AGRICULTURAL SCIENCES DIVISION

ASD-1

PHYSICO-MECHANICAL CHARACTERIZATION OF PLANTATION-GROWN PALASAN (*CALAMUS MERRILLII* BECC.) CANES

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To promote the utilization of plantation-grown canes so as to preserve the remaining palasan canes growing in natural forests, the physical and mechanical attributes of plantation-grown Palasan (*Calamus merrillii* Becc.) canes were compared to wild rattan canes. Likewise, the effect of fiber percentage and cane age on the strength properties of the material was assessed. This was accomplished through standard static bending tests and structural evaluation of palasan canes derived from various plantations in the Philippines. In terms of modulus of rupture (MOR) and modulus of elasticity (MOE), plantation-grown canes were more or less similar to wild rattan canes. Contrary to plantation-grown trees, plantation canes were not at all inferior in strength properties to wild canes. Ovendried specific gravity and fiber percentage were also similar. These two parameters did not influence the variation in strength properties of a particular position within the cane. Similarly, cane age had no significant influence on the mechanical attributes of the cane. Apparently, young canes also possess the same strength values as that of a more mature stem. This would imply that plantation-grown canes could also be used by the industry without negatively altering the mechanical qualities of the finished products. Hence, it could serve as a good substitute to wild canes which ensure the industry with an exhaustible supply of raw canes paving the way to the preservation of the country's remaining wild rattan resources.

Keywords: plantation-grown canes; modulus of rupture, modulus of elasticity, specific gravity, fiber percentage, good substitute

ASD-2

INFLUENCE OF STRUCTURE ON THE POTENTIAL YIELD OF BUNTAL FIBERS COMING FROM BURI PALMS (*CORYPHA UTAN* LAMK.)

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Knowing the significant contribution of buntal fibers to the livelihood of farmers and how inefficient they are extracted from the fronds of Buri palms (*Corypha utan* Lamk.), anatomical evaluation was conducted to determine the distribution of the buntals within the fronds in order to find ways in which buntal fiber yield could be maximized. The fronds were divided into three regions: top portion (T); middle portion (M); and basal portion (B). Likewise, the position across the radius of the fronds [Periphery1 (outermost layer or P1), Core (C), and Periphery2 (innermost layer or P2)] were considered. Vascular bundle composition, ground parenchyma percentage and vascular bundle diameter were measured using the ImageJ analysis software. Fiber length, fiber diameter, lumen diameter and cell wall thickness were also determined using an Olympus microscope with a built in micrometer. Anatomical observation showed that buntal fibers were actually the vascular bundle itself. The bundles were made up of two layers of fiber strands that envelop the conducting tissues e.g., xylem and phloem. Such design provides stability to the bundle during manual extraction of the buntal. Vascular bundle was abundant in P1 of the middle portion whilst ground parenchyma percentage was highest at the basal region. Fiber length was longest at the middle portion and cell wall thickness was thickest in the top region. Bundle diameter was greatest in P1 of the basal region which dramatically decreased at C and P2. The top and middle portions gave almost the same values. Therefore, buntal fibers could be extracted in any part of the fronds; however, the yield would be highest in the middle portion. More over, the same portion would yield uniform buntal quality as indicated by the more or less even bundle diameter.

Keywords: Buntal fibers, Buri palms, vascular bundle, ground parenchyma, fiber length, cell wall thickness

ASD-3

GERMINATION STUDY AND EFFECTS OF BIOLOGICAL FERTILIZERS ON SURVIVAL AND EARLY GROWTH OF ALUPAG (*Euphoria didyma* Blanco)

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Alupag (*Euphoria didyma* Blanco) is one of the lesser-used endemic tree species of the country that has been depleted by logging amidst its potential as food and timber crop. Most documented study on Alupag failed due to poor germination count (Caguioa, 1936). The effects of pre germination treatments (soaking, nicking and control) and biological fertilizers (Mykovam, Bio-N and control) on the growth and survival of Alupag were investigated. Two RCBD set-up having 4 blocks and 3 treatments were adopted. Different germination and growth parameters were measured which include, percent germination, height increment, biomass and other indicators.

Results showed low to moderate germination turn-out (36-69%) with nicking having earlier germination (p=0.048), and higher germination, 58.5% compared to control (50.8%) and soaked seeds (42.8%) (p=0.0135). Alupag exhibit hypogeal type of germination. It is also polyembryonic and it can possibly be grown using vegetative means of propagation.

Application of Bio-N improved the growth of Alupag seedling but the observation period may not be enough to observe significant results. On the contrary, application of Mykovam reduced the growth of Alupag seedlings during the 50 days observation. Investigation of the property of the soil used for potting revealed abnormally high amount of Phosphorous (83-98 ppm) resulting to nutrient imbalance in Alupag as evidenced by shoot chlorosis.

Keywords: Alupag (*Euphoria didyma* Blanco), germination, **Bio-N**, Mykovam, **Phosphorous**

ASD-4

NODULATION AND GROWTH OF TRANSPLANTED *ALNUS MARITIMA* MARSH NUTT. IN FERTILIZER ENRICHED MINE SPOIL

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The sub-marginal condition of mine spoil or mine waste soil may adversely affect the degree of nodulation in Alnus and its growth. This study was conducted to determine the degree of nodulation of *Alnus maritima* Marsh nutt. in unfertilized and fertilized mine spoil and relate its nodulation to growth.

Bare-root seedlings of Alnus washed with distilled water were transplanted in plastic cups containing either pure mine spoil, mine spoil with compost, mine spoil with urea or soil taken from natural Alnus stand. After two months, height increment, biomass, survival and nodulation were measured.

Results showed that all seedlings formed live nodules, in spite of the critical concentration of cadmium (Cd), 7.13 mg kg^{-1} and Chromium (Cr), 117 mg kg^{-1} in the mine spoil. However some existing nodules died after transplanting among those planted in pure mine spoil and mine spoil with urea. Nodulation in garden soil > mine spoil + compost > pure mine spoil > mine spoil + urea.

Growth of Alnus as reflected by root, shoot and total biomass appear in the treatment order garden soil > mine spoil + compost > mine spoil > mine spoil + urea. In terms of height increment, mine spoil with compost and garden soil are significantly taller than mine spoil and mine spoil + urea 60 days after treatment application at 1% level of significance using LSD. The comparative growth of those grown in garden soil and mine spoil with compost indicate the potential of the Alnus in the rehabilitation of mine sites.

Keywords: *Alnus maritima* Marsh nutt, root nodules, mine spoil, fertilizer, heavy metals

ASD-5

GROWTH AND YIELD PERFORMANCE OF PROMISING NAPIER GRASS (*Pennisetum purpureum*) ACCESSIONS AS AFFECTED BY THE FREQUENCY OF CHICKEN MANURE APPLICATION

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Three frequencies of chicken manure application, i.e. zero, single, and split, were used in fertilizing seven promising accessions of napier grass. The study aimed to compare the effect of single and split chicken manure application on the growth and yield of promising napier grass accessions, to identify the high yielding napier grass accession and to compare the cost benefit ratio of producing napier grass using either single or split application of chicken manure.

The frequencies of fertilizer application were randomly distributed to three horizontal strips while the accessions were randomly distributed to the seven vertical strips with using the Strip-plot design. Each experimental plot had a measurement of 3 m x 4 m..

Results showed that frequency of chicken manure application significantly affects the number of days to shoot emergence, the number of tiller produced, height and dry herbage yield of napier grasses. Grasses with single or split chicken manure application produced new shoots earlier and more tillers than those with zero manure application. Grasses with split chicken manure application were taller and produced higher total dry matter yield than those with single or zero application.

In terms of napier grass accessions, no differences were observed on the number of days to shoot emergence and total dry herbage yield. Ex Cuba and Miniero are the accessions that consistently produced the lowest number of tillers and the shortest both in wet and dry seasons. Ex Local was the tallest during wet season while Ex Indonesia and Capricorn during dry season

Based on the result of the study, split application is better than single application because the marginal benefit cost ratio of split over single chicken manure application was 3.29. Any of the accessions could be used because they have comparable herbage yield.

Keywords: napier grass, chicken manure, frequency of application, accessions

ASD-6

KAWAYAN CHARCOAL BRIQUETTE TECHNOLOGY PRODUCTION OF KAWAYAN CHARCOAL BRIQUETTES USING cHICHACORN PROCESSING EFFLUENT AS BINDER

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These research and technology promotion undertaking showcased the production of kawayan (bamboo) charcoal briquette (KCB) using chichacorn processing effluent and corn starch as binders with the following objectives: (a) produce charcoal briquettes and enhance recovery from bamboo waste which otherwise end up to burning and rotting, (b) find out means to reduce the volume of chichacorn effluent which otherwise are contributory to environmental problem, (c) develop products as source of additional income of bamboo processors, and (d) produce a bio-fuel that is environment friendly and economically feasible.

Recovering waste materials from harvesting and processing of bamboo, and effluent from chichacorn processing through carbonization of the bamboo waste materials and mixing it with the effluent as binder, and compacted into various forms produced an excellent bio-fuel. The briquettes had an average density of .46 g/cc, ash content of 8- 11%, heat value of 4,201 kcal/kg, 85 kg compression strength, and 5-8 percent friability. These characteristics of the briquettes are as good as the briquettes from wood and other agricultural wastes. Kawayan charcoal briquette-making is feasible with a net return of P0.89 for every peso investment.

The transfer of technology was materialized through the concept of Academe-Local Government/Cooperative partnership. A series of meetings and training activities was conducted with the target clientele (E-kawayan Producers Association), the Mariano Marcos State University, and representatives from variuos Local Government Units in Ilocos Norte. The community approach was an effective strategy in organizing and empowering cooperators in decision-making related to kawayan charcoal briquette production, plantation management, utilization, and commercialization.

Collectively, the experience in this project is a sound basis for the mass production of briquettes from kawayan. Likewise, it is a good example and guide in recycling of waste materials which otherwise are contributory to environmental problems.

Keywords: effluent, binder, chichacon, carbonization, briquette, heat value

ASD-7

IMPROVING PRODUCTIVITY OF UNMANAGED KAWAYAN TINIK *BAMBUSA BLUMEANA* SHULTES PLANTATION FOR POLES AND SHOOTS

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The productivity of previously unmanaged *Bambusa blumeana* Shultes (Kawayan tinik) plantation was assessed over a period of five years. We studied the combined effects of cleaning, irrigation, inorganic fertilizer application, mulching, and organic matter on the production of quality poles and shoots. The silvicultural treatments were combined with six pole density treatments with definite age of poles per year per clump, i.e. 4-4-4-4 which means that the successive numbers indicate the number of one, two, three or four-year old culms in each clump, counted and marked just before the shoot season.

Generally, irrigation significantly improved productivity index, shoot emergence and number of shoots per clump of *B. blumeana* for various uses. The average shoot production of 6 shoots per clump from all treatments is within the range of shoot production of *B. blumeana* in areas with a distinct dry and wet season. The clumps that received irrigation during the shoot stage had a significantly bigger diameter poles than those without irrigation. The 3-year old and the four-year old mother culms had a very low percentage shoot production of less than 3.8 percent which means that it is more advantageous to harvest the mother culms for pole production rather than for shoot production. The quality of poles in the clumps with 4-4-4-4 or 16 culms per clump produced the highest number of poles and most superior strength properties. Extending the age of the pole from three years to four years old posed advantage to productivity.

It is concluded that irrigation and cleaning significantly improved clump productivity and quality for specific use of poles. It was possible to predict the productivity the clumps following the scheme of retention of various number of poles per age giving a definite number of poles and potential number of shoots to be harvested every year in unmanaged bamboo plantation.

Keywords: clump, poles, shoots, culm, productivity, cleaning, silviculture

ASD-8

RESPONSE OF *Toona kalantas* ON VARYING LEVELS OF VERMICOMPOST

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Kalantas (*Toona kalantas)* is an endemic species of forest trees. Propagating such tree would be beneficial most especially in supporting the program of the government on regreening. The study was focused on the response of the *Toona* kalantas on varying levels of Vermicompost. The Vermicompost is a kind of organic fertilizer having worm casting of an African crawler (earthworm) which are bought from the Research Laboratory of Forestry of Nueva Vizcaya State University, Bayombong, Nueva Vizcaya

The study consisted of five treatments. Each treatment had 15 kalantas, so that there were 75 kalantas being planted. The 2- month seedlings of kalantas were obtained from the nursery of the Department of Environment and Natural Resources (DENR). Except the control group, the other four treatments were given varied amount of vermicompost (treatment 1- 10 g, treatment 2 – 20 g, treatment 3 - 30 g and treatment 4 - 40 g) The amount of soil was made constant in each treatment. The plants were set up using completely randomized design. Considering the rate of survival, the highest rate was treatment 2 having 100% rate and the lowest rate was treatment 3 having 80%, the total number of plants that survived was 66 kalantas which was 88%. In terms of the mean, the greatest mean was in treatment 2 (38.71 cm) and the least mean was in the control group (25.19 cm). Using Statistical Packaging for Social Sciences (SPSS), the mean height of kalantas has no significant difference. Based from the Tukey's Honestly Significant Difference (HSD), the mean height of kalantas in the control group and in treatment 2 had significant difference. The rest of the treatments had no significant difference. Through these results, the study suggested that the most appreciated amount of vermicompost to be applied was 20 g in propagating kalantas. The researchers recommend the use of vermicompost in different vegetable crops following the suggested amount of the organic fertilizer.

Keywords: Kalantas, *Toona kalantas*, vermicompost, African crawler,

ASD-9

COATING PROPERTIES OF RAW PAGSAHINGIN VARNISH

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Pagsahingin, popularly known as Manila elemi in the world market is a resinous substance obtained from trunks of *Canarium spp. that* are endemic to the Philippines. According to literature pagsahingin is a good material for surface coating however, previous experiments showed that it is tacky and has long drying time.

In this study, pagsahingin was utilized as the main component in the production of varnish with reduced drying time. Four varnish formulations from pagsahingin were prepared namely: raw pagsahingin, raw pagsahingin with linseed oil, almaciga-modified pagsahingin and almaciga-modified pagsahingin with linseed oil. Physicochemical properties such as acid and saponification numbers were determined. Fourier-transformed infrared analysis to determine its functional groups was also conducted. Total solids, specific gravity and viscosity were some of the physical properties determined. Performance of the varnishes in terms of adhesion, drying time, gloss, number of coats and resistance to common household was evaluated and compared with commercial varnish. Results showed that the raw and almaciga-modified pagsahingin varnishes without linseed oil exhibited properties comparable with commercial varnish. No significant difference was observed on performance of the experimental and commercial varnishes.

Keywords: pagsahingin, Manila elemi, varnish, adhesion, specific gravity

ASD-10

UNDERUTILIZED CROPS: IMPORTANCE VALUE AS PERCEIVED BY THE FARMING COMMUNITY IN LAGUNA PROVINCE

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Underutilized crops are plant and tree species with potential, not yet fully exploited, to contribute to food security, poverty alleviation and environmental enhancement or conservation. They tend to be neglected by research, extension services, policy-makers, donors, technology providers and to some extent, even by the farmers. This study is an attempt to identify underutilized plant and tree species and evaluate their importance based on a multi-stakeholder perspective. This is also an attempt to provide a basis for prioritizing underutilized crops for further research and development.

Importance values were assessed in two parts: first - based on abundance and geographic distribution which was done through biodiversity measurement, description of their geographic distribution as well as the biophysical conditions associated with them; and second - based on the economic and non-economic values as perceived by the farming community which was done through key informant and key informant panel interviews. Presented here are the results of the second part of the study.

About 83 underutilized plant and tree species were identified in selected municipalities of the Laguna Province. These included tropical fruit trees, indigenous trees and vegetables as well as wild plants, tubers and root crops. The identified plant and tree species were rated according to importance by the respondents. Results showed that importance rating was highly influenced by the functions of these crops in the community.

This Philippines is endowed with rich natural diversity. A significant portion of the country's rural landscape consists of mixed cropping, and homegardens where important components are trees and plant species that naturally grow or planted but are left unmanaged despite their uses. Continuous neglect of these plant and tree species may lead to their eventual disappearance hence a waste of resources that otherwise could be very good sources of nutrition, alternative income and resources for environmental enhancement.

Keywords: underutilized crops; neglected; indigenous, plant and tree species; importance value, multi-stakeholder perspective; environmental enhancement; rural landscape; biodiversity

ASD-11

BENGUET STATE UNIVERSITY ORGANIC AGRICULTURE PROGRAM

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Benguet State University (BSU) is located at the heart of La Trinidad, Benguet, Philippines. The university is basically an agricultural institution primarily serving farmers and other stakeholders in the cordilleras and nearby provinces in the Northern Philippines.

With its ideal climatic conditions, productions of high-value vegetable crops become a lucrative business in the farming community. For almost four decades, farmers intensively and extensively cultivate their farms adopting the conventional chemical farming practices. These practices consequently contributed to soil deterioration, soil fertility depletion and degradations as manifested by the present situations in the area i.e. Too acidic soil condition, proliferation of soil pathogens like clubroot in cabbage, pollution of water, etc. If this system goes unabated it is feared that time will come when degradation of the environment becomes irreversible and becomes unproductive. This threat is real and brought impetus in the development of organic agriculture.

As potent force of innovations, Benguet State University responds to the universal call for ecologically sound and sustainable practices by conceptualizing and adopting the concepts of organic agriculture. In doing so, it aims to promote the healthy, proper care and conservation of the remaining resources in agriculture, and foster indigenous and ecologically sound production systems that will produce sufficient, safe and nutritious food for the present and the future generations.

Benguet state university is envisioned to become the premier organic university in the highlands Philippines.

Keywords: organic agriculture, chemical farming, ecologically sound and sustainable, indigenous

ASD-12

GROWING CROPS IN MINE-TAILED AFFECTED AREA AMELIORATED WITH ORGANIC MATERIALS: AN ATTEMPT

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An on-site trial was conducted to determine the growth and yield performance of four crops (green onions, peanut, pechay, and potato) and grass (Vetiver grass) and on some physical and chemical properties of the soil ameliorated with organic fertilizer.

Plants grown in mine-tailed area ameliorated with organic fertilizers (compost, chicken dung and Giant 8-8-8) showed better growth and yield compared to those without organic amelioration.

Application of organic fertilizers improved the physical (bulk density and porosity) and chemical (pH, organic matter, nitrogen, phosphorus and potassium content) properties of the mine-tailed area.

Keywords: ameliorated, organic fertilizer, mine-tailed, mine tailings, physical and chemical properties

ASD-13

A GIS-ASSISTED MAP OF ESTIMATING SOIL EROSION IN PROPOSED COPPER MINING IN TAMPAKAN SOUTH COTABATO, PHILIPPINES

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Exploration of copper in Tampakan by Sagittarius Mining Inc has been on-going, guided by programs for sustainable mining through scientific management. Among the science-based research, which is investigated in this paper, is the use of Geographical Information System to map primary impact areas (Barangay Danlag, Pula Bato and Tablu) and estimate erosion using Universal Soil Loss Equation (USLE). The research process involved primary and secondary data collection, computation of USLE factors, data organization, digitizing and editing of GIS maps, data encoding, and data analysis. Using the derived USLE factor maps, soil erosion map was generated by multiplying factors using Map Calculator function from ArcView software. The derived soil map was classified into six erosion categories expressed in tons ha^{-1} $year^{-1}$ as: very slight (< 1.000), slight (1.001-2.500), moderate (2.501-5.000), high (5.001-7.500), severe (7.501-10.000), and extreme (> 10.000) soil erosion.

The erosion index value that covered large area had very slight erosion characterized by protection and production forest mostly situated in Barangay Tablu, Danlag and Pula Bato. Moderate erosion index was recorded in grassland ecosystem in Barangay Danlag, Pula Bato, and Tablu. By comparison, the area with extreme erosion index was seen from peaks of mountains located in three barangays. The problem of soil erosion in all sites sampled was enhanced by land-use, particularly shifting cultivation commonly practice in upland communities dominated by B'laan tribes. Soil erosion was further enhanced in degraded mountains, having steep slope, high annual rainfall volume, and poor soil properties. In conclusion, Barangays that are likely exposed to risk and hazard of soil erosion can be managed wisely using the soil erosion map to facilitate assessment. The GIS-based soil map will also provide the company with a holistic view of future rehabilitation plan of affected slopes and conservation strategies for areas with existing protection and production forest.

Keywords: geographical information system, Universal Soil Loss Equation, soil erosion, copper mining, Tampakan South Cotabato

ASD-14

ONLINE DATABASE INFORMATION SYSTEM OF MULTIPURPOSE INDIGENOUS PLANT SPECIES USED IN THE CORDILLERAS, NORTHERN LUZON

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The Cordilleras of the Philippines is home to a rich diversity of plant species that are used as nutrient source in organic farming and fallow systems; as nutrient source, biocontrol and soil and water conservation agents in sustainable indigenous farming systems; as herbal medicine in community health care; as food supplements; and as offering or symbols in cultural rituals. Written accounts on these plant species in the Cordilleras is fragmented and sporadic. This study aims to develop an online database information system of indigenous plant species used for various purposes in the Cordilleras, Northern Luzon.

Literature survey was conducted in Cordillera Studies Center, U.P. Baguio and Benguet State University (BSU), La Trinidad, Benguet. Key informant interviews were also conducted to document additional information particularly on the use of indigenous plants in sustainable farming systems and organic farming. The online database information system of this project was developed with MySQL and PHP, an open source development tool.

A total of 338 plant species was included in the online database information system of the project. These species were used in various purposes such as indigenous farming systems, organic farming, food and food supplement, cultural practices, construction and livelihood, ornamentals, gardening and landscaping, and community healthcare system. About 85 plant species were of multipurpose use. Out of the 338 total plant species documented, 107 species were classified as indigenous plants with majority of these species commonly used for food. *Miscanthus sinensis* (runo, pao, segbat, sapsap) was found to be the most commonly used multipurpose plant species for ornamental, gardening, contruction/livelihood, for food and community health care.

The online database information system will be an important knowledge-base in sustainable farming systems, health care and family nutrition of the communities in the upland areas of the country.

Keywords: database, information system, indigenous plant species, MySQL, PHP

ASD-15

SEASONAL CLIMATE FORECAST (SCF): FARMERS' KNOWLEDGE AND PERCEPTIONS

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The Philippines is greatly affected by the two phases of El Nino Southern Oscillation (ENSO); the El Nino and La Nina. ENSO impacts all segments of society, but among most vulnerable are resource-constrained farmers whose livelihoods are greatly dependent on the changing seasons. Seasonal Climate Forecast (SCF) is one of the tools which could help farmers and decision makers better prepare for seasonal climate variability. This paper tried to document farmers' perception and awareness on SCF and its effect on rice production. Since rainfed farming is more vulnerable to climate variability, the survey was conducted in rainfed rice areas in Talugtog and Lupao, Nueva Ecija.

Majority of (95%) the farmers in rainfed areas undoubtedly valued Seasonal Climate Forecast (SCF) and climate related information, stressing their significance on their farm operations and crop decision making. It allows farmers to prepare for climatic events and aids them in deciding when to plant or commence the cropping season. They also opined that early climate forecasts and advisory would help in their decision making process. On-farm decisions affected by climate variability and disturbances were the crops to be planted and timing of planting, which are also influenced by SCF like El Nino and La Nina. Most farmers (84%) wait for signs before commencing farm operations. Farmers today do not believe on the idea of good and bad luck in managing their farms. Reliable indigenous knowledge was scarce, and farmers relied mostly on the climate and weather advisories provided by PAGASA through television and radio announcement. Very few of these farmers have risk coping mechanisms and mitigating measures at times of calamity such as drought and flood.

Keywords: Seasonal Climate Forecast (SCF), El Niño, La Niña, El Niño Southern Oscillation (ENSO), climate variability

ASD-16

BIOCAPACITY AND ECOLOGICAL FOOTPRINT FOR RICE AND WOOD IN THE PHILIPPINES

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A national assessment on the availability and use of resources for rice from 2003 to 2005, and wood from 2003 to 2004 was conducted using biocapacity and ecofootprint analyses. The assessment was accomplished by determining the demand and supply for rice and expressed the demand into ecofootprint while supply into biocapacity. Ecological surpluses and deficits were determined through biocapacity and ecofootprint comparisons. Ecofootprint for rice and wood were also interfaced to reflect the environmental conditions of riceland and forest ecosystems, reinforced by forest cover area, flood occurrences, and extent of irrigated rice areas.

For food alone, the Philippines could have a minimal ecological surplus. If seeds, feeds and wastes are included, the country had an ecological deficit of about 0.50 million nationwide hectares (M nwha) or a per capita of 0.005 nwha from 2003 to 2005. For wood, the Philippines had a biocapacity of 7.168 M nwha in 2003 and 2004, while ecofootprints were 18.19 and 13.78 M nwha, respectively. This means a national ecological deficit of 11.02 and 6.62 M nwha or a per capita of 0.135 and 0.078 nwha for 2003 and 2004, respectively. Importations supplemented the deficits for both rice and wood.

Consumption reduction, population control and increase productivity could reduce ecological deficits. Avoidance of loss and reduce seed use could also reduce deficits for rice, while improved harvesting and wood processing could reduce wood deficits.

Interface of ecofootprint for rice and wood identified 14 provinces that are vulnerable to flooding hazards and should be given considerations for any future action.

Keywords: biocapacity, ecofootprint, ecological surplus/deficit, nationwide hectare, global hectare

ASD-17

SUBMERGENCE TOLERANT RICE FOR POOR FARMERS IN FLOOD-PRONE AREAS

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Submergence afflicts some 15 million ha of rice lands in Asia, and annual losses to rice production are estimated at over $650 million. Short-term flash floods (for 1 to 2 weeks) can occur at any stage of plant development, sometimes more than once, with consequent severe yield losses. In direct-seeded rice, submergence after sowing substantially reduces stand establishment because of the high sensitivity of existing rice varieties. Additionally, water-logging or stagnation for up to 50 cm for a few months during the growing season is a serious problem in some rainfed areas. Modern rice varieties are not adapted to these conditions and this is probably the reason these varieties are not widely adopted in these areas and farmers still grow their local landraces with low yield. The Sub1A gene, derived from FR13A, a rice variety from Orissa, India, confers tolerance of up to 2 weeks of complete submergence. This gene can be introduced through marker-assisted backcrossing (MAB) into popular varieties, providing some protection to farmers against short-term flooding. The MAB approach was used to transfer Sub1A into six rice "mega varieties" Swarna, Samba Mahsuri, IR64, Thadokkam 1 (TDK1), CR1009 and BR11. Other sources of submergence tolerance were identified and further genetic studies are on-going. Varieties with the Sub1A gene have the same yield and other characteristics as the original varieties, and they can be used to replace these varieties in flood-prone areas. To elicit farmer's variety preferences, participatory variety selection (PVS) approach is being implemented in 28 on-farm locations using varieties with Sub1A gene and the improved local varieties known to be tolerant to submergence. Seed multiplication of existing varieties and development of new Sub1 varieties is now proceeding in India, Bangladesh, Cambodia, Indonesia, Laos, Thailand, Vietnam and Philippines in partnership with the National Agricultural Research and Extension Systems (NARES).

Keywords: submergence tolerant rice, Sub1A gene, flooding, abiotic stress, marker assisted backcrossing

ASD-18

SEED PRIMING AND ITS MORPHO-BIOCHEMICAL EFFECTS DURING SUBMERGENCE IN DIRECT-SEEDED RICE

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Poor seedling establishment is a major constraint for direct seeding of rice (*Oryza sativa* L.). Germinating seeds are highly sensitive to oxygen deficiency, hence the need for tolerance to submergence or low oxygen concentration during germination. Priming of seeds could enhance seed germination and seedling establishment during submergence. The objective of this study was to determine the effect of seed priming on submergence tolerance through morpho-biochemical analysis of rice cultivars contrasting in tolerance to flooding during germination. Two genotypes of rice Khao hlan on (tolerant) and IR42 (intolerant) were used. Percentage germination and coleoptile and root growth were measured after seven days of germination, whereas activities of alcohol dehydrogenase (ADH) and pyruvate decarboxylase (PDC) were measured at different time intervals. Results showed that under low oxygen or hypoxia, seed priming did not improve percentage germination of the two genotypes, but significantly improved coleoptile growth in both genotypes. Moreover, growth of roots of Khao hlan on was reduced by priming while for intolerant IR42 no significant reduction in root growth was observed. Enzyme analysis revealed that seed priming stimulated ADH and PDC activities between 24 to 72 hours after the start of imbibition in both Khao hlan on and IR42. Results suggest that seed priming enhanced coleoptile growth during hypoxia via the increase in PDC activity, which is a control point for anaerobic energy production, thus improving submergence tolerance of rice during germination.

Keywords: alcohol dehydrogenase, coleoptile growth, germination, direct-seeded rice, pyruvate decarboxylase, seed priming

ASD-19

MOISTURE SORPTION CHARACTERIZATION OF HYBRID RICE SEEDS: PSB RC72H (MESTIZO 1) AND NSIC RC116H (MESTIZO 3)

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Rice self-sufficiency in the country has potentially exhibited increasing productivity with the nationwide implementation of hybrid rice technology. Hybrid rice technology increases rice yield by 15% better than inbred varieties. Postproduction technologies are geared towards the development of suitable practices and facilities such as dryers and storage facilities. Simulating postharvest operations may be hampered due to insufficient data in the literature to predict rates of adsorption of moisture by the recently released varieties of hybrid rice seeds.

Equilibrium moisture content (EMC) data are necessary for the optimization of most postharvest operations. Hence, the study was conducted to establish the moisture sorption characteristics of two public-bred hybrid rice seeds.

Equilibrium moisture contents (EMC) of PSB Rc72H (Mestizo 1) and NSIC Rc116H (Mestizo 3) were measured at 25, 35, 45°C with relative humidities (RHs) ranging from 5.6 to 84.43%. Equilibrium moisture content was determined using the gravimetric static method. Five EMC model equations and their estimated parameters were evaluated for goodness of fit, namely: (1) Henderson Equation, (2) Oswin Equation, (3) Chung-Pfost Equation, (4) Halsey Equation and (5) GAB Equation.

The generalized correlation (R^2), standard error of estimates (*SEE*), mean standard error (*MSE)* and the mean relative percentage error (P) of the developed models were in the range of 96.33790 - 99.8523, 0.2062 - 1.02682, 0.04251 - 1.0544, -3.99184 - 0.240997, respectively for Mestizo 1 and Mestizo 3. Using the *SEE, MSE and P* values as criteria to evaluate the ability of the developed models to provide a well fit curve, the modified Henderson is the best model used.

A single model equation can be used for Mestizo 1 and Mestizo 3. Developed models are generally adequate to describe the fitting performance of the predicted EMC values against the experimental values. Henderson equation is the best model having the least residual errors.

Keywords: hybrid rice seeds, Equilibrium Moisture Content (EMC), storage, sorption isotherms

ASD-20

EFFECT OF MOISTURE CONTENT ON RICE SEED VIABILITY AT LOW TEMPERATURE STORAGE

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Seed moisture content is one of the factors that affect the viability of seeds at storage. One of Harrington's rule of thumb is that for every one percent increase in seed moisture content, the seed life is halved. This study was conducted to determine the correlation of rice seed viability and moisture content under cold storage condition. Seeds packed in aluminum foil and were in storage for 3 years in freezers were tested for viability following standard germination test. The seed moisture content of each sample was also measured using portable moisture meter. Seeds were germinated in between moistened paper towel and incubated in 30oC incubator. Seeds were placed in 50oC oven for five days to break dormancy prior to germination test. Scoring was done 14 days after sowing. The moisture content of the seed samples ranged between <8 to 15.0%. A total of 1024 seed samples were tested and 618 samples (60% of the total samples tested) showed no germination. Most entries (532 samples) that showed no germination have moisture content ranging between 11.0-15.0%. The results showed that seed viability is correlated with seed moisture content (r=0.74).

Keywords: Seed viability, moisture content, dormancy, germination

ASD-21

MONITORING OF RICE DORMANCY FOR GENETIC RESOURCES CONSERVATION

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Viability monitoring is an important core activity in rice genetic resources conservation to ensure good quality of stored seeds. Germplasm materials need to

be tested for germination prior to their storage. One of the factors that could affect the result in germination tests of the conserved germplasm is dormancy. In rice, some varieties are dormant at harvest and the degree of dormancy decreases over time. In this study, seed dormancy in 22 traditional and modern varieties was monitored. Sampling of each seed lot was done at harvest and every 2 weeks thereafter. Seed samples were germinated in Petri dishes and incubated in 30°C incubator. Another batch of seeds was placed in the oven set at 50°C for five days to break the seed dormancy and also sampled for germination test. Scoring of normal and abnormal seedlings was done seven and 14 days after sowing. Germination test showed that at harvest, germination of seeds that were not placed in the oven (non-oven seeds) to break seed dormancy ranged between 0-55% in contrast to the seeds placed in the oven (oven seeds) which exhibited 3-93% total germination. Germination of non-oven seeds four weeks after harvest had increased with values ranging between 0-92% total germination. In oven seeds, germination observed ranged between 39-99% total germination. Some seedlots showed very low germination even after longer period of storage. Seedlot FG 21 only had 9% total germination even after 12 weeks of storage in contrast to its oven seeds which showed 96% germination. This showed that germination test of germplasm for storage should not be done immediately after harvest even if the seeds will be placed in the oven to break its dormancy since germination is not yet at its optimum.

Keywords: dormancy, rice genetic resources, germplasm, germination

ASD-22

MUTATION HASTENS DEVELOPMENT OF IMPROVED BREEDING LINES FROM TRADITIONAL RICE VARIETY POKKALI

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Gamma-irradiation (250 gy ^{60}Co) was used to treat the seeds of Pokkali, a salt-tolerant, tall, with spreading culm, late maturing, photosensitive, low yielding and with poor grain quality traditional rice variety from India. The M_1 and M_2

populations established in 2005 dry (DS) and wet season (WS), respectively, generated 59 M_2 plants with reduced plant height and maturity. The M_2 plants, established plant to a row in 2006 DS, generated M_3 lines, of which 32 were selected. The selections, advanced to M_4, were field evaluated in 2006 WS, and 18 lines chosen. The M_4 lines were evaluated for phenotypic acceptability, plant height, maturity and yield potential in 2007 DS. In 2007 WS, evaluation of M_5 lines, under irrigated and rainfed condition, identified 15 most agronomically improved mutant lines which have intermediate to erect culm, reduced plant height of 92-115 cm, compared with 137-176 cm for Pokkali checks, and shortened maturity of 109-127 days after sowing (DAS), compared with 120-126 DAS for the checks. The mutants had more productive tillers, 15-28, compared with 7-17 for the checks. The mutants yielded 4.1-8.5 tha^{-1} and 3.1-5.9 tha^{-1}, while Pokkali checks had 1.6-4.9 tha^{-1} and 0.7-3.8 tha^{-1} yield, under irrigated and rainfed condition, respectively. The mutants were improved for grain quality, viz., from awned to awnless grains, intermediate to short and slender grains, and from red to white pericarp. The milling potentials of most mutants are within the standards, chalkiness reduced, amylose content of 17.5%-24.4%, and of intermediate to low gelatinization temperature. The mutants are to be evaluated in multi-location trials targeting possible release as varieties. It took only three seasons to generate the stable mutants and another three for evaluation prior to multi-location trials, as compared with at least six seasons to generate stable lines and additional six for performance trials with conventional pedigree method of breeding line development.

Keywords: γ-irradiation, mutant, traditional variety, Pokkali, grain quality

ASD-23

RICE GRAIN QUALITY AS AFFECTED BY DROUGHT STRESS

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The effect of drought on rice grain quality was determined from 11 breeding lines grown under irrigated and drought-stressed condition. The traits

included % brown rice, % milled rice, % head rice for milling potentials, grain size (length and width) and shape and % chalky grains for physical attributes, % amylose content and alkali spreading value for physicochemical characteristics. Grains from drought-stressed plants were creamish white and dull in color compared with white and glossy grains from well irrigated plants. A reduction of 1.1%-19.3%, 1.5%-19.5% and 2.5%-32.4% in brown rice of six (55%) lines, milling recovery of all lines, and head rice of seven (64%) lines, respectively, were observed for grains harvested from stressed plants. The head rice of two stressed lines increased by 3.2% and 6.1%, while comparable with unstressed plants for two other lines. Drought stress reduced grain length by 0.1 mm-1.2 mm in 10 lines, while increased grain width in eight lines by 0.08 mm-0.42 mm. Drought stress resulted in an increase in grain length-width ratio (grain shape) of four lines, and a decrease in seven lines. When classified, only one line, shifted from intermediate to slender shape. The other lines remained intermediate or slender. Chalkiness in drought-stressed plants was increased by 1.8%-19.2%. Drought stress decreased amylose content by 0.9%-6.5% in eight lines and increased by 1.1%-6.5% in three lines. Drought stress further resulted in reduction of alkali spreading value in 10 lines and an increase in one line. Results indicate that the degree of the effects of drought in grain quality varies with genotype, and analysis with grain samples from stressed plants may not reflect the real genetic potentials of the genotypes. The source of grain samples for analysis has significant bearing in breeding line selection and/or commercialization where grain quality is of important consideration, particularly when the target environments for cultivation are drought-prone areas.

Keywords: drought stress, grain quality, milling potential, physical attributes, physicochemical characteristics, brown rice, milled rice, head rice, grain size and shape, chalkiness, amylose content, alkali spreading value

ASD-24

RELATIVE WARP ANALYSIS OF SHAPE VARIABILITY IN THE RICE BLACK BUG, *SCOTINOPHARA* SPP. (*COARCTATA* GROUP) OF THE PHILIPPINES AND MALAYSIA

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The landmark-based geometric morphometric approach of relative warps (rw) was used to determine the relationships of rice black bugs (RBB), *Scotinophara* spp. belonging to the *coarctata* group, of diverse geographic origins in the Philippines and in one site in Malaysia. The first two relative warps extracted from the matrix of all shape variables (rw scores) accounted for 25- to more that 40% of the total variation. The plots showed that in many cases, the landmark configurations are continuous. Landmark configurations of the prosternum in males separated the RBB from Agusan del Norte and Ajuy, Iloilo. In the discriminant analyses using the relative warp scores, more RBB were correctly classified when the shape of the prosternum was used to delineate the groups (>70% in both sexes). Cluster analyses showed differences in the shapes of the pronotum, prosternum and head between the Philippine RBB and those collected from Omar, Malaysia except for the female prosternum. Considerable shape differences between populations were also found locally within Luzon, Iloilo, Palawan and Mindanao based from the results of the discriminant analyses. The biological relevance of the morphological distinctness of the RBB from the different sites has yet to be further studied.

Keywords: *Scotinophara* spp. (*coarctata* group), rice black bug, relative warp analysis, geometric morphometrics, species groups

ASD-25

SYSTEMATIC RELATIONSHIPS OF PHILIPPINE RICE BLACK BUGS, *SCOTINOPHARA* SPP. (HEMIPTERA: PENTATOMIDAE: PODOPINI)

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The systematic relationships of Philippine rice black bugs (RBBs), *Scotinophara* spp. was inferred using Nonmetric multidimensional scaling technique (MDSCALE) and parsimony analysis to determine patterns of variation among the species and species groups. The MDSCALE result revealed a very distinct structure with clusters representing species groups visually apparent in the map. The distinct gaps in the phenetic spaces between species groups reflect the ease by which the species can be classified using numerical phenetics.

On the contrary, parsimony analysis showed that the species groups did not form monophyletic groups. It is suggested that more parsimony informative characters should be included to shed light into our basic understanding of the various evolutionary processes involved in the differentiation of these species of black bugs.

Keywords: *Scotinophara* spp., black bugs, Nonmetric multidimensional scaling, Parsimony analysis, autapomorphies, minimum spanning tree, species complex, systematics

ASD-26

TRENDS ON FERTILIZER USE IN RICE PRODUCTION IN THE PHILIPPINES

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The study sought to determine the trends in the use of fertilizer in rice production across ecosystems and seasons for the past ten years. The five-season data from the 33 major rice producing provinces of the Integrated Farm Household Analysis Project (IFHAP) was used in this study.

Results revealed that majority of the farmers applied inorganic fertilizer two to three times in their rice crop. Very few used the combination of inorganic and organic fertilizer. In irrigated areas, the percentage of farmers applying fertilizers rose from 96 percent in 1996 to almost 100 percent in 2006. However, a more dramatic increase was noted among farmers in rainfed areas, with the percentage of farmers applying fertilizers increasing from 81 percent in 1996 to 99 percent in 2006. Additional findings on farmers' use of inorganic fertilizers reveal that the rate of application of nitrogen, phosphorus, and potassium has been increasing over the past 10 years, both in irrigated and rainfed farms. The share of fertilizer ranges from 7 to 12 percent of the total cost of production.

With the increasing use of fertilizers and given its very important role in the food security program, support services ensuring efficient access of such inputs should be availed by small farmers to enhance their productivity and profitability in rice production. Farmers should be encouraged and trained on how to evaluate soil and plant conditions from which form the basis on the proper fertilizer management practices. Techniques and tools on how to diagnose the nutrient status of the soil and rice plant such as the Leaf Color Chart (LCC) and Minus One Element Technique (MOET) must be intensively promoted. The farmers must be educated on the importance of understanding the soil resource base and crop's demand for fertilizer at certain stages of the rice crop.

Keywords: organic fertilizer, inorganic fertilizer, nitrogen, phosphorus, potassium

ASD-27

MANAGEMENT OF ORGANIC MATERIALS IN AN ORGANIC-BASED RICE FARMING SYSTEM

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The amount of organic matter in soil is a function of the amount of plant residues returned to the soil and the rate at which these residues decompose. Plant residues are not only the substrate for the replenishment of soil organic matter, but they also serve as an important source of nutrients for paddy rice.

A Straw Quality Index (SQI) was developed from a series of perfusion experiments to determine the decomposition rate of straw from different rice varieties (*Oryza sativa L.*). The correlation matrix of the initial composition of straw samples and the cumulative C release established the relationships between residue quality parameters and decomposition rates: SQI = -56.85 + (11.68 x %N) + (1.25 x %DOM) + (2.59 x %lignin). It uses important descriptors of plant residue quality: nitrogen, digestible organic matter (DOM), and lignin concentration. These findings indicate the potential of SQI in assessing the quality of straw materials in predicting their usefulness in crop-residue management systems.

The efficiency of SQI and its relationship with rice grain yield was further examined under field condition. To evaluate the influence of organic materials' addition on the growth performance of rice and quality of paddy soil, a field experiment was conducted on a low-fertility clayey soil Maahas Series (*Aquandic Epiaqualf*) at IRRI-U.P Los Baños Experiment Station. The experiment confirmed the importance of SQI in assessing the quality of rice straw (*Oryza sativa L.*) and on multi-purpose tree species (*Gliricidia sepium* and *Macaranga tanarius*) under field condition. The effect of organic materials on rice grain yield and the subsequent changes on the properties of rice paddy soil was further investigated. There was a direct relationship between SQI and rice dry grain yield ($r2 = 0.87$). Management of organic materials in an organic-based farming systems demonstrated great potential in enhancing the sustainability of lowland rice cropping systems.

Keywords: organic material, decomposition, plant quality, organic farming

ASD-28

ASSESSING THE QUALITY OF PLANT TO ENHANCE THE SUSTAINABILITY OF LOWLAND R ICE CROPPING SYSTEM

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The initial benefit of plant residues appears to be related to their quality and decomposition rate and associated nutrient release. Plant residues are vital resource in the replenishment of nutrients in soil and in affecting the sustainability of rice production.

A glasshouse pot experiment was conducted to study nutrient availability after rice straws (*Oryza sativa L.*) of different quality were incorporated to an Alfisol sandy loam soil. The effects of water condition (flooded and non-flooded) and straw residue treatments on the availability of nutrients in the soil were examined at different sampling times (active tillering, maximum tillering and maturity). There was higher concentration of total C (C_T) and total N (N_T) remaining in the soil in straw residues with high Straw Quality Index (SQI) than those residues with low SQI. Flooded soil condition significantly decreased C_T concentration in all straw-residue treatments. Decomposition rate of straw residue was faster under aerobic than anaerobic conditions. The results demonstrated that nutrient availability is dependent on the quality of residues after the straw has been incorporated into the soil.

A field experiment was conducted to confirm the results of glasshouse experiment and evaluate the influence of 'quality' of plant residues on rice grain yield and properties of soil. The leaves of multi-purpose plant species *(Gliricidia sepium* and *Macaranga tanarius*) and straws of different rice varieties were incorporated on a low-fertility clayey soil (*Aquandic Epiaqualf*) at IRRI-UPLB Experiment Station in Los Baños, Laguna. Results showed that application of plant residues improved rice grain production. No significant changes in soil organic matter after 3 rice crops but its level increased afterwards. The study recognized the value of plant residue quality as an important aspect of low-input sustainable rice production systems. Maintaining adequate levels of soil organic matter is an important factor in the long-term productivity of such systems.

Keywords: nutrients, decomposition rate, plant residues, plant quality, soil organic matter

ASD-29

SEQUENCE-BASED IDENTIFICATION, AGGRESSIVENESS AND FUMONISIN PRODUCTION OF A POPULATION OF *FUSARIUM* SPECIES CAUSING BAKANAE DISEASE OF RICE IN THE PHILIPPINES

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Forty *Fusarium* strains were isolated from rice stems, shoots and grains in the Philippine provinces of Nueva Ecija and Laguna. All isolates were identified as *Fusarium fujikuroi* based on the elongation factor -1 α sequence except three isolates which were identified as *F. proliferatum*, *F. sacchari* and *F. oxysporum*. Based on PCR amplification of *MAT* (mating type) specific sequences, the 37 *F. fujikuroi* segregated 10:27 of *MAT-1* and *MAT-2*, respectively. Only five isolates produced fumonisins in liquid culture; concentrations, estimated by Enzyme Linked Immunosorbent Assay (ELISA), ranged from 0.025 ppm to 0.238 ppm. High Performance Liquid Chromatography (HPLC) analysis of 20 isolates revealed seven isolates as fumonisin producers with production ranging from 0.86µg/g -210 µg/g. Amplification of a partial sequence of the *fum1* gene (a key gene in fumonisin biosynthesis) by Real Time-PCR (RT-PCR) is in agreement with the results obtained by fumonisin analyses. No association between fumonisin production and aggressiveness of isolates under lab and greenhouse conditions was observed. The production of fumonisins of *F. fujikuroi* in rice and implies the need to explore a larger population of this pathogen to promote food safety.

Keywords: aggressiveness, bakanae, elongation factor -1 α sequence, Enzyme Linked Immunosorbent Assay (ELISA), fumonisins, *Fusarium fujikuroi*, High Performance Liquid Chromatography (HPLC), Real Time-PCR (RT-PCR), rice

ASD-30

SITE-SPECIFIC NUTRIENT MANAGEMENT FOR MAIZE: A CASE IN ISABELA, BUKIDNON, NUEVA ECIJA AND TARLAC, PHILIPPINES

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Increasing the productivity of irrigated and rainfed maize requires the efficient use of nutrients from soil indigenous and fertilizer sources to meet the nutrient needs for high and sustainable yield. This research was conducted to develop, evaluate and disseminate a new site-specific nutrient management (SSNM) approach for maize under varied soil and climatic conditions in key maize growing areas in the Philippines

Five replicated on-farm trials with hybrid maize were conducted in 83 farms in Isabela, Bukidnon and Nueva Ecija/Tarlac in 2005-2007. Irrigated maize was grown in the dry-season after wet-season rice in Nueva Ecija/Tarlac, while two wet-season maize crops were grown under rainfed conditions in Isabela and Bukidnon. Attainable yield was estimated in NPK treatments with ample nutrient supply (200 kg N, 120 kg P_2O_5 and 120 kg K_2O ha^{-1}). Soil indigenous nutrient supplies of N, P, and K were estimated as grain yield in omission plots where nutrients other than the omitted were not limiting yield. SSNM recommendations were developed based on attainable yield and the estimated yield responses to fertilizer N, P and K. Other treatments included planting densities, timing and split N application and the use of leaf color chart (LCC) for optimizing N management.

Planting densities of 65,000 to 75,000 plants ha^{-1} produce high yield and profit. Yield results obtained in the farms ranged from 6-10 t ha^{-1} in Isabela, 6-8 t ha^{-1} in Bukidnon, and 8-10 t ha^{-1} in Nueva Ecija/Tarlac. Using optimal planting densities and SSNM guided fertilizer recommendations increased yield by 0.6-2.0 t ha^{-1} and net benefit by 6-21% compared to the farmers' practice across all sites and seasons.

SSNM for maize is now ready for wider scale evaluation and current activities focus on farmer participatory evaluation of SSNM recommendationsincluding the use of the LCC to fine tune mid-season N management.

Keywords: maize, planting density, site-specific nutrient management, omission plot, leaf color chart

ASD-31

GREENHOUSE TECHNOLOGY IN THE PHILIPPINES: PROSPECTS AND PROBLEMS

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A marked increased in the number of greenhouse structures in the Philippines was observed within the last ten years brought about by the intensive promotion of greenhouse supplies and structures, available local government and foreign funding coupled with the realization to produce high value crops out of season and with less pesticides. The structures are of different models and utilize different covering materials.

The Central Luzon State University and the Pampanga Agricultural College are among the state colleges and universities that made advances in high value crop researches under greenhouse condition in Luzon. Developed technologies were promoted and commercialized in four provinces of Central Luzon with funding from Philippine Council for Agriculture, Forestry and Natural Resources (PCARRD) through the Central Luzon Agricultural Resources Research and Development Consortium (CLARRDEC) in cooperation with local government units.

Twenty greenhouse cooperators were selected based on the criteria set by the project, i.e very low utilization of the structures and lack of technical know-how on greenhouse culture. Science and technology interventions were made on technical problems that include crop and variety, water requirement, pest control and fertilization. Other technical problems such as covering material used, location of the greenhouse were the variables considered in differentiating the performance of the technology introduced.

Greenhouses which nylon mesh covering material (70%) and higher can be utilized for high value crop production for 9 to 10 months (June to April.) growing period generating a net income of about Php 12,000 to 20,000 per 100 m^2.

Greenhouses which are dominantly UV plastics can only be utilized profitably for 6 to 7 months without cooling/ventilation system such as blowers/fans. Lower income were derived from these greenhouses because of heat stress of plants inside the structure.

Keywords: greenhouse,, abiotic factors, covering material, ventilation,

ASD-32

FRUIT AND SHOOT REMOVAL AS METHODS TO CONTROL EGGPLANT FRUIT AND SHOOTBORER *Leocinodes orbonalis* GUENEE

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The study was undertaken to evaluate treatments on removal of infected plant parts such as fruits and shoots of eggplant every other day, every three days, weekly and every 10 days in controlling eggplant fruit and shootborer *Leucinodes orbonalis* Guenee. Untreated plants and recommended insecticide application using Profenofos at the rate of 400 L per hectare were used as standard checks.

Treatments on removal of the infested plant parts every other day, every 3 days, weekly and every 10 days significantly reduced the fruit and shootborer damage in eggplant. Moreover, these treatments produced more undamaged fruits compared to the untreated check and recommended insecticide application. Among the treatments, removal of the infested plant parts every other day and every 3 days produced the highest percentage undamaged fruits. The more frequent the removal of infested fruits and shoots the greater is the reduction of damaged fruits.

Cost and return analysis showed that removal of infested plant parts every other day gave the highest gross income but the practice is not economical considering the higher labor cost due to more frequent removal of infested plant parts. Removal of infested plant parts every week and every 10 days gave the insect enough time to complete its development thereby allowing them to do greater harm to plants. Removal of infested plant parts every 3 days is the most practical and economically viable.

Keywords: eggplant, shootborer, Profenofos

ASD-33

FARMER KNOWS BEST – CHANGING TRENDS IN PRODUCTION PRACTICES AND PEST MANAGEMENT IN AN EGGPLANT AFTER RICE CROPPING SYSTEM IN BALETE, BATANGAS

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The province of Batangas produces about two percent of the total eggplant in the country and the bulk of production comes from Balete, Batangas. Known as the eggplant capital of Batangas, most farmers in this area grow eggplant after rice in the last 40 years and only recently some farmers shifted to growing eggplant the whole year round. Insect pests and diseases were the major problem in eggplant production and the use of pesticides is the common practice to control these pests. However, continuous spraying brought a lot of health and environmental problems and this had encouraged farmers to look for alternative measures. This project aims to survey the eggplant production and pest management practices among farmers in Balete, Batangas and document some of the approaches they discovered themselves to reduce pest incidence. Also, different eggplant cultivars were introduced and screened for pest resistance and consumer preference in five selected farmer cooperators.

In collaboration with the Office of the Mayor and the Municipal Agriculture Office of the Local Government Unit of Balete, thirty-three farmers were interviewed regarding their profiles, production practices and pest management discoveries.

Results showed that most farmers were tenants, farming an average of 0.5 eggplant monoculture fields. For pest management practices, the farmers used pesticides to control insect pests and diseases and spray twice weekly.

Male members decide what to do with pest problems and get knowledge on pesticides from DA technicians and dealers. Only 25% of them attended an IPM seminar.

The farmers were hesitant to plant and sell the off-type cultivars (A300, Abar and EG203) and only planted the Casino hybrid. Off-types were only for home consumption. Grafted eggplant (Casino-scion, EG203-rootstock) was acceptable because of the higher yield and the fruits (like Casino) and moderately resistant to bacterial wilt and phomopsis.

The most significant change in farmer's practices which they discovered themselves is the reduction in their pesticide spraying (only at vegetative stage) and retaining trimmed weeds in the alley to lower pest population thus saving pesticide cost. Some farmers also observed decrease in pest incidence when other crops were planted inside or within the eggplant field and significantly increased their income. Once the practice had become known and successful as a result of increased income, the farmers started to copy one another's experience and today, the area not only practiced reduced spraying but also planted other vegetables. With this changing perception and environmental awareness among eggplant farmers of Balete, Batangas, having discovered what is best for them and their farming practices, the place will always be known as the eggplant capital and continue to produce premium, consumer-friendly and environmentally-safe eggplants and vegetables.

Keywords: pest management, eggplant production, Balete, Batangas, Casino hybrid, grafted eggplant

ASD-34

GROWING LETTUCE ON RECYCLED BOTTLES WITH SNAP

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Simple Nutrient Addition Program (SNAP) is a hydroponics system being popularized for the mass production of crops such as lettuce in areas with small available space. This method of growing crops is applicable in urban areas where soil or space for growing crops is not adequate. This is called urban farming. Urban farming can be done in apartments and townhouses where small terraces can be used for growing plants. Residents in these types of houses can grow crops for their own consumption.

This study has included some modification to the SNAP hydroponics system through the use of recyclable softdrink bottles and addition of potting mixtures for anchorage and additional nutrient source for the crop. Furthermore, the effect of microbial based fertilizers on the yield of the crop and its interaction with the nutrient solution was investigated.

The experiment was conducted at the Institute of Plant Breeding following a two factor randomized complete block design (RCBD) with six replicates per treatment. Factor A involved two levels of SNAP, the full strength (FS) and half strength (HS) while factor B involved the use of the biofertilizers BioGroe and Mykovam.

Incorporation of the potting mixture sterilized soil: sand: coir dust: rice hull: charcoal (1:1:1:1, v/v) at the upper part of the bottle provided better growth for the lettuce seedlings because of added nutrients and root anchorage. The use of half strength SNAP solution showed higher marketable yield, shoot fresh weight compared to the full strength. Biofertilizer application increased the marketable yield when applied with half strength SNAP solution. Simple financial analysis showed the feasibility of acquiring a quantitative income using the SNAP hydroponics system.

Keywords: Lettuce, SNAP, Mykovam, BioGroe, urban-farming

ASD-35

BIOMASS, NITROGEN UPTAKE AND NITROGEN FIXED PARTITIONING in MUNGBEAN (*Vigna radiata* | L.] Wilczek) GROWN UNDER FIELD CONDITION

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Legumes like mungbean have the ability of converting atmospheric nitrogen into a form that can be used by the plant through the biological nitrogen fixation (BNF) process. A field trial was conducted at UPLB to determine the effect of inoculation with *Bradyrhizobium* sp. strain M6 on biomass, harvest index (HI), nitrogen harvest index (NHI), BNF and partitioning of nitrogen fixed in four mungbean genotypes. BNF was estimated using the ^{15}N isotope dilution technique which involved the application of ^{15}N labelled ammonium sulphate fertilizer with 5% atom excess in designated microplots at the rate of 20 kg N ha^{-1} and analysis of ground plant samples for ^{15}N atom excess by mass spectrophotometry. In general, the inoculated and control plots did not differ significantly in terms of the above parameters measured due to high native rhizobia population present.

The four mungbean entries differed significantly in terms of biomass and grain yield. Pag -asa 7 produced the highest yield followed by Pag-asa 3 while Acc 15781 produced the lowest yield as a result of its susceptibility to insect pests and diseases. Significant differences in HI, N uptake and NHI were mainly due to differences in total biomass production. However, the four entries did not differ significantly in terms of BNF with % N derived from air (Ndfa) ranging from 30.43 to 37.94 % and 22.82 -39.79 kg N fixed per ha. From the total N fixed, 39.89%-43.08% was partitioned to the grains while 51.54%-55.74% of N fixed was left in the shoots. Hence, it is important to plow back mungbean stover because of the considerable amount of N and N fixed left in the shoots. The high N demand by grains were shown by the net soil N removal of 22.66 to 33.57 kg N per ha.

Keywords: Biological Nitrogen Fixation, ^{15}N isotope dilution technique, Nitrogen Harvest Index, Harvest Index

ASD-36

VEGETATIVE COMPATIBILITY GROUPINGS AND VIRULENCE OF *FUSARIUM OXYSPORUM* IN BITTER GOURD AND BOTTLE GOURD IN THE PHILIPPINES

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Vegetative compatibility groups (VCGs) were determined for 57 *Fusarium oxysporum* isolates from *Momordica charantia* L. (bitter gourd) and *Lagenaria siceraria* (Mol.) Standley (bottle gourd) in two provinces in the Philippines namely Batangas and Bulacan using nitrate-nonutilizing (nit) mutants. Sixty one and 25 nit mutants were generated from *F. oxysporum f. sp. momordicae* and *F. oxysporum f. sp. lagenariae* isolates, respectively. Frequency of reversion to wild type was higher in *F. oxysporum f. sp. momordicae* than in the *lagenariae* populations. Two and four VCGs were found in bitter gourd from Batangas and Bulacan, respectively with a ratio of VCGs to isolates (VCG_{di}) of 0. 20 - 0.33. Two and three VCGs were found in bottle gourd from the two locations with VCG_{di} of 0.40 - 0.50. VCG was not correlated with radial growth rates of *F. oxysporum* in either hosts or locations. The two *formae speciales* of *F. oxysporum* were not vegetatively compatible. Low VCG diversity of *F. oxysporum* populations in both hosts and locations could be attributed to clonal reproduction, parasexual recombination and limited gene flow. Bottle gourd isolates from Bulacan were not compatible with those from Batangas whereas some bitter gourd isolates from both locations were compatible. incompatibility of bitter gourd and bottle gourd isolates suggests high host specificity of *F. oxysporum*. Virulence of some bitter gourd isolates tested was not associated with a particular VCG. Cross-inoculation tests showed that bitter gourd isolates were not pathogenic to bottle gourd and vice versa.

Keywords: *Fusarium oxysporum* f. sp. *momordicae*, *Fusarium oxysporum* f. sp. *lagenariae* , bitter gourd, bottle gourd, vegetative compatibility groups

ASD-37

DEVELOPMENT OF PURELINE FRESH MARKET TOMATO CULTIVARS

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The development of pureline fresh market tomato cultivars was conducted in Ilocos Norte from 2000 – 2006. This started with the three MMSU off-season tomato F1 hybrids: Native x Line 1, Native x Line 2 and Native x Line 3. These were developed into pureline cultivars through continuous selections until the desirable characteristics become stable. Stabilization was done using pedigree method from F1 up to F8 generation or until there were no longer segregation. Selections were undertaken during the vegetative, flowering and fruiting stages based primarily on the growth habit, reaction to pests, crop vigor, fruit size and shape, fruit setting, yield and yield components. The developed fresh market tomato purelines were further evaluated based on their performance on-station and on-farmers field and then select the best for off-season planting, i.e., wet season.

The four selected lines (MT3-25-26-4-43-16-13, MT2-18-16-6-16-4-1, MT3-25-6-18-41-14-5 and MT3-43-12-10-60-26-14) showed good performance and outyielded the MMSU tomato hybrids. These lines produced an average yield of 37.82, 34.44, 37.22 and 37.28 t/ha^{-1}, respectively. These have pinkish to pinkish red fruit color, the fruit shapes are round to flat round, characteristics are mostly preferred by the consumers. All the selected lines have juicy and sour tastes which resembled or were comparable with the three MMSU hybrids, wherein these desirable qualities are most preferred for fresh market tomatoes.

The advantage of planting purelines is its stability from one generation to the next, hence, farmers can still use the seeds for their next cropping seasons. By planting purelines, the cost of production particularly the amount allocated for seeds will be reduced. Hence, higher net income per hectare and per peso invested will be realized as compared in the planting of hybrids.

Keywords: purelines, fresh market tomato, off-season production, breeding, selection, development

ASD-38

A BREAKTHROUGH IN THE MICROPROPAGATION OF MANGO (Mangifera indica L.) VIA SOMATIC EMBRYOGENESIS AND A SIMPLE SYSTEM FOR PLANTLET ACCLIMATIZATION AND TRANSFER TO POTTING MEDIA

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The 'Carabao' mango or Manila Super, is the lone commercial variety of the Philippines. Its importance increased tremendously with the advent of flower induction by KNO, in the 1970's. The fruit needs further improvement in color, shelf life, size, among others, through biotechnology where a successful tissue system is a necessary step.

This paper presents a breakthrough in the micropropagation of mango and a simple system for plantlet acclimatization and transfer to soil.

Somatic embryos (1°, 2°, .. n°) were produced continuously using the protocol of Pateña et al. (2002). The protocol was reproducible in different 'Carabao' strains. Primary (1°) somatic embryo (SE) induction ranged from 18.39 to 100%. In 2007, we induced 67 nucellar cultures and obtained 23.88% primary SE induction. This was relatively high for a woody species like the mango. We previously reported that a single somatic embryo was needed to start continuous proliferation. The somatic embryos exhibited the different developmental stages (globular, heart, torpedo, and cotyledonary stages). We identified 6 distinct tissue culture stages: SE induction, SE proliferation, SE germination, root and cotyledonary leaf formation, initial shoot formation, and true leaf formation. Somatic embryos germinated and developed into complete plants like mature seeds grown in soil. SE-derived plantlets were acclimatized and transferred to soil. On previous attempts, plantlets survived for 10-17 days in other potting media while none survived in soil. Various acclimatization techniques were tested and we have developed a simple system for transfer of plantlets to potting media. This system of continuous production of SEs, their development into complete plantlets, and successful transplant to potting media provides a means for mass propagation and a tool for improvement through biotechnology.

Keywords: 'Carabao' mango, somatic embryogenesis, micropropagation, acclimatization

ASD-39

A NEW MEDIUM FOR IN VITRO ROOTING AND PLANTLET REGENERATION AND A SIMPLE TECHNIQUE OF ACCLIMATIZING PLANTLETS

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Tissue culture is used in almost all biotechnology work to generate plants with improved characteristics. There are several factors needed to succeed in tissue culture, foremost are the medium and the acclimatization technique. These are exemplified in our work on avocado and orchids.

In avocado, the medium that we developed, Barba and Pateña's BP medium, proved to be the best in obtaining complete plantlets. We had difficulty regenerating plantlets from somatic embryos, hence, we resorted to in vitro rooting of shoot cultures of cvs 'Semil', 'Mainit' and 'RCF' Purple'. Highest rooting percentage was observed in BP medium (83%), followed by Murashige and Skoog's (MS) medium (58%) and least in the Woody Plant (WP) medium (33%); all media were supplemented with growth regulators. In orchids, the use of BP medium favored plantlet regeneration of in vitro germinated embryos.

A critical factor in tissue culture is the transfer of regenerated plantlets to soil. Our work on avocado and mango resulted to a successful technique of acclimatizing regenerants and their subsequent transfer to potting media. This included well-lighted, cool environment and the use of hydroponics-style plastic cups, an innovation first reported in this paper.

These two innovations, the BP medium and the acclimatization technique, will greatly contribute in the tissue culture of woody species, the group of crops which are difficult to tissue culture.

Keywords: woody species, tissue culture medium, BP medium, in vitro rooting, acclimatization

ASD-40

INVASIVE MEALYBUG: THE CULPRIT IN THE DECLINE OF THE ATIS INDUSTRY IN LOBO, BATANGAS

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The buff coconut mealybug (BCM), *Nipaecoccus nipae* (Maskell), is a recently introduced pest in the Philippines and has become very destructive among important agricultural crops in the last five years. This invasive pest was first observed in early 2001 and after five years, it has already been recorded in almost 60 plant species belonging to 14 genera. It is the aim of this paper to present the unfortunate situation brought about by this mealybug to the 'atis' industry of Lobo, Batangas. Through this paper, we wish to call the attention of concerned agencies to look at this very important pest and its continuing threat to more agricultural crops

in the country.

One of the most susceptible crops that did not escape from BCM attack is the famous 'atis' or sugar apple of Lobo, Batangas. Lobo "atis' is not only very special among the Batangueños but also around the country because of its delicious, sweet taste and relatively bigger size allowing ease in eating. This crop is planted along the rolling hills of Lobo situated along the coast of Batangas. This fruit is actually one of the major sources of income of the municipality with an estimated average annual production of over the past forty years. The BCM were first observed in early 2000 on the hilltops of the upper barangays of Lobo particularly in Banalo and San Miguel. The infestation progressed to the lower barangay. The farmers started to complain about this pest in 2003. They observed the decrease in yield and the secondary damage by the consequent sooty molds on the 'atis' trees and surrounding vegetation. The damage had been aggravated by long spells and the big plunge came in 2005 when there was almost no income generated.

The recent supertyphoons might have put down the mealybug population significantly. However, as early as January 2007, signs of resurging mealybug populations have already been imminent and there have been a steady increase. So far, no effective natural enemies whether parasitoids or predators have been found. The steep slope of most 'atis' farms also make chemical control or other non-biological means not only costly but also impractical. The search for effective control measures, however, continues to be stalled by lack of financial resources for R&D and lack of government support to this pest epidemic.

Keywords: buff coconut mealybug, *Nipaecoccus nipae*, Lobo, Batangas, 'atis', sugar apple

ASD-41

VIABILITY AND IN-VITRO REGENERATION OF INDIGENOUS ORCHID PODS COLLECTED FROM HOME GARDENS AND COLLECTING POINTS

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The Philippine flora possesses a tremendous diversity of taxa in the *Orchidaceae* family, with about 800 species. Plants exported from the Philippines is mainly orchids. 61-93% of exported orchids were collected from the wild while 7-39% were reported as artificially propagated. One strategy to ease over collection from the wild for trading is to collect pods from home gardens and collecting points and regenerating them *in vitro* as a viable source of planting materials.

Both mature and immature indigenous orchid pods were collected home gardens and collecting points. Intact pods were surface-sterilized in 100% commercial bleach for 20 min. Exposed seeds were subjected to 20% commercial bleach for 20 minutes followed by 10% commercial bleach for 10 min. The seeds were cultured following the standard orchid embryo culture using Knudson C as the base medium. Seed viability was determined using the standard tetrazolium test. Germination time, measured in weeks was noted.

A total of 98 genotypes from 28 species of indigenous orchids were cultured. The orchid genotypes collected showed wide variation in seed viability and germination time. Forty two percent (42%) of the orchid genotypes had a viability of 50 to 100% and germination time of 4 to 15 weeks. Within species, mature pods exhibited higher seed viability and faster germination than immature pods. Plantlet regeneration was obtained from all genotypes collected upon transfer of germinated seeds.

These results prove that both immature and mature indigenous orchid pods are viable sources of planting materials for indigenous orchid production. Thus, collection from the wild will be eased.

Keywords: indigenous orchids, embryo culture, seed viability, plantlet regeneration, Knudson C medium

ASD-42

INTRODUCED BANANAS: NEW CULTIVARS, MORE OPTIONS FOR THE BANANA FARMERS

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In the last 15 years, *Musa* researchers worldwide have identified and developed a number of new, high-yielding and disease-resistant cultivars of banana. Today, these improved cultivars are being made available for testing and distribution to smallholder farmers through Bioversity International (formerly INIBAP/IPGRI). This strategy is viewed as a shortcut to a long, tedious and expensive banana breeding program. In 2001, 24 hybrids and landraces were introduced into the country for conservation and multiplication. The performance of these new cultivars under local growing conditions was evaluated in terms of agronomic and yield characteristics, visual and organoleptic (taste) acceptability, and reaction to common diseases. Results of the study conducted by the Institute of Plant Breeding, University of the Philippines Los Baños (IPB-UPLB) showed that FHIA 17, FHIA 23 and FHIA 25 significantly produced heavier bunches than the highest yielding local cultivar (Cardaba) while FHIA 17 produced the heaviest individual fruits. However, these introduced cultivars were less sweet than the local cultivars based on TSS reading. Most of the introduced cultivars were also found to posses moderate resistance against the banana bunchy top virus (BBTV).

In terms of taste, Saba is still preferred as boiled while Lakatan is more preferred as table bananas than the introduced cultivars. However, FHIA 01 is better liked as cake compared to Bungulan. All FHIA hybrids (except FHIA 25) are preferred over the local Saba variety for processing into honey-flavored and salted chips. This highlights the cultivars' potential as raw material for value-added processed products (banana chips) for both the local and export markets.

Keywords: Banana, local and introduced cultivars, BBTV resistance, yield, taste test, banana chips

ASD-43

FIELD PERFORMANCE OF BANANA CV. LAKATAN (*MUSA ACUMINATA*) UNDER TWO FERTILIZER MANAGEMENT SCHEMES IN INFANTA AND GEN. NAKAR, QUEZON

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Banana cv. Lakatan (*Musa acuminata*) is an important cash crop of small farmers in the Philippines. However, crop productivity remains low due to under management and vulnerability to typhoons. This study aims to evaluate the field performance of Lakatan cv. using two fertilizer management schemes namely, (1) inorganic fertilizer recommendation (100% RF) of 250N : $30P_2O_5$: $350K_2O$ kg ha^{-1} and (2) combination of biofertilizers developed by the University of the Philippines Los Baños (BIO-N® and MYKOVAM®) and a quarter of the inorganic fertilizer recommendation (25% RF+BF). Except for the fertilizer treatment, all other management practices were similar in four cooperator farms. The treatments cost an additional 24 man-days labor per ha. (i.e., PhP 2.40 $plant^{-1}$) and PhP 10.74 $plant^{-1}$ for 100% RF fertilizer materials and Php 3.78 for 25% RF+BF. For the farmers to recover this cost, the 100% RF have to harvest at least 1.17t ha^{-1} (0.5 kg $plant^{-1}$ at 2,500 plants ha^{-1}) more than the 25% RF+BF combination while the 25% RF+BF need to increase yield by 0.74 t ha^{-1} as compared with the farmers' existing practice of no fertilization.

Generally, the 100% RF had significantly taller plants (282.47 cm), wider area of the 2nd youngest fully-expanded leaf (13,447 cm^2) and larger pseudostem girth (68.89 cm) compared with 25% RF+BF at shooting. 100% RF treated plants also fruited earlier (12 months) compared to 25% RF+BF treatment which started fruiting after 14 months. Initial yield data are as follows: total weight of hands, 9.5-13 kg; number of hands, 8-13; and number of fingers, 104-181 for the 100% RF compared with 8-11 kg; 6-8; and 106-124, respectively for the 25% RF+BF treatment, with a clear trend of attaining higher than the minimum yield increase required to compensate for fertilizing banana plants. Early fruiting is an added advantage in 100% RF which could minimize by two months the risk of field exposure to natural elements and pests and diseases. Result of this study offers the farmers options on how to better manage their bananas for increased productivity and income.

Keywords: Lakatan banana, productivity, fertilizer management, growth, yield, biofertilizers

ASD-44

ROLE OF HEALTHY-LOOKING SABA AND OTHER ALTERNATE HOSTS ON THE SPREAD OF BANANA BUNCHY TOP DISEASE (BBTD)

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Banana bunchy top disease (BBTD) caused by *Banana bunchy top virus* (BBTV) is the most destructive disease of banana causing a significant yield loss on the quality and quantity of banana production. BBTV can persist naturally in banana plants with no apparent symptoms of BBTD. Apparently healthy-looking banana and alternate hosts of BBTV have implications in developing disease management srategies. Asymptomatic banana representing varying cultivars were collected from Laguna, Batangas, Cavite and Quezon where banana bunchy top disease (BBTD) was prevalent. Saba was the most frequently collected cultivar. Enzyme-linked immunosorbent assay (ELISA) was done to determine the presence or absence of BBTV on the collected banana plants. Results of ELISA showed that most of the collected banana samples were positive to the virus. This indicates the presence of the virus in the symptomless plants. Insect transmission test of selected positive samples showed that the virus can be transmitted from asymptomatic banana plants to tissue-culture derived banana cv. Lakatan. Characteristic symptoms of BBTV were observed from inoculated test plants. Symptoms started to appear 21 days after inoculation. Artificial inoculation to alternate hosts of banana aphids including camia (*Hedychium coronarium*), taro (*Colocasia esculenta*), *Colocasia* sp., *Costus* sp., *Heliconia* sp., and *Dieffenbuchia* sp. was also done. Initial studies show three possible and potential plant reservoir of BBTV outside *Musaceae* family based on insect transmission studies and ELISA. These include variegated gabi, Bandera Espanola, and *Heliconia* sp. Symptoms started to appear 4 weeks post-insect transmission only on variegated gabi and *Heliconia* sp. as marginal chlorosis and mosaic, respectively. The results showed that asymptomatic banana plants within an area with BBTD, regardless of variety, can serve as infection foci for the spread of BBTD. Crops other than those belonging to Musacea can also serve as source of inoculum.

Keywords: immunosorbent, Musacea, inoculum, chlorosis, *Musaceae*

ASD-45

DIFFERENTIAL EXPRESSION OF A NOVEL BANANA MADS-BOX GENE SHOWS DEVELOPMENTAL CONTROL OF CLIMACTERIC FRUIT RIPENING

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The regulatory role in ripening of a novel banana fruit-specific MADS-box gene was investigated by quantification of its expression and correlation to the rise in ethylene production during fruit maturation. The gene, *MaMADS2*, was isolated from ripe banana fruit cDNA and had a putative protein sequence that was structurally similar to Type II MADS-box transcription factors that are implicated in key developmental processes.

Using real time PCR analysis, *MaMADS2* expression was quantified in pulp and peel tissues sampled during ripening of bananas stored in 95% (high) and 82% (low) relative humidity (RH). Ethylene and CO_2 production were measured using headspace gas analysis.

Storage under low RH decreased time to ripening with a more rapid peel color loss and firmness of banana fruits. Under low RH, no typical ethylene climacteric peak was observed, rather, the increase in ethylene production persisted until fruit deterioration. This pattern was similar in whole fruit and peel tissues, while there was no significant rise in pulp ethylene, as was observed in pulp of banana stored at high RH. In contrast, the carbon dioxide produced was similar under both storage regimes.

MaMADS2 was differentially expressed in pulp and not in peel. At high RH storage, *MaMADS2* expression increased steadily and was highest a day after the climacteric. In contrast, low RH conditions induced very high *MaMADS2* expression on the second day of storage suggesting that *MaMADS2* is dependent not only on the developmental process but also on environmental conditions. It is not clear how *MaMADS2* expression due to low RH affects the loss of pulp ethylene climacteric and the shortening of the ripening period of bananas.

Results show that *MaMADS2* is expressed before the rise in climacteric ethylene and that it has a possible regulatory role in the ripening process possibly only in pulp.

[1]MADS-box- MADS is derived from the initials of the founder proteins Minichromosomal maintenance1, Agamous, Deficiens and Serum Response Factor

Keywords: MADS-box, developmental factors, banana, ripening, climacteric

ASD-46

BANANA TISSUE CULTURE: FROM IDRC TO IPB TO THE INDUSTRY AND BACK TO IPB

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In 1983, IDRC of Canada approved an invitational proposal, from Dr. RM. Lantican, then Director of IPB, prepared by LF Pateña (Project Leader) and RC Barba (Coordinator). The objective was to promote planting of banana in rural villages as cheap source of food, using micropropagation as the source of affordable if not free planting materials. In one year, the team completed the micropropagation of 50 banana cultivars resulting in a paper that was a finalist for the CSSP Best Paper Award. A training course was prepared by LF Pateña and implemented by AB Zamora for 6 trainees from Malaysia, Thailand and the Philippines. One Filipino trainee, Adonis Jadraque, a staff of Twin Rivers Research Center (TRRC) in Davao, set up a laboratory to mass produce a new variety of banana. The result was very successful that other corporations set up their own laboratories, with the assistance of Lydia Magnaye, the other local trainee from BPI-Davao, to produce their own planting materials of Cavendish banana for export. Meanwhile, the IPB-PCTCL micropropagated banana to serve the original purpose of the project from 1984-1995 and stopped because of budget constraint.

Lately, the Department of Agriculture (DA), Republic of the Philippines, recognized the need for planting materials and awarded IPB a grant to produce seeds and vegetatively propagated planting materials. This included a portion for the PCTC Laboratory to produce virus-free (indexed by BIOTECH) banana in 2006 and distribute/sell plantlets in 2007. The initiative of DA to support, and IPB to implement, the banana micropropagation, could be the start of a profitable commercial venture. A feasibility study is presented in a separate paper.

Keywords: banana, virus-free, micropropagation, IDRC, IPB, PCTCL, commercial venture

ASD-47

SAFEGUARDING THE SUGAR INDUSTRY FROM DISEASE INCURSION AND EPIDEMIC

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Sugarcane varietal improvement can be hastened through germplasm exchange and varietal introduction. This will only succeed if the risks of introducing exotic diseases are minimized. Post-entry quarantine measures which include regular monitoring and disease indexing must be followed. A total of 159 promising varieties were acquired and introduced to the country from Thailand, Malaysia, Indonesia, Bangladesh, Australia, China, France and Mauritius. These varieties were allowed to grow for 18 to 24 months inside the post-entry quarantine glasshouse and eight to ten months in an open field quarantine to ensure that only disease-free materials will reach the fields. Visual observation coupled with disease detection involving antibody- and nucleic acid-based techniques were employed to monitor the presence of diseases whether exotic or endemic to the Philippines. Cold soak and long hot water treatment (50C for 2 hr) and fungicide treatments were done to eliminate disease-causing organisms. Diseases like mosaic, leaf scald, ratoon stunting disease, yellow leaf scald were detected and eradicated from planting materials.

Keywords: sugar, germplasm, fungicide treatments, mosaic, leaf scald, ratoon stunning disease

ASD-48

ACID PROTEASE PRODUCTION OF THERMOPHILIC BACTERIA ISOLATED FROM MUD AND SOIL OF MUDSPRING, MT. MAKILING, LAGUNA, PHILIPPINES

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A total of 244 bacterial isolates were isolated from mud and soil of Mudspring, Mt. Makiling, Los Baños, Laguna for acid protease production. Approximately 62% of these gave positive growth at 65°C and were screened for proteolytic activity using skimmilk assay plate at 45, 55 and 65°C. Out of 150 isolates screened, six (6) bacterial isolates gave high proteolytic activity at all temperatures tested. Conventional cultural, morphological, physiological and biochemical analyses revealed that two of these are *Bacillus subtilis* (7MM-8 and 7MM-16), two *Bacillus brevis* (4MM-22 and 5SM-6), one *Bacillus pumilus* (3SM-23) and one *Bacillus polymyxa* (4MM-2). Cell suspension of these isolates was inoculated in modified soybean cake extract containing 6% soybean extract, 13% potassium phosphate, 0.8% dextrin, 0.3% magnesium sulfate, 0.5% potassium chloride, 0.02% calcium chloride and 0.2% yeast extract at pH 4.5. Cultures were incubated at 45°C with shaking and the cells were harvested from the culture supernatant by centrifugation. The supernatant, as crude acid protease, was used for the assay. The activity of the crude acid protease produced by the *Bacillus* spp. was assayed using 2% casein as substrate. Results showed that acid protease from 4MM-22 and 7MM-16 yielded activities of 277.5 and 247.0 acid protease unit (APU), respectively. Characterization of the two isolates showed that 4MM-22 was active and stable at pH 4 and 55°C and pH 2.0 to 4.0 and 20 to 50°C. Isolate, 7MM-16, was active and stable at pH 4.0 and 55°C and pH 2.0 to 5.0 and 20 to 50°C. These results reveal the promising value of the acid protease produced by the isolated thermophilic bacteria in food and industrial applications. These isolates are currently deposited in the Microbial Culture Collection of the Museum of Natural History for application in wine clarification and identification and expression of other potential thermophilic enzymes.

Keywords: thermophilic bacteria, acid protease production, acid protease unit (APU), Mudspring, Mt. Makiling, assay

ASD-49

HETEROLOGOUS EXPRESSION OF THE COAT PROTEIN (CP) GENE FROM THREE PHILIPPINE ISOLATES OF ABACA BUNCHY TOP VIRUS (ABTV)

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The abaca bunchy top virus (ABTV) coat protein (CP) gene was isolated and amplified through polymerase chain reaction. The template used for PCR was total DNA extracted from the leaves of ABTV-infected plant. The CTAB method was performed to obtain the total DNA. Primers in PCR were based upon the coat protein gene sequence of three Philippine strains of the banana bunchy top virus (BBTV). By agarose gel electrophoresis, it was shown that the PCR product was 580 bp in size, roughly the same length as the coat protein gene of BBTV. The putative CP gene was then cloned into the vector pEXP5-NT/TOPO by TOPO-TA cloning. *Escherichia coli* BL21(DE3) cells were transformed with the CP-vector construct. Sequences of the cloned gene were highly homologous to the banana bunchy top virus coat protein gene. Protein expression of the coat protein was done by IPTG induction of BL21(DE3) transformants. SDS-PAGE was used to analyze the total protein from induced BL21(DE3) cells. A ~24 kDa band corresponding to the putative CP-His tag fusion protein was obtained for Davao, Laguna, and Leyte isolates.

Keywords: abaca bunchy top virus (ABTV), coat protein, protein expression, molecular cloning

ASD-50

INSECT PESTS AND DISEASES: EMERGING PROBLEMS IN SWEET SORGHUM PRODUCTION

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Sweet sorghum, *Sorghum bicolor* offers an excellent source of feedstock in bio-ethanol production. Like other crops, insect pests and diseases could be a productivity constraint. Their identities serve as benchmark in solving possible pest problems in sweet sorghum production.

Field trials of 59 ICRISAT cultivars in the Mariano Marcos State University, City of Batac, Ilocos Norte were conducted. Samples of major insect pests and diseases were collected and identified appropriately. Promising cultivars were evaluated based on zero (0) infestation/infection of specific pests.

Based on the results obtained, the insect pests attacking the leaves were: *Spodoptera spp.* (cutworm/armyworm), *Helicoverpa armigera* (budworm), *Rhopalosiphum maidis* (corn leaf aphid) and *Schizaphis graminis* (green bug). Soft kernel pests were: headworm (*H. armigera*), webworm (*Ephestia sp.*), chinch bug (*Blissus sp.*), phalacrid beetle (*Phalacrinus rotundus*), corn sap beetle (*Carpophilus dimidiatus*), and maize weevil (*Sitophilus zeamais*). *Ostrinia furnacalis* (stalk borer) attacked the stalk from vegetative to maturity while *Delia sp.* (seedcorn maggot) attacked the base of the stem from seedling to vegetative stages. Stored seed pests noted were *S. zeamais*, *Tribolium sp.*, *Oryzaephilus sp.*, and *Ephestia sp.*

Major leaf diseases were caused by *Helminthosporium sativum*, *Fusarium graminearum* and *Puccinia purpurea*. Low incidences of bacterial stripe (*Pseudomonas sp.*) and mosaic at seedling and vegetative stages were noted.

Of the promising cultivars identified, 9 were not attacked by both *Phalacrinus rotundus*, and *Carpophilus dimidiatus*, while 7 others were not infested by *Sitophilus zeamais*. There were 9, 12, and 13 cultivars that were not attacked by *F. graminearum*, *H. sativum* and *P. purpurea* respectively while 9 others were not infected by kernel mold. These materials are relevant inputs in solving pest problems of sweet sorghum.

Keywords: emerging problems, insect pests, diseases, sweet sorghum, promising cultivars, productivity constraints

ASD-51

CORN SILK BEETLE, MONOLEPTA BIFASCIATA (HORNSTEDTH) A NEW PEST RECORD ON CORN POLLEN IN THE PHILIPPINES

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The corn silk beetle, Monolepta bifasciata (Hornstedth) is a common pest of corn and other fruit trees. This beetle has been reported feeding on the silk (female flower) and leaves of corn in the Philippines. Some farmers in Pampanga and Tarlac have mentioned the unusual number of these beetles on Bt corn's silk and tassel (male flower). We observed and pictorially recorded the unusual numbers of this beetle on the silk and tassel of Bt corn in Santiago, Lubao, Pampanga last October 2007. As high as 50 or more individuals were observed on each tassel. Since the beetles consume the pollen, they effectively prevent pollination resulting to non-grain formation or irregular grains on the cob. The nearby fields of sweet corn with flowering stages were not attacked at the tassel by this beetles. This observation is the first time that we know of on corn in the country wherein these beetles attacked the corn pollen in the tassel. This novel information is likewise an invaluable addition on the arthropods diversity of Bt corn in the Philippines. It certainly provides the necessary documentation on anecdotal reports related to Bt corn and its faunal diversity.

Keywords: Monolepta bifasciata, pollen feeder, silk, corn, Philippines, new pest record, Bt corn

ASD-52

PROLONGING THE SHELF LIFE OF CARABAO MANGO USING CONTROLLED ATMOSPHERE TECHNOLOGY

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Controlled atmosphere (CA) storage is a technology developed to extend the shelf life of various perishable products. The technology involves a process of reducing the oxygen (O_2) level while increasing the carbon dioxide (CO_2) level in a storage facility maintained with a low temperature. A validation trial using a stationary container van was conducted to evaluate the quality of 'Carabao' mangoes using CA technology for 28-day storage. Five metric tons of export quality mangoes were sorted, washed, hot water treated and dipped in fungicide. The mangoes in export quality boxes were loaded in a 40-foot container van equipped with CA facility. After attaining the number of days set for the duration of storage, the mangoes were unloaded and observed for physico-chemical and sensory evaluation. The CA-stored mangoes reached the color index 6 (CI 6 – full yellow) six days after unloading and were generally acceptable in terms of chemical characteristics and sensory qualities. The cost of processing mangoes for export using the protocol derived from this project was estimated at PhP9.47 per kilogram. Controlled atmosphere storage with levels of 4%O_2, 6%CO_2 and pulp temperature of 13°C, derived from previous laboratory experiments, was confirmed to delay the ripening process and extends the shelf life of mangoes up to 28 days. The encouraging results of the study make it possible for mango exporters to transport mangoes to distant markets requiring three weeks in sea freight using CA container vans.

Keywords: controlled atmosphere, controlled atmosphere storage, post harvest, mango storage, delayed ripening

ASD-53

TOXICITY AND PISCICIDAL EFFECTS OF SELECTED ENDEMIC PLANTS AGAINST AFRICAN CATFISH (*Clarias gariepinus* Burchelle) and TILAPIA (*Oreochromis niloticus* L.) FINGERLINGS

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The study was conducted to determine the toxicity and piscicidal effects of the leaf extracts of makabuhai *Tinospora rumphii*, kamoteng kahoi *Manihot esculenta*, and datiles *Muntingia calabura*, and bark extracts of kamatsili *Pithecellobium dulce* and payhod *Albizia procera* against African Catfish *Clarias gariepinus* and Tilapia *Oreochromis niloticus*. Lethal concentrations (LC_{50} and LC_{100}), expressed as ml L^{-1} of plant extract to water, were determined through a laboratory static bioassay.

The 6-hour lethal concentration showed that the plant with the strongest toxicity (expressed as LC_{50}) and piscicidal (expressed as LC_{100}) activity for both *C. gariepinus* and *O. niloticus* is the bark extract of payhod.

The toxicity effects of the five plant extracts used against *C. gariepinus* arranged in order of decreasing toxicity is as follows: *A. procera* (0.95)>*T. rumphii* (1.76)> *P. dulce* (2.04)> *M. esculenta* (21.84)> *M. calabura* (28.91) and for *O. niloticus*: *A. procera* (0.45)>*T. rumphii* (1.65)> *P. dulce* (3.41)> *M. esculenta* (36.42)> *M. calabura* (37.99).

The piscicidal effects of the five plant extracts used against *C. gariepinus* arranged in order of decreasing effect is as follows: *A. procera* (1.92)>*T. rumphii* (4.79)> *P. dulce* (4.84)> *M. esculenta* (51.63)> *M. calabura* (74.59) while for *O. niloticus*: *A. procera* (1.71)>*T. rumphii* (4.65)> *P. dulce* (6.88)> *M. esculenta* (72.85)> *M. calabura* (82.80).

Results showed that the evaluated endemic plants could be a potential source of locally available toxicant to eliminate selective predators and competitors in pond.

Keywords: Toxicity tests, piscicides, endemic plants

ASD-54

OPTIMIZING PREPARED FEED RATION FOR SOMATIC GROWTH AND GONAD PRODUCTION OF THE SEA URCHIN *Tripneustes gratilla* (LINNAEUS, 1758)

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Somatic growth (wet weight and equatorial and polar test diameters), gonad production (gonadosomatic index) and gonad quality (color) of the sea urchin *T. gratilla* fed prepared diets were studied *in vitro* using glass aquaria from April to August 2006. The study consisted of five treatments with three equal replications arranged in CRD as follows: I-Fresh *Sargassum sp.* (control), II-Dried pellets at 2% body weight (BW)/day, III-Dried pellets at 3% BW/day, IV-Dried pellets at 4% BW/day, and V-Dried pellets at 5% BW/day. The dried pellets were mainly of *Sargassum sp.* with 6.0% binder (corn starch and gelatin).

Results show that Treatments I, IV and V significantly ($p<0.05$) gave better results than Treatments II and III. The highest monthly mean growth increment was observed in Treatment V which was significantly higher ($p = 0.05$) than all the treatments except for Treatment IV. These results show that dried pellets feeding ration was optimized at 4 to 5 % BW/day. Significantly higher gonadosomatic index ($p=0.05$) was also observed in Treatments I, IV and V than Treatments III and II, respectively. Treatments II and III did not differ significantly.

Monitored water parameters were within the favorable ranges for growth of the organisms. Significant positive correlation existed between wet weight and equatorial test diameter ($r=0.92$, $p=0.0001$) and polar test diameter ($r=0.71$, $p=0.01$). Gonadosomatic index was also significantly positively related with gonad color ($r=0.88$, $p=0.0002$).

Results suggest that the best ration for prepared feed based on *Sargassum sp.* would be at 4.00% BW/day since this would optimize somatic growth and gonad production and quality. Similar studies can be done using other feedstuff such as tomato and squash which are locally available pigment sources that may improve the quality of the organism.

Keywords: Tripneustes gratilla, prepared feed ration, somatic growth, gonad production and quality

ASD-55

CATCHING EFFICIENCY OF MULTIPLE HANDLINE OPERATED IN PAYAW AREAS

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Multiple handline fishing was carried out in payaw areas in waters off the Northwestern Ilocos coast. Three handlines with varying hook distances (50, 75, and 100 cm) attached to the mainline baited with red and silver artificial lures were used in the study. Fishing operations were done in the morning and in the afternoon. The main objective was to determine which of the artificial lures, handlines with different hook distances and time of fishing operation will give the best yield.

Results show that red lure significantly yielded more fish catch than silver lure both in terms of number and weight. The 100-cm hook distance gear significantly had the highest catch compared to the other two (50 cm and 75 cm). Fishing gears baited with red lure can be best operated in the morning particularly those with greater distances in between hooks.

Cost and return analyses show that the 100-cm hook distance gear baited with red lure had the highest net income (ROI of 225.12)

Three pelagic species of fish, namely: *Thunnus albacares*, *Decapterus macarellus* and *Katsuwonus pelamis*, comprise the catch. *Thunnus albacares* relatively had the highest abundance among the three.

Table 1. Mean catch per day (kg) and return on investment (ROI, %) of the different multiple handlines (50-cm, 75-cm and 100-cm distance in between hooks) used in the study

Fishing Gear	Mean Catch/ Day (kg)	ROI (%)
50-cm Hook Distance		
Red Lure	5.83	-41.90
Silver Lure	4.67	-53.40
75-cm Hook Distance		
Red Lure	10.80	7.40
Silver Lure	6.67	-33.70
100-cm Hook Distance		
Red	32.67	225.12
Silver Lure	22.83	127.20

Keywords: line fishing, artificial lures, hook distances, fishing time

ASD-56

EDIBLE SEAWEEDS IN ILOCOS NORTE : FOOD PREPARATIONS OTHER LOCAL USES AND MARKET POTENTIAL

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The study deals with the economic importance of seaweeds in Ilocos Norte, which is an account of the researchers' survey of edible seaweeds of the province. Seaweed gatherers and vendors in public markets were interviewed to determine the respondents' socio economic profiles, the species of seaweeds that are commonly harvested for home consumption and for marketing both inside and outside the province, and the marketing channels and practices of the vendors.

Also, the researchers determined what seaweeds the respondents prefer to eat, their methods of preparation, and some other uses. The local names of the seaweeds were noted. Fresh samples from the sea and dried samples from the markets were brought in the laboratory for identification. Frequencies, percentages and means were used in the analysis of data gathered from the interview schedule.

Results of the study show that majority of the respondents of this study were young, majority female and majority married, elementary graduates belonging to small and medium household size. Majority had minimum income which was not sufficient for their basic needs.

There are 22 genera of seaweeds belonging to green, brown and red algae that are used as food in Ilocos Norte. Food preparations of the seaweeds may be in the form of salad, vegetables for viand, dessert or pickles. Other local uses include: medicine, fertilizer and insect repellant.

The flow of the wet/raw seaweeds from gatherers to consumers passes through several middlemen before it reaches the consumers. The current market price of seaweeds ranges from Php50.00/kg fresh form and PhP3, 00/kg dried form.

Based on the results of the social aspect and the presence of potential species of seaweeds in Ilocos Norte, there is a need to develop food products for the gatherers to meet their basic needs in life.

Keywords: edible seaweeds, food preparation, market potential

ASD-57

COMMUNITY STRUCTURE OF MARINE BENTHIC MACROALGAE IN SELECTED AREAS OF ILIGAN BAY

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The aim of the present study was to determine the relationship of selected abiotic factors with the community structure of marine benthic macroalgae in selected coastal areas of Iligan Bay. Four sites were surveyed including three southern (Kauswagan, Linamon, Dalipuga) and one northeastern intertidal zones on December 2007 to January 2008. Macroalgal species composition, biomass, species diversity, and distribution were determined. A total of 46 macroalgal taxa were identified. Multivariate classification analysis revealed three groupings of sites, i.e. the northeastern Gimangpang site, Linamon, and the two southern sites Kauswagan and Dalipuga. Abundance, Shannon and Simpson's species diversity indices, Margalef's species richness index, and Pielou's evenness index were highest in the Gimangpang site, intermediate in Kauswagan and Dalipuga, and lowest in Linamon. Canonical correspondence analysis showed that water motion and temperature and pH gradients strongly influenced the structuring of macroalgal assemblages. For instance, *Boergesenia forbesii*, *Turbinaria ornata*, *Sargassum crassifolium*, *Hypnaea spinella*, *Hypnaea valentiae*, *Laurencia obtusa*, *Gracillaria heteroclada*, *Gracillaria salicornia*, *Gracillaria* sp., *Halimeda opuntia*, *Gelidiella acerosa*, *Coelothrix irregularus*, *Dictyota cervicornis*, and the two "green tide" species, *Chaetomorpha crassa* and *Ulva reticulata*, were most abundant in warmer, more alkaline, and quieter waters. Colder, normal seawater pH, and high water motion favored higher abundance of three *Sargassum* species, coralline *Amphiroa* species, and *Padina australis* and *Padina minor*.

Keywords: abiotic factors, macroalgal taxa, *Sargassum, coralline Amphiroa*

ASD-58

THE GLEANERS OF PORO ISLAND, CENTRAL PHILIPPINES: THEIR PRACTICES, SOCIO-ECONOMIC STATUS AND DIVERSITY OF CATCH

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Poro Island is the largest island in Camotes Group of Islands with wide tidal flats and wide mangrove areas serving as gleaning area. Overpopulation has been noticed in the municipalities where too much gleaning pressure has been felt. That is why this study was conducted in order to find out the gleaning methods used, species of flora and fauna gathered and the socio-economic status of gleaners.

Interview and actual visit of the gleaning areas as well as market survey were the techniques used in gathering the data. There were 15 coastal barangays being assessed where 10 barangays of the Municipality of Poro and 5 in the Municipality of Tudela.

Results showed that the gleaned organisms in the island of Poro are 20 species of mollusks; 7 species of Echinoderms; 5 species of crustaceans; 5 species of fish and 1 species of seaweed. Results further showed that barangay Paz and Villahermosa are the barangays heavily gleaned on mollusk in the entire island. For the Echinoderms, it is barangay Esperanza, Cagcagan, Paz and Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante. For the crustaceans it is barangay Libertad, Mabini, Eastern Poblacion, Western Poblacion, Teguis, Mercedes, Paz, Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante.

Handpicking, using bolo, spears and rake are the methods used by the gleaners. Catch per unit effort (CPUE) of mollusks is 1-2 hours per 1 kilo of mollusks; 1-2 hours per kilo of seaweeds; crustacean is 3-4 hrs/kilo; echinoderm is 1-3 hrs for a kilo and for fish 2-4 hours per kilo of fish. Monthly income ranges from Php. 1,000.00- 3,000.00 from animal raising and fishing. Sixty percent (60%) of the gleaned products are for consumption and 40% for the market. Houses are made of nipa and radio, TV sets and kitchen utensils are their material possessions.

Keywords: Poro Island, Gleaners, Socio- economic status, Catch Diversity.

ASD-57

COMMUNITY STRUCTURE OF MARINE BENTHIC MACROALGAE IN SELECTED AREAS OF ILIGAN BAY

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Keywords: Poro Island, Gleaners, Socio- economic status, Catch Diversity.

ASD-59

INFLUENCE OF NATURAL ADDITIVES ON THE ACCEPTABILITY OF FLAVORED FISH SAUCE FROM ANCHOVIES, *Stolephorus spp.*

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Flavored Fish Sauce is a value-added product from fermented anchovies *Stolephorus spp,* locally known as "patis", with natural additives such as calamansi, chili pepper and carrageenan. The product is used as dipping condiments for fish, shrimp, pork, chicken, and other fried or steamed food items. It is also used as seasoning which adds distinction to cuisines. Experimental method was employed in the study. Natural additives enhanced its flavor, color, odor, and texture. The product has amber yellow color, fish-like flavor, pleasant odor and fine consistency texture based on the sensory evaluation using descriptive testing as evaluated by the twenty five experienced panelists. The general acceptability rating of the most preferred flavored fish sauce was "Like Moderately" based on the 9-point hedonic scale. The color and texture attributes of the most preferred sample were significantly different from other experimental samples with various additives using Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) at 5% level of significance. The newly formulated flavored fish sauce had a pH values of 4.57 and a bacterial count of less than 2.50×10^3 cfu/g sample, per result of laboratory analysis by the Bureau of Fisheries and Aquatic Resources (BFAR-RO7), Region 7. It has a crude protein content of 5.3, Moisture Content of 84.4, Salt Content of 4.3 and Ash Content of 8.9 as analyzed by DOST RO VII Regional Standards and Testing Center. The addition of natural additives improves the color and texture of a flavored fish sauce, decreases pH and lowers the bacterial load.

Keywords: anchovies *Stolephorus spp.* flavored fish sauce. natural additives.

ASD-60

THE EFFECTS OF CURING AND DRYING ON THE SPECIES-SPECIFIC FLAVOR AND SENSORY ATTRIBUTES OF CHEVON

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Goat is now emerging as an alternative source of meat in many parts of the world. However in the Philippines, the average annual per capita consumption of chevon is still relatively low. It is believed that one reason for the low consumption is the highly distinct chevon flavor that is desirable to some but unpleasant to many.

This research focused on combined curing and drying as a flavor modifying strategy for goat meat to provide variability in the utilization of chevon that would result in its wider acceptance among consumers.

The overall objective of this study was to determine the effects of curing and drying on the species-specific flavor and sensory characteristics of chevon. For curing, salt and nitrite were studied and the drying methods used were sundrying and smoke/oven-drying. The dried chevon products were evaluated in terms of their eating quality, acceptability and the presence of goat flavor after processing.

Results indicated that fatty acids of below C_{10}, particularly capryllic acid, believed to be a major contributor to goat-like flavor, were not detected in either fresh or cured-dried chevon. This explained the very low perceptibility of goat-like flavor in the samples as evaluated by the experienced panel.

Curing and drying presented no significant effects ($P>0.05$) on the percent composition of fatty acids in both fresh and cured-dried chevon. However, experienced and consumer evaluation indicated that although all samples did not give out significant strong species-specific flavor, the goat flavor of smoked/oven dried samples was less perceptible than in sundried samples.

Prepared into *caldereta*, nitrite-cured/sundried chevon were the most acceptable to the experienced panel in terms of general sensory attributes. On the other hand, all sundried samples, regardless of the curing brine used were the most desirable to the consumers in Los Baños and vicinity.

Keywords: chevon flavor, dry-cured chevon, sundrying, smoke/oven-drying

ASD-61

EFFICACY OF THE EXTRACTS OF TUBLI (*Derris elliptica*), SILI (*Capsicum* sp.), AND MALUNGGAY (*Moringa oleifera* Linn) AS PESTICIDE AND GROWTH ENHANCER OF PECHAY (*Brassica rapa* ssp. *pekinensis*)

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Vegetable farmers continue to use synthetic pesticides and fertilizers that contribute to pesticidal residue in the surrounding. The use of botanical materials is the most environmentally friendly practice in agricultural treatments.

Extracts from tubli roots, sili fruit and malunggay roots, in solution, were used as pesticide and growth enhancer of pechay. The botanical samples were extracted by maceration and mixed in water. Pechay plants were grown for 45 days on properly cultivated plots in a home garden, and treated with the prepared solutions at different concentrations (100% and 50%) and malathaion as standard. Treatments were applied at 10 days interval.

The efficacy of the said treatments was evaluated by comparing the areas of the pechay leaf blades and the damaged portion immediately after harvest. The leaves were flattened and overlapped with chicken wire. The areas were measured by the squares (3x3 mm) of the chicken wire taken as units. The rounded and irregular holes observed on the leaf blade were the only pest damage considered.

Results show that the treated pechay has larger leaf areas and lesser damaged portion compared to the control and standard, indicating that the extracts used can be a growth enhancer and substitute for the common commercial synthetic pesticides.

Keywords: pesticide; growth enhancer; leaf blade area; pest damage

ASD-62

PERCENT RECOVERY, DIGESTIBILITY AND FEEDING VALUE OF CATTLE RUMEN CONTENTS IN SWINE DIETS

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This study was conducted to determine the digestibility, nutritive and feeding value and economy of cattle rumen contents (CRC) as component of plant protein-based swine diets. Specifically, it aimed to: a) determine the percent recovery, nutrient composition of CRC; b) determine the digestibility of CRC in swine; c) evaluate the effects of CRC as a component of plant protein-based swine diets in terms of growth performance, dressing percentage, backfat thickness and livability; and, (d) assess the economy of CRC as component of plant protein-based swine diets.

Five dietary treatments were used in the feeding trials. Dietary Treatments II, III and IV were treated with CRC at 10, 12 and 14 percent levels of incorporation, respectively, while Dietary Treatments I (0% CRC) and V (Commercial Swine Feed) served as control. The dietary treatments were arranged in a Completely Randomized Design (CRD) replicated thrice with one animal per replication.

The percentage dry matter (DM) recovery of cattle rumen contents was 25.02 percent. Proximate analysis revealed that CRC contains a fairly high percentage of crude fiber (24.8%) and moderately high percentages of nitrogen-free extract (53.99%) and crude protein (15.41%) but low in gross energy (0.72 kcal/kg). The digestion trial revealed a fairly high ether extract digestion coefficient (82.48%). The digestibility of crude protein and nitrogen-free extract were moderately high (65.17% and 46.57%, respectively) while crude fiber digestibility was low (38.68%).

The average initial and final weights of the experimental animals were statistically similar. The feed conversion ratio did not significantly vary during the starting and finishing stages, but highly significant differences (P0.01) were noted during the growing stage (2.46 for Diet V vs. 2.83, 2.98, 3.20 and 3.32 for Diets I, II, IV and III, respectively).

Significant variations (P0.05) on protein efficiency ratio were noted among treatment means (2.53 for Diet V vs. 2.19, 2.09, 1.94 and 1.89 for Diets I, II, IV and III, respectively) during the growing stage but, no significant differences were noted during the starting and finishing stages.

Experimental animals fed with Diet V (Commercial Swine Feed) gave the highest dressing percentage of 65.12 percent (P0.01) while those in Diet I (0% CRC) had the lowest (54.57%).

Experimental animals given Diets II, III and IV gave comparable dressing percentages of 63.28, 62.18 and 61.84 percent, respectively. The data revealed that the diets treated with CRC had superior dressing percentages over those in the zero percent CRC diet but inferior to pigs fed with commercial swine feed. Experimental animals given 14 percent CRC produced significantly (P0.01) thinner and better backfat thickness of 1.66 cm when compared to those in the control diets (Diets I and V) with 3.00 and 2.83 cm, respectively.

Pigs fed with Diet IV (14% CRC) incurred the lowest cost of feed per unit gain-in-body weight (CFG) values during the growing and finishing stages.

Pigs fed with Diet I (0% CRC) gave the highest return above feed cost (RAFC) of P3, 898.06 as compared to those in Diet V (Commercial Swine Feed) which gave the lowest RAFC of P 2,617.74. Experimental animals fed with Diets II, III and IV gave RAFC of P3, 539.81, P3, 524.08 and P3, 815.42, respectively.

With all these information, it could be deduced that nutritionally and economically, cattle rumen contents could be safely incorporated in swine diets at 10 to 14 percent levels.

Keywords: cattle rumen contents, rumen contents, cattle stomach contents, ingesta