mitotic index in onion root tips. The inhibitory properties of these bioactive compounds operate at the cellular level, and may help attribute to their successful invasion in the Zamboanga peninsula.

Keywords: *Chromolaena odorata*, Zamboanga Peninsula, invasive plants, mitotic index, crude extracts, germination inhibition

AS-13

ASSESSMENT OF THE VARIABILITY OF RAINFALL AND TEMPERATURE IN ILOCOS NORTE, PHILIPPINES FOR CROP PRODUCTION MANAGEMENT

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Climate change is now widely recognized as a major environmental problem facing the globe. In the Philippines, the variability of rainfall and temperature had already been generally analyzed but limited studies have been conducted so far to determine the extent of this phenomenon in specific localities. In view of this, it is therefore important to analyze the local weather data to have better understanding of the changes that have been occurring and to come up with coping mechanisms or climate change adaptation strategies and thereby minimizing its negative impacts. This study aims to provide decision-makers with the needed information and tools to manage or mitigate the risks brought about by the changes in rainfall and temperature in the province of Ilocos Norte. Thirty-five-year (1976-2010) daily weather data on rainfall and temperature from MMSU-PAGASA Agrometeorological Station in Batac, Ilocos Norte and 30-year (1981-2010) tropical cyclone data from Laoag City, Ilocos Norte Synoptic Station were analyzed to determine the variability of rainfall, temperature, and cyclone patterns in Ilocos Norte. Annual and monthly variations were determined using descriptive statistics and simple linear regression analysis was used to determine the degree of annual change. Average data from 1976-1990 (normal base period) and 1991-2010 were compared to find out if there were changes that occurred during these periods. Result showed that there is an increase in annual temperature and this was found to have deviated from the normal-base period. With respect to rainfall, the annual trend is variable but there is a significant change in monthly pattern and a slight change in the frequency of maximum rainfall events. On the other hand, the number and intensity of tropical cyclone increases annually and deviated from the normal. Likewise, monthly trend and intensity posted a remarkable change.

Keywords: climate change, rainfall, temperature, Ilocos Norte, crop production management

AS-14

ELEVATED SOIL ORGANIC CARBON TURNOVER IN LIMED ACID SOILS: CONTRIBUTIONS OF PRIMING EFFECT OF LIME TO ATMOSPHERIC CO₂ EMISSIONS

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Agricultural ecosystems are significant terrestrial sources of atmospheric CO₂. Management practices like liming of acid soils were initially found to accelerate CO₂ emission due to the mineralization of lime-carbonates. We used ¹³C-labeled calcium carbonate [Ca¹³CO₃ (13C 99%)] as lime and tracer in a 33-day constant temperature laboratory incubation experiment. We were able to distinguish and quantify lime-CO₂ and soil organic carbon (SOC)-CO₂ from an acid soil and identified contribution of liming to the turnover of native SOC. It was confirmed that 67.01–67.43 % of total CO₂ emission was lime-CO₂, indicating that it is the major source of CO₂ emission during liming. SOC turnover (¹²CO₂) between limed and non-limed samples indicated a priming effect (PE) of 47.44–51.01 %. PE are short-term increases in SOC turnover due to moderate treatment of the soil. ¹²CO₂ turnover was higher by 8.69–8.81 mg kg⁻¹ dry soil in limed samples. To determine the source SOC pool of the extra ¹²CO₂ emission in limed samples we have separated the stable SOC fraction using a combined chemical dispersion and physical fractionation procedure. It was confirmed that the increased turnover of SOC have originated from the labile SOC fraction and not from the stable pool. Considering the extent of global acid soils and world utilization of lime, we need to incorporate the contribution of the priming effect of lime in our CO₂ simulation and modeling studies in terrestrial ecosystems.

Keywords: liming, mineral-associated organic carbon, soil organic carbon, priming effect, CO₂

AS-15

**GIS-AIDED CROP SUITABILITY ASSESSMENT
AND DESIGN OF CROP INTENSIFICATION AND
DIVERSIFICATION MODELS FOR MAJOR SOIL SERIES
IN UPLAND NON-RICE-BASED FARMING SYSTEMS IN
BATANGAS, PHILIPPINES**

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Effective and feasible land use planning at present requires systematic evaluation of inter-relationship among attributes of land to acquire optimum and sustained crop yield. Adopting the 1976 FAO framework, land evaluation was performed for major upland land units (LUs) in non-rice-based land utilization types (LUTs) in Batangas to characterize the major upland soils, assess the suitability to important crops and design the development models in agreement with the cropping intensification and diversification potential of the area using Geographic Information Systems (GIS). Pertinent biophysico-chemical variables of LUs were considered for crop-land suitability analysis. Results show that considerable portion of eight soil series analyzed by quick fertility test had moderate nutrient availability while Sibul and Taal series were moderately low and Tagaytay was high. Generally, most of the crops were classified as moderately (S2) and marginally suitable (S3) due to limitations on topography (t), soil physical condition (s) and fertility (f). Coconut-banana intercrop and single corn system models can be intensified (S2wstf-S2wst and S3tsf, respectively). For corn-sweet potato double crop, land use shift to pineapple cultivation (S2tfs rating and PhP 130,381 ha⁻¹ net benefit) is recommended due to severe limitations of Tagaytay sandy loam (8-16% slope) and current unsuitability to corn production (U1fts). Diversification models are focused to recommend modifications on vegetable and sugarcane LUTs. Sitao (S2tws) is socially-accepted and suitable to vegetable production models. Green pepper (S2wsft) and goat integration in sugarcane farming model is expected to gain a net benefit of PhP393,976 ha⁻¹. When the schemes are applied in certain areas, farmers can adopt the identified combination of specific component technologies. Since crop yields are location and season specific, the models can be subjected to validity thru field trials to determine the actual increase on productivity and profitability in the area.

Keywords: intensification, diversification, GIS, component technology

AS-16

**PHENOTYPIC DIVERSITY IN A POPULATION OF RICE
BLACK BUGS, *Scotinophara molavica* (HEMIPTERA:
PENTATOMIDAE) FROM BUUG, ZAMBOANGA SIBUGAY,
PHILIPPINES**

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Rice black bugs (RBB) are believed to be a serious pest of rice infesting all growth stages of the plant. Different management approaches have already been applied to control and regulate populations of this pest. However, control efforts have been muddled by lack of understanding of the taxonomy of this insect resulting from immense intra- and inter-population diversity in phenotypic traits. Here, a total of thirty one traits were scored from an outbreak population consisting of one hundred and twenty female rice black bugs from Buug, Zamboanga Sibugay and analyzed using principal component analysis. Plots of the two principal components summarizing 68.8% of the total variation and subsequent K-means clustering showed that this population of RBB belong to at least four groups distributed as follows: group 1 – 14 individuals; group 2 – 12; group 3- 60 and group 4 – 34. These individuals are polymorphic for nine traits only, specifically on the length of relative lengths of the Tylus and the Jugum, presence of Cicatrices humps, number of antennal segments, shape and reach of the Scutellum, Shape of the junction of vein R+M in the outer wing, number of closed marginal cells, Inumber of ongitudinal veins below discal cell, and Proboscis reach. The importance of these traits to intra-population divergence and life history of the RBB has yet to be determined. Thus, further studies should be conducted to determine the genetic and functional bases of the observed diversity. This information is necessary for the proper formulation of management strategies for the control and regulation of populations of this insect.

Keywords: Rice Black bugs, phenotypic diversity, K-means clustering, principal component analysis, *Scotinophara molavica*

AS-17

DIETARY EFFECT OF SAPONIN AND/OR YUCCA ON GROWTH, ANTIOXIDANT CAPACITY AND METABOLIC RESPONSE OF NILE TILAPIA *Oreochromis niloticus* L.

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The use of synthetic substances that were found to increase the efficiency of feed utilization by animals such as antibiotics and steroid hormones as animal feed additives are currently prohibited in several countries. In this context, search for natural, biologically active, and renewable plant products that could be used to replace hazardous synthetic growth stimulants are relevant. Saponin (S) can be a potential replacement since it can enhance the growth performance as well as the immune response and resistance of fish. This study evaluated the effects of S and/ or yucca (Y) on growth, antioxidant capacity and metabolic response of Nile tilapia *Oreochromis niloticus* (1.9 ± 0.08 g). The commercial diet served as the control (C). Fish were fed diet containing 150 mg kg^{-1} S, 150 mg kg^{-1} Y or combination of 75 mg kg^{-1} S and 75 mg kg^{-1} Y (S/Y) for 8 weeks. Weight sampling was conducted every 2 weeks while survival was monitored everyday. Antioxidant capacity and metabolic response were analyzed after 8 weeks of feeding. The S/Y-fed fish had the highest weight gain among treatments. On the other hand, no significant difference was observed in survival. S/Y-fed fish had the lowest SOD level among treatments. On the other hand, glucose level of S-, Y- and S/Y-fed fish was decreased by 26, 42 and 60%, respectively as compared to the C. These results indicated that S/Y in the diet improves the growth performance, enhances the antioxidant activity and stabilizes the metabolic response of fish.

Keywords: antioxidant capacity, *Oreochromis niloticus*, metabolic response, saponin, yucca

AS-18

CAGE CULTURE AND LAKE MANAGEMENT PRACTICES IN LAKE DANAOS, SAN FRANCISCO, CENTRAL PHILIPPINES

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Lake Danao of Camotes Island was studied to find out its status and government initiatives to conserve the lake being the source of livelihood and a tourist destination in the Islands of Camotes. The interview guide and actual field visits were used to gather data. Results show that fishing with the use of gill nets and fish pots topped among the activities of the inhabitants in Lake Danao, followed by soli-soli gathering for mat weaving and other articles, ecotourism, aquaculture and nipa shingles making. Government initiatives in conserving and sustaining the lake includes the legislative supports which are declaring Lake Danao as flora and fauna sanctuary; requiring barangay captains of six lakeshore barangays to implement activities for lake protection; declaring September 18 of every year as Municipal Clean Up Day in the marine and lake waters of San Francisco; prohibiting slash and burn farming on lakeshore; prohibiting cutting of mangroves and other tropical trees in the lake; ban on bird hunting around the lake; soli-soli plant cutters/weavers to secure mayor's permit; prohibiting the use of motorized vessels, carabao bathing and washing of clothes and laundry along lakeshore; prohibiting construction of dwellings and other structures twenty meters from lakeshore; adopting and implementing of articles 51 and 52 of RA 1067 prohibiting solid waste and garbage dumping in the lake; collecting entrance fees from Lake Danao visitor and creation of San Francisco Lakewatch. Aquaculture activities in the lake are only given to BFAR, LGU and other agencies to control proliferation of cages and maintain the carrying capacity of the lake. BFAR-7 had a quarterly restocking of the lake with 50,000 tilapia fingerlings and imposing the standard size of gillnets to be used in fishing. The Cebu Technological University and BFAR-7 conducted limnological researches of the lake to monitor lake health and sustainability.

Keywords: cage culture, Lake Danao, Central Philippines, Camotes Island

AS-19

**ANTIOXIDANT CAPACITY AND METABOLIC
RESPONSE OF RED STRIPED SNAPPER (*Lutjanus
erythropterus* Bloch, 1790) FED DIETS WITH
ASTAXANTHIN AND/OR OXIDIZED OIL**

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Marine fish diets contain large amount of highly unsaturated fatty acids (HUFA) which are easily oxidized. The oxidized HUFA might lead to oxidative stress in fish. Aside from pigment-enhancing property of astaxanthin (AX), it is commonly supplemented to fish diet to act as a powerful antioxidant against oxidative stress. This study evaluated the effects of AX on antioxidant capacity, metabolic response and liver AX content of red striped snapper (*Lutjanus erythropterus*) (20.05±1.65 g) fed diet with or without oxidized oil (OX). The commercial diet served as the control (C). Fish were fed diet containing 240 mg kg⁻¹ AX, 100 ml kg⁻¹ OX or combination of 240 mg kg⁻¹ AX and 100 ml kg⁻¹ OX (AX+OX) for one day. Antioxidant capacity and metabolic response were monitored at 0, 6, 12, 24, 48 and 72 h and liver AX content was analyzed at 72 h after feeding. The AX-fed fish (AX and AX+OX) had significantly lower antioxidant capacity and metabolic response at 6 and 12 h than the non AX-fed fish (C and OX). On the other hand, OX-fed fish resulted in higher GPx at all sampling times, except 24 h, as compared to the non OX-fed fish. Moreover, OX-fed fish had higher GR, glucose, triglycerides and lactate at 6 and 12 h than the non OX-fed fish. Additionally, treatments that received AX showed significantly higher liver AX content. These results indicated that AX could enhance the antioxidant capacity and metabolic response of *L. erythropterus*.

Keywords: antioxidant capacity, astaxanthin, *Lutjanus erythropterus*, metabolic response, oxidized oil

AS-20

FORMULATION AND EVALUATION OF DIFFERENT MUTTON RECIPES

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Sheep is easy to raise, require less capital, has short production cycle and prolific. However, farmers are raising limited number of sheep because there was no ready market for fresh mutton. Disposing and selling the animals at a right time has a greater impact on income derived from venturing to animal production. To encourage farmers to venture on sheep production, ways must be designed and developed on how to utilize mutton or lamb aside from fresh meat. Two recipes (burger patty and skinless sausage) were formulated and prepared. The products were cooked and subjected for organoleptic test. The products were evaluated for aroma, taste, texture, appearance and general acceptability using the 9-point Hedonic scale. Five different groups served as evaluators. The products were also subjected to microbial analysis and descriptive analysis was used in the study. In terms of aroma, taste, texture and general acceptability, both the burger patty and skinless sausage were rated *Like Very Much*. For appearance of the products, skinless sausage rated *Like Very Much* while the burger patty was rated *Like Moderately*. Rating for the appearance was attributed to the color of the processed product. Skinless sausage was attractive due to the added food color to the product because mutton is whitish in nature. Results of the microbial analysis showed that just after slaughter, *E. coli* was detected. This maybe because parts of the animal such as skin, hooves, rumen and intestines contained enormous counts of bacteria. However after processing the products, no trace of *Salmonella*, *Staphylococcus coagulase* and *Listeria monocytogenes* were found in the processed products. Based on simple cost and return analysis, skinless sausage cost P9.62 per piece while one piece of burger patty cost P8.05. Mutton can be processed into skinless sausage and burger patty and can satisfy the taste of the Ilocano consuming public.

Keywords: sheep, mutton, formulated, sausage, patty

AS-21

GROWTH PERFORMANCE OF *Eucalyptus robusta* Sm. AND *Pterocarpus indicus* Willd. TO WEEDING AND SPACING TREATMENTS IN BUKIDNON, PHILIPPINES

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Eucalyptus robusta Sm. and *Pterocarpus indicus* Willd. are promising plantation species in Bukidnon. The former species is exotic while the latter is endemic in the Philippines. The study was conducted to evaluate the effects of various weeding and spacing treatments on the growth performance of the two tree species planted under smallholder-farm conditions. It was laid-out in split plot design replicated three times. Spacing treatments comprised the main plot of the study while the weeding treatments served as the subplot. The study was carried out in Lantapan, Bukidnon with a duration of three (3) years. Findings revealed significant difference in stem diameter increment and degree of termite infestation in *E. robusta*. On the other hand, significant difference in height growth was observed in *P. indicus*. *E. robusta* has a diameter increment of 5.5 cm in ring weeding treatment while only 4.2 cm. in strip brushing treatment. Degree of termite infestation was also lesser in ring weeding with 32.9% compared to strip brushing treatment with 39.2%. In *P. indicus*, wider spacing (2 meters x 4 meters) presented taller height growth with 216.8 cm while the treatment of closer spacing (2 meters x 2 meters) had only 171.8 cm. Furthermore, ring weeding treatment was slightly higher in height growth for *P. indicus* with 197.4 cm as compared to strip brushing with 197.3 cm. On farmers' evaluation, ring weeding treatment was preferred over strip brushing since the former accordingly was easier to perform with less time spent in carrying out the activity. Frequency of conducting ring weeding in the plantation was lesser (2 times a year) as compared with strip brushing which was between 3-4 times a year. In terms of spacing, farmers prefer wider spacing since there was lesser number of trees maintained for weeding operations.

Keywords: *Eucalyptus robusta* Sm., *Pterocarpus indicus* Willd., Strip brushing, ring weeding, spacing

AS-22

PRIORITY PROTECTION, CONSERVATION AND DEVELOPMENT AREAS OF MAKILING-BANAHAW GEOTHERMAL AREA, PHILIPPINES

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As one of the environmental stewards of the area, CHEVRON Geothermal Philippines Holdings, Inc. (CGPHI) and Aboitiz Power Renewable Inc. (APRI) intends to pursue its important role of fostering responsible use of this area's life sustaining ecological resources for present and future generations through community-based ecological initiatives, pollution prevention activities, resources management programs, awareness and education. The general spatial distribution of priority protection, conservation and development areas within the ecological influence areas of Mak-Ban was determined by analyzing slope, elevation, vegetation cover and location of facilities. The study map of priority protection, conservation and development areas such as soil and water conservation and forest biodiversity areas. Areas with slopes of more than 50% should be considered as priority protection areas and these areas are concentrated in the Sipit headwaters in Mt. Makiling, which are still with natural forest cover. Potential conservation areas or areas that have moderate to steep slopes and may or may not adequate vegetation cover. Relative to CGPHI facilities, all slopes at Mt. Bulalo poses threat, with the greatest towards the western slopes because of more facilities that would be affected. Vegetation cover can help mitigate the risks inherent in steep areas. As these areas are being cultivated, farming and land use strategies that promote soil and water conservation and promote biodiversity should be encouraged and sustained. Strict protection would be necessary for these areas and risk reduction studies maybe appropriate for potential impact areas.

Keywords: ecological areas, priority protection, conservation, development areas, headwaters

AS-23

DEVELOPING SITE INDEX EQUATION FOR SMALLHOLDER TREE PLANTATION USING HEIGHT – AGE RELATIONSHIP

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Site index is an essential component in determining yield and a basis for sound and effective management of smallholder tree plantation for wood production and carbon sequestration. The study was conducted to develop a site index equation using height – age relationship and construct site index table for mangium (*Acacia mangium* Willd.) in Claveria, Misamis Oriental. Mangium is one of the important smallholder tree plantation species and commodity for wood industry in the region and the country. Data on total height and age were produced from direct measurements of height and age of 3,910 trees. The study had generated site index equation, $\log SI = \log H + .8955(\log A - \log BAGE)$ and site index table (ages 3 to 18 years and total height 5 to 40 meters). Based on the equation, the mean annual height increment of a smallholder Mangium plantation is 2.88 meters at site index 25 and 1.36 meters at site index 12. At age 10, mangium planted at site with an index of 12 could attain a total height of 15 meters while those at index 25 could attain 30 meters. The site index equation can be employed as a basis for efficient management and development of smallholder Mangium plantations. The tree farmers could make use of the site index table in determining site quality and estimated height. It can also be used in determining economic rotation, cut schedule, plantation development schedule and business projection. The equation had been developed for plantations located in Claveria, Misamis Oriental. The equation was applicable outside the study area but careful validation should be done to ensure effective *A. mangium* tree plantation establishment and management.

Keywords: site index, mangium, height, age, smallholder, equation

CHARACTERIZATION AND DETECTION OF FOREST LANDUSE CHANGE IN A SMALL MANGROVE FOREST: THE CASE OF BANACON ISLAND, BOHOL, PHILIPPINES

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The lack of ample information about forest landuse and landuse change hampers our ability to come up with sustainable forest management plans and programs. Mangrove forest is among the forest ecosystems where geospatial information is often limited. This study was therefore conducted to provide practical techniques in characterizing landuse and detecting landuse changes in a small community-managed mangrove forest using remotely sensed data. Banacon Island in Bohol Province, Philippines was selected as a case for this study. Standard radiometric correction and maximum likelihood classifier were done using two Landsat 5 TM satellite images with a decadal interval, 1993 and 2004. Available on-line global explorer programs such as Google Earth Plus and Bing Map were also used to supplement ground-truth data for better classification. Results of the classification were found accurate using standard error matrix procedure therefore suggesting that landuse changes observed could serve as vital inputs for future landuse planning. Three major forest landuses were identified namely, dense mature stand, dense intermediate stand and sparse mangrove area. Overall, mangrove forest of Banacon Island has improved as seen in the expansion of dense mature and intermediate forest stands. Apparently, large portion (60%) of the sparse mangrove has decreased and eventually developed into dense intermediate plantations. This is reflective of the continuous reforestation being done by local community in the area. However, some portions of dense intermediate stands also showed losses that can be attributed to illegal timber poaching that were reported during those periods. Some themes to improve the current condition of the site were recommended.

Keywords: bakawan, forest conservation, GIS, land use change, local community, remote sensing

AS-25

EFFECT OF GLYPHOSATE ON SURVIVAL, GROWTH AND REPRODUCTION OF *Pontoscolex corethrurus*

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We aimed to examine the assumption that agricultural chemicals are bad for the environment, using a common earthworm species, *Pontoscolex corethrurus*, as indicator. Earthworms help maintain soil health but they are highly sensitive to changes in soil chemical content. The environmental effect of glyphosate, one of the most commonly used herbicides in Philippine agriculture, was evaluated using 4 laboratory experiments. In experiment 1, earthworms were observed in glass containers lined with filter paper irrigated with normal dosage of glyphosate, 10x, 20x, 30x, 40x and 50x the normal. In experiment 2, survival and weight gain of earthworms in soil-filled containers sprayed with 3 mL of the same range of doses of glyphosate, were measured for 2 weeks. The third experiment was an avoidance test where half the Petri dishes were lined with the control and the other half with the normal glyphosate dose. Earthworm positions were recorded for 100 min. Lastly, in reproduction test, soil-filled glass containers were sprayed with varying glyphosate doses (normal up to 16x the normal). On day 28, adult worms were removed and evaluated while cocoons and juveniles were observed for another 28 days. Glyphosate did not significantly show toxic effects to *P. corethrurus* up to the highest dosages in experiments 1, 2 and 4. However, in experiment 3, *P. corethrurus* showed significant avoidance response to normal concentrations of glyphosate ($P=0.03$). The study shows that the common assumption about the negative environmental effect of glyphosate may not be justified.

Keywords: glyphosate, earthworms, *Pontoscolex corethrurus*, toxicity

AS-26

**REACTION OF WILD AND CULTIVATED *Musa* SPECIES
TO MAJOR BANANA VIRUS DISEASES****Fe M. Dela Cueva**¹, Eric G. Dinglasan¹,Olivia P. Damasco¹ and Lorna E. Herradura²¹Institute of Plant Breeding, College of Agriculture, University of the Philippines Los Baños, ²Davao National Crop Research and Development Center, Bureau of Plant Industry, Davao City; fmdcueva@yahoo.com

Philippine *Musa* germplasm collection at IPB-UPLB and BPI Davao City holds a wide array of wild and cultivated banana cultivars. The germplasm provides wide gene pool as sources of desirable traits for breeding programmes like resistance to pests and diseases. Major banana viruses which include Banana bract mosaic virus (BBrMV), Banana bunchy top virus (BBTV), and Cucumber mosaic virus (CMV), as well as detection of Banana streak virus (BSV) has been observed in the *Musa* germplasm collection. Information on the reaction of these cultivars against these viruses is very little, hence this study. *In vitro* derived plantlets were evaluated for resistance against BBrMV, BBTV, and CMV under greenhouse condition. A total of 57 banana cultivars were evaluated. At 3-7 weeks after insect transmission, symptoms of BBTV appeared as marginal chlorosis and leaf narrowing. Low BBTV incidence (<50%) was recorded on some cultivars ranging from 0-44%. ELISA reading from asymptomatic plants ranged from 0.140 - 0.657, in which some cultivars were detected to be BBTV-positive. This indicates that BBTV is still present even in asymptomatic condition. For CMV, symptoms appeared 3 - 4 weeks after inoculation only in 1 cultivar. ELISA also detected CMV infection on some cultivars, which ranged from 0.143 - 0.940, even in asymptomatic condition. For BBrMV, all plants showed no diagnostic symptoms but ELISA also detected virus infection on some cultivars. ELISA values ranged from 0.140 – 0.913.

Keywords: *Musa* germplasm, ELISA, BBTV, BBrMV, CMV

AS-27

BIOMASS COMPOSITION AND SUGAR CONTENT OF SWEET SORGHUM (*Sorghum bicolor* (L.) Moench) AT DIFFERENT DEVELOPMENTAL STAGES

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Sweet sorghum is a water-use efficient crop that has great potential as feedstock for bioethanol and pulp production. As a bio-based crop, it is important to determine the best growth stage of the plant to harvest the biomass for optimum yield in sugar and structural carbohydrates. This study was conducted to determine the sugar content and biomass constituents of the stalk juice at different developmental stages. Stalks of sweet sorghum v. ICSR 93034 were collected from the MMSU Sweet Sorghum project. Samples were collected from vegetative (before panicle formation), reproductive (during grain formation) and post-reproductive stages (after grain harvest). Fresh juice was extracted to analyze the brix value before they were dried, cut, and ground to 40 mesh. Analyses of the biomass constituents; cellulose, hemicellulose, and lignin, of the extractive-free stalks was carried out following the TAPPI standard procedures. Brix value (°Bx) was lowest at vegetative stage (5), followed by post-reproductive (11.5), then reproductive (14.5). The structural carbohydrates increased with the sweet sorghum plant's growth maturity. The variety under study contains more hemicellulose than cellulose. Cellulose, which contains a long chain glucose sugar, was lowest at vegetative stage, 29.69% while 32.27% was determined in reproductive and post reproductive stalk samples. Hemicellulose, which is a polymer of glucose and pentoses (e.g. xylose), was found highest during the vegetative stage, 44.5%, while 39.44% in both the reproductive and post-reproductive stages. Lignin, the complex binding material for the structural sugars, was found to be present in the following order: vegetative < reproductive and post-reproductive.

Keywords: sweet sorghum, structural carbohydrates, bioethanol, pulp, sugar feedstock

AS-28

POTASSIUM AND SODIUM UPTAKE OF CORN (*Zea mays* L.) GROWN ON SALINE SOIL

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Corn is considered as a moderately saline sensitive crop and there is a shifting interest to corn farming due to its high value and demand. However, in some areas identified to have saline soil, corn remains as one of the famous crop and one of the most practical way to minimize the adverse effect of this stress to corn is to grow tolerant varieties. A field experiment was conducted to evaluate the potassium and sodium uptake of three corn varieties grown on saline soil amended with additional potassium. The experiment was laid out in randomized complete block design with four replications and three varieties were used. Salinity severely affected the performance of the three corn varieties. IPB Composite 3, which was screened to be drought tolerant, showed better performance compared with the other varieties. Potassium uptake of IPB Composite 3 was also significantly higher compare to the other varieties while on the other hand sodium uptake of this variety was significantly lower. Na:K ratio of IPB Composite 3 was relatively lower compared to other varieties indicative of its inherent characteristics to be saline-tolerant.

Keywords: corn, potassium, sodium, uptake, salinity

AS-29

A PRE-HARVEST 1-METHYLCYCLOPROPENE (1-MCP) AQUEOUS SPRAY FORMULATION TO DELAY RIPENING OF MANGO (*Mangifera indica* L. cv. 'Carabao')

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A pre-harvest 1-methylcyclopropene (1-MCP) aqueous spray was applied to mangoes to determine whether it could effectively control ethylene responses. Mango produces two ethylene peaks, the first of which occurs at about 10 days before harvest maturity. 1-MCP at 0, 10, 20 and 30 ppm was sprayed to mangoes at 90, 100 and 110 days after flower induction (DAFI). Fruits were harvested at 117 DAFI, stored at 12.5°C and ripening parameters were monitored. CO₂ production peak was delayed for 7d in the 1-MCP treatments at 100 DAFI with 10 ppm having the lowest CO₂ production. Ethylene production was lower for 10ppm 1-MCP treatment at 100DAFI compared with the control. Significantly higher firmness, delayed peel color development, decline in visual quality and slower disease development was also observed with this treatment. 1-MCP was found to be effective as a pre-harvest spray when applied at 100 DAFI. At this stage, sufficient ethylene receptors are already present in tissues but the upsurge in ethylene production pre-harvest has not yet occurred. 1-MCP was proven effective because it was able to bind to the ethylene receptors which are mostly unbound to ethylene. The 1-MCP concentration of 10ppm was enough to saturate the receptors and further increase in concentration would not elicit a more favorable response. A pre-harvest aqueous spray formulation of 10 ppm 1-MCP applied at 100 DAFI was proven effective to delay the ripening of mango. This is the first study, to the best of our knowledge, on a pre-harvest 1-MCP aqueous spray application on 'Carabao' mango.

Keywords: 1-methylcyclopropene, 'Carabao' mango, pre-harvest spray, delayed ripening, aqueous spray

AS-30

MODIFIED ATMOSPHERE PACKAGING (MAP) TECHNOLOGY FOR THE EXTENSION OF MANGO (*Mangifera indica* L.) FRUIT FRESHNESS

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The market of Philippine mangoes (*Mangifera indica* L.) is limited due to its short shelf life in which the fruit ripens in five to eight days after harvest at ambient condition. Modified atmosphere packaging (MAP) technology is known to supplement temperature and relative humidity control to maintain the quality and prolong the shelf life of fresh fruits. This study aims to increase the shelf life of mangoes using MAP technology. Mangoes obtained from various parts of the country were pre-treated with fungicide with active ingredient, azoxystrobin, and vapor heat treatment (VHT) prior to storage in MAP at various conditions including: a) low temperature storage at 10°C and 15°C, b) use of local and imported MAP plastic films in storing mangoes at 10°C, and c) packaging MAP mangoes in different packing sizes. Stored mangoes in MAP were evaluated for physical and sensory qualities and shelf life was determined. Results showed that the shelf life of MAP mangoes pre-treated with fungicide and VHT could be extended up to 30 days by storing MAP fruits using 30 CE plastic film of the Korea Food Research Institute (KFRI) as modified atmosphere packaging material, bulk packing at 4 boxes of 5 kg fruits to a box, and storage at 10°C. At the maximum shelf life of 30 days, MAP mangoes did not shrivel, ripened to yellow peel color index of 5 to 6, had slight to moderate mango odor and flavor, and had no internal breakdown. MAP is a promising technology that could extend the mango fruit freshness and allows export of fruits to distant markets therefore increasing the share of exports of Philippine mangoes globally.

Keywords: MAP, mango, shelf life, bulk packing, MAP film

AS-31

DISEASE CONTROL METHODS FOR MANGOES UNDER MODIFIED ATMOSPHERE PACKAGING (MAP)

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Disease is one of the major forms of deterioration in mangoes after harvest. Mangoes prior to storage in Modified Atmosphere Packaging (MAP) should be treated with effective disease control to prevent decay due to anthracnose and stem-end rot. This study aims to evaluate the physical and chemical methods to control diseases in Philippine mangoes cv. Carabao held under MAP at 10°C and 30°C. Green mature mangoes were treated for disease control by dipping in fungicides – Benomyl and Amistar®; chlorine; and hot water using low temperature, long time (LTLT) and high temperature, short time (HTST). Pre-treated mangoes were wrapped in either 30 CE or 20 CE MAP plastic films made of zeolite-coated low density polyethylene and stored at 10°C, at ambient conditions, and at 30°C for 18 and 10 days, respectively. The film was removed after the specified storage period, and mangoes from 10°C were transferred to 25°C in normal air to ripen. Control samples were not wrapped in the film but stored and ripened under similar ambient conditions. Effectiveness of disease control is in the following order: Amistar® > HTST > LTLT > Benomyl > Chlorine. Benomyl enhanced peel discoloration and is banned for use. In general, development of yellow peel color, shriveling, internal breakdown, and sensory characteristics were not affected by all disease control measures used regardless of storage conditions. Amistar®, however, resulted in the highest disease control >90% in mangoes stored under MAP at 10°C and 30°C. Although Amistar® provided the best disease control, this is currently registered as a pre-harvest and not yet as postharvest fungicide for mangoes. Further investigation on disease control measures suitable for prolonged storage of mangoes in MAP is recommended to exploit new markets for the export of Philippine mangoes.

Keywords: disease control, mangoes, MAP, decay, postharvest treatment

AS-32

FERTILIZERS AND ORGANIC RESIDUE EFFECTS ON THE DYNAMICS OF CO₂ AND N₂O IN SATURATED AND UNSATURATED SOILS

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Carbon dioxide (CO₂) and nitrous oxide (N₂O) are two of the most potent greenhouse gases produced in managed agricultural ecosystems. In an 80-day constant temperature laboratory incubation experiment, we determined the CO₂ and N₂O dynamics in the following: Treatment 1 (T1): Unfertilized (control); Treatment 2 (T2): 100 mg (NH₄)₂SO₄-N kg⁻¹ soil; Treatment 3 (T3): 100 mg paddy residue-N kg⁻¹ soil; and Treatment 4 (T4): 100 mg (NH₄)₂SO₄-N +100 mg paddy residue-N kg⁻¹ soil. CO₂ emission in both saturated and unsaturated conditions peaked in the early stage of incubation and in a declining pattern. The application of NH₄-N seemed to decrease CO₂ emission both in saturated and unsaturated conditions. CO₂ emission in T2 was even lower in the unfertilized treatment (control). N₂O flux peaked in T3 and T4 two days after flooding in the saturated condition and three to four days after flooding in T1 and T2 but at a much lower concentration. N₂O flux was almost nil under unsaturated conditions. Residue and nitrogen application did affect N₂O flux only at the early stage of flooding and had no influence at all under unsaturated conditions. Nitrogen application can decrease CO₂ emission with and without residue application and nitrogen fertilization is a good strategy to decrease CO₂ emission from decomposing organic residues in agricultural fields.

Keywords: carbon dioxide, nitrous oxide, residues, saturated soil, unsaturated soil

AS-33

EXPLAINING THE PERSISTENCE OF NINE WEED SPECIES IN A PLANTATION AGRICULTURE ENVIRONMENT

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Seed longevity and germination pattern of 9 weed species, *Ageratum conyzoides*, *Bidens pilosa*, *Cleome ruidosperma*, *Acalypha indica*, *Drymaria cordata*, *Eleusine indica*, *Cyperus brevifolius*, *Paspalum conjugatum* and *Cynodon dactylon*, in a banana plantation in Davao City were studied to explain their population dynamics in a long term weed control experiment using paraquat and manual weeding. Dry seeds were exposed to high temperature (day/night temperature of 33°C / 28°C and 2.9x10⁴ lux) and high relative humidity (95%) in an improvised accelerated aging chamber. Initial germination percentage was taken for freshly collected seeds of each species. Every week, for 3 months, samples of seeds from each species were obtained from the chamber and were germinated in Petri dishes lined with cotton and daily irrigated with distilled water. There were 3 replicates with 50 seeds per replicate. Germination was done in the laboratory with a day temperature range of 26°C to 30°C and a night temperature range of 24°C to 28°C. Germination percentage of all species except *A. indica*, *E. indica* and *P. conjugatum* significantly fluctuated ($P < 0.05$) in the course of the experiment. Percentage germination of *C. ruidosperma* and *D. cordata* seeds steadily decreased through time, consistent with the pattern observed in seeds that do not have dormancy and easily eradicated. On the other hand, germination of *A. conyzoides*, *B. pilosa*, *A. indica*, *C. brevifolius* and *C. dactylon* was spread out and showed no marked decline with length of storage. Percent germination of *A. conyzoides*, *B. pilosa*, *E. indica* and *P. conjugatum* increased during storage. These patterns are associated with persistent weeds. They constitute a mechanism for long-term survival of these species under fluctuating soil moisture conditions.

Keywords: seed longevity, weeds, banana plantation, seed dormancy, seed germination

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ERADICATION OF WILD DAISY (*Wedelia trilobata* (L.) Hitchc) USING DIFFERENT LEVELS OF HERBICIDE

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Wild daisy was considered one of the top 100 most invasive species in the world and also a problem in many farms in Misamis Oriental. The study was conducted to determine the effective level of glyphosate (C₃H₈NO₅P) to control the growth of *Wedelia trilobata* (L.) A.S. Hitchc (Wild daisy). Also, determine its effect on growth and biomass under field condition. The experiment was laid out following a randomized complete block design with four replications and treatments: 1) No herbicides (control); 2) Recommended dosage (160 ml/16 liters); 3) Twice below the recommended dosage (80 ml/16 liters); 4) Twice above the recommended dosage (320 ml/16 liters). At the end of the experiment, growth characteristics such as coloration, % biomass, length of stolon and period of recovery were documented. The result showed that wild daisy was significantly affected by the herbicide treatment of 320 ml/ 16 liters. The length of stolons was reduced by 48.7 cm. Similarly, the amount of biomass produced was significantly different compared to the control. All other treatments were not significant to each other. The effects to the leaves were assessed based on the color. Plots treated with 360 ml/ 16 liters showed yellowing after 2 days and were eradicated while plots treated with 80 ml/ 16 liters and 160 ml/ 16 liters exhibited yellowing after four days and showed regrowth. Control of wild daisy invasion on farmland, open – grassland, forestland and gardens can be effectively implemented by using treatment 320 ml/ 16 liters.

Keywords: wedelia, herbicides, glyphosate, biomass, stolons, growth