

POSTER ABSTRACTS

AGRICULTURAL SCIENCES

1. SEED IDENTIFICATION OF LEGUMES IN THE PHILIPPINES

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The project deals with seed morphological features in the identification of legumes in the Philippines. Using fruit characters, leguminous plants are placed under one family, *Leguminosae* or *Fabaceae*. One classification considers the group as order Fabales, consisting of three distinct families. Using floral characters, these are: *Caesalpinaceae*, *Mimosaceae*, and *Papilionaceae*.

Using seed characters, only two groups are recognized: Caesalpinoid-Mimosoid group, and the Papilionoid group. The two composing the first group are basically similar to each other in several aspects, except for the presence of face line or pleurogram in Mimosoid seed. Both develop from a natropous ovule.

Papilionoid seeds on the other hand exhibit distinct kidney shaped, developing from a campylotropous ovule. Identity of taxa at the generic level is possible through structural details of the hilar groove and hilar rim.

Presented are: 1. Enlarged colored photographs of leguminous seeds representing some genera for the three families. Species under a genus are unified by some distinct features. 2. Outline drawing of two seed types indicating parts. Based on this study, a manual for seed identity of legumes has been prepared.

2. COMPETITION BETWEEN *Cymbopogon citratus* (DC.) STAPF AND *Imperata cylindrica* (L.) BEAUV.

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This study investigated the interspecific competition between *Cymbopogon citratus* (DC.) Stapf and *Imperata cylindrica* (L.) Beauv. under field conditions. The competitive ability of either species was assessed in terms of: (1) plant height, (2) tiller production, (3) plant biomass, (4) chlorophyll content, and (5) nitrogen content of tillers and roots for a period of ten months.

Plant materials were collected from natural populations. Three-tillered individual plants of approximately similar size and vigor were selected and their shoots were cut to about 15 cm from the root-stem junction. Four individual cut plants of varying ratios between the two species were planted in each potted soil: 4 *Cymbopogon* (Cc): 0 *Imperata* (Ic); 3 Cc: 1 Ic; 2 Cc: 2 Ic; 1 Cc: 3 Ic; 4 Cc: 0 Ic. Each treatment had ten replicates. Soil moisture levels were maintained every other day at saturation point.

At higher planting ratios in a mixed culture or when there are more individuals in each pot, *C. citratus* plants did not grow as well as the pure cultures but could effectively reduce the growth of *I. cylindrica* plants. This response enhanced competitive advantage to the lemongrass individuals in harvesting when grown in the same pot with cogon plants. Interspecific competition consistently enhanced tillering in the lemongrass. The presence of lemongrass apparently had a negative influence on tiller production in cogon plants. The presence of more cogon individuals in each pot, significantly enhanced plant biomass in *C. citratus* which may be attributed to higher tiller production. Likewise, the presence of lemongrass in the same pot resulted in much lower plant biomass in *I. cylindrica*. The levels of pigment and nitrogen however, did not significantly differ between individuals of both species in pure and mixed cultures.

3. IMPROVING DAIRY CATTLE PRODUCTION AT FARM LEVEL IN SOUTHERN LUZON. PHASE I: BASELINE STUDIES

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A data bank comprising approximately 40,000 entries (Jul. '92-Dec. '94) was constructed on the baseline studies conducted in 10 villages in Bgys. Sta Cruz and Pagsangjan, Laguna, and Sariaya, Quezon. Crossbred HFxS dairy cows (n = 110) managed by smallholder dairy farmers belonging to five cooperatives were monitored according to the following parameters: liveweights and body condition scores; plasma/milk, progesterone, and plasma thyroid hormone concentrations; reproductive traits/events (number of services per conception, calving to conception and calving intervals, pregnancies, reproductive losses and ovarian cyclicity); milk production; feed analyses based on dry matter, protein and ash content, and kinetics of feed degradation; plasma nutritional metabolite concentrations (albumin, β -hydroxybutyrate, urea, globulin, total protein, and inorganic phosphorus), health status based on fecalysis, hematology and other health observations, feed resources inventory, and management at smallholder level; climatological data.

This data bank will be used to gather significant statistical correlations to aid in the formulation of an integrated management strategy for the improvement of dairy cattle production and reproduction.

4. IN VITRO CULTURE OF *Platycerium grande* (FEE) PRESL

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Platycerium grande (Fee) Presl is a highly prized ornamental fern which is endemic in the Philippines and reported to be becoming extinct. Its spores rarely germinate under natural conditions, thus propagation of this fern is slow. There is a need to propagate its spores on culture media for rapid multiplication and at the same time to study its gametophyte development.

This study was conducted to determine gametophyte development in *Platyserium grande*. The spores germinated nineteen days after sowing. The pattern of spore development was of the *Gleichenia* type. Prothallial plates appeared after thirty-one days in culture. The development of the prothallus was of the *Drynaria* type. Since the spores readily germinated in culture media, in vitro culture of *P. grande* is one way of conserving this rare endemic fern.

5. SOIL EROSION LOSS AND SOIL FERTILITY CHANGES OF AGROFORESTRY SCHEMES IN LEYTE

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A study was conducted at the Department of Forestry, Visayas State College of Agriculture Forest Reserve for soil erosion loss and soil fertility changes of agroforestry schemes in Leyte. Four appropriate agroforestry schemes were chosen, namely: Sloping Agricultural Land Technology, Alley Cropping, Taungya, and Multi-Storey Cropping. Evaluation criteria used in the study were: degree of soil erosion and changes in soil fertility.

The results of the study on the degree of soil erosion showed that Multi-Storey Cropping scheme had the least soil erosion loss. The average soil erosion rate was 2.88 cm during the two-year observation. Alley Cropping scheme had the highest soil erosion rate of 3.91 cm during the 24 months of observation. Soil fertility changes showed a fluctuating trend with each of the soil parameters, namely: soil pH, organic matter, available nitrogen, available phosphorus, and exchangeable potassium in the four agroforestry schemes in Leyte.

6. OCCURRENCE AND BIOLOGY OF PINK BOLLWORM, *Pectinophora gossypiella* SAUNDERS ON COTTON

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The peak occurrence of pink bollworm, *P. gossypiella*, monitored through pheromone delta traps, was recorded at 142 and at 71 days after cotton emergence (DAE), respectively. These periods coincided with the bursting stage of the early-

planted crop and flowering/early bolling stage of the late-planted crop. High infestation was also observed on 21 to 28 day-old bolls.

The total developmental period of pink bollworm was 34.13 ± 1.41 days. The mean duration of each developmental stage was: egg, 3.68 ± 0.09 ; larva, 11.33 ± 0.64 ; pupa, 7.42 ± 0.20 , and adult, 11.70 ± 0.48 days. Average fecundity per female was 70 eggs with 85% hatchability.

The female moth laid eggs on the squares, growing tips, and bolls of the cotton plant. The newly hatched larva entered the fruiting structure 25-30 minutes after hatching and spent its whole larval period inside. It moved out during the prepupal stage and settled on wilted and dried cotton flowers or leaves and sometimes on the ground.

Pink bollworm damage was characterized by rosetting of the flowers causing premature shed-off. When the larva fed on the seed of a young boll, it allowed boll maturity. However, it caused nonflossing of bolls or if the bolls flossed, produced an inferior-quality lint.

7. METABOLISM OF CALCIUM AND PHOSPHORUS IN GROWING PHILIPPINE INDIGENOUS SHEEP

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A 16-week feeding trial in a 3x2 factorial experiment involving 3 levels of Ca and P in the ration (A - 2.6 g Ca and 1.17 g P/kg DM, B - 3.85 g Ca and 1.76 g P/kg DM, and C - 5.08 g Ca and 2.3 g P/kg DM) and 2 sexes (male and female) in a Randomized Complete Block Design was conducted to determine how Ca and P are utilized in sheep.

Sheep fed rations B and C consumed significantly ($P < 0.01$) more C and P. Calcium and P were excreted mainly in the feces although a higher amount of P was detected in the urine than Ca with animals fed rations B and C. Apparent absorption and retention of Ca and P was found to be positive in the male sheep in ration B and for female sheep in ration C.

Calcium and P concentrations in the different compartments of the GI tract showed an increasing trend with increasing level in the diet. The concentrations of Ca in the tract were lower than the level in the ration but P concentration was higher. Based on these results, it appears that for Ca and P to be absorbed, retained, and utilized efficiently by the animal, they should be in amounts required by the animal. Growing male sheep should consume 131 mg Ca and 57 mg P/kg LW/day of ration B and the female should consume 167.6 mg Ca and 82.8 mg P/kg LW/day or ration C.

8. THE UTILIZATION OF WHITE MUSCARDINE, *Beauveria bassiana* AGAINST *Passiflora* FEEDER, *Cethosia biblis insularis* C. FELDER (LEPIDOPTERA: NYMPHALIDAE)

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The pathogenecity of ten strains of white muscardine, *Beauveria bassiana*, was studied against the third instar larvae of *Passiflora* feeder, *Cethosia biblis luzonicus*. The species *Beauveria tenellas* and untreated control served as comparison and check.

Five strains were of low pathogenicity (0-33.33% mortality) while the other five strains were moderately pathogenic, (50-73.33% mortality).

The most promising strain is Fb10 followed by Fb2 with LT_{50} values of 139.58 and 165.83, respectively. The strain AJ 111-1 and the check, *Beauveria tenella*, showed the lowest LT_{50} values of 193.39 and 214.46, respectively.

There was no mortality in the control.

9. PHYLOGENETIC AND PATHOTYPIC ANALYSES OF THE BACTERIAL LEAF BLIGHT POPULATION IN LUZON

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Bacterial leaf blight, caused by *Xanthomonas oryzae* pv *oryzae* (Xoo), is an important disease of rice during the wet season, especially in lowland irrigated areas. In the absence of effective chemical control and due to environmental considerations, plant resistance is regarded as the method of controlling the disease. However, plant resistance genes have been known to break down with the emergence of new pathotypes in the field. Therefore, an understanding of the pathogen population is essential in order to design effective breeding and deployment strategies for a sustainable and integrated disease management scheme.

Bacteria were isolated from infected leaf samples collected from several provinces in Luzon. Genomic DNA was extracted, digested with *EcoRI* and analyzed by Southern hybridization using the repetitive element TNX1 as a probe. Different banding patterns (haplotypes) were detected from the Xoo isolates analyzed. These

haplotypes were grouped into distinct lineages. While the data indicate that certain lineages seem to be distinct to specific locations, a more intensive sampling is required before definite conclusions can be made. Inoculation experiments were also conducted to determine the relationship between phylogeny and the *Xoo* pathotype.

10. ALIEN GENE TRANSFER IN MAIZE (*Zea mays* ssp. *mays* L.)*

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Hybrids between maize ($2n=20$) and its wild relatives namely: *Z. mays* ssp *mexicana* ($2n=20$), *Z. diploperennis* ($2n=20$), *Z. perennis* ($2n=40$), and *Coix lacryma-jobi* ($2n=20$), were produced using the conventional hybridization technique with the aim of transferring desirable characters/traits (resistance to pests and diseases, high nutritional quality, multiple ears, tillering, perenniality) from the wild to the cultivated maize.

A total of 152 cross combinations were made 52 of which were maize x *Z. mays* ssp *mexicana*; 26 of maize x *diploperennis*; 6 of maize x *Z. perennis*, and 68 of maize x *Coix*. Higher success of recombination as measured by higher percentage of seed set was exhibited by crosses of recombination as measured by higher percentage of seed set was exhibited by crosses between maize and *mexicana*, followed by maize x *diploperennis*, maize x *perennis*, and maize x *Coix*. Meiotic analysis of the hybrids showed partial to complete homology among the chromosomes of maize, *mexicana*, and *diploperennis* while one of the sets of the tetraploid *perennis* was homologous to the maize chromosomes indicating closer genetic affinity among the diploid *Zea* species. The chromosome number of hybrids between diploid species ranged from 18 to 20 while between maize and *perennis*, 22 to 30.

Backcrossing to the maize parent was done for five (5) generations. At every backcross generation, selection for the maize type was undertaken and only those exhibiting more maize characteristics were backcrossed to the maize parent. Screening for downy mildew and corn borer resistances was done at the second to fourth backcross generation. The materials selected were turned over to the IPB Corn Breeding Division for their use in the Corn Improvement Program.

*Best poster paper award in the Agricultural Sciences Division.

Successful transfer of downy mildew resistance genes was observed in 42 different backcross progenies, corn borer resistance genes in 51; and both downy mildew and corn borer resistance in eight (8).

11. ASSESSING VARIABILITY IN *Bacillus thuringiensis* STRAINS AND EFFECTS OF ENDOTOXINS AGAINST RICE STEM BORERS

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The diversity of *Bacillus thuringiensis* (*Bt*) strains in various sources in the Philippines was surveyed and their toxicological and physiological effects on rice stem borers were evaluated. Endotoxins derived from the strains were also characterized and tested. Results of the study showed the diversity of the strains and the characterized endotoxins both in toxicological and physiological effects on the borers.

When different populations of the borers were tested against the endotoxins, a significant population, endotoxin and population x endotoxin effects were observed indicating variability in populations of borers in their susceptibility to *Bt* toxins. A within-population investigation on the effects of *Bt* showed that the diversity of the response of the borers to *Bt* is due to the ability of some individuals to avoid the toxin-treated diet. The implications of the data in *Bt*-engineered rice are presented in this paper.

12. VARIABILITY IN RESPONSE OF SELECTED RICES TO TUNGRO

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Six traditional and six IRRI rices with known genetic background for resistance to the green leafhopper (GLH), *Nephotettix virescens*, were planted in five locations in the Philippines for four seasons. Ten-day seedlings were planted at 25 x 25 cm spacing in two rows of susceptible TN1 replicated four times every season. Tungro-infected hills were monitored at 30 and 60 days after transplanting. The

data for both traditional and cultivated rices were subjected to ANOVA. Results showed variability in response of the rices to tungro from locality to locality and from season to season. There was a negative correlation between the number of GLH collected and the frequency of infection on different rices. Population genetic studies on selected GLH populations revealed genetic differences even among populations which are geographically close indicating that variation in response of the rices to tungro was due to differences in virulence of the insect vector.

13. MOISTURE ADSORPTION ISOTHERMS OF TAPAHAN DRIED COPRA AT DIFFERENT TEMPERATURES AND IMPLICATIONS ON MOLD GROWTH AND AFLATOXIN PRODUCTION

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The moisture adsorption isotherms of tapahan dried copra were determined at 22, 30, and 38°C. The isotherms were of a shape similar to published isotherms on copra and of type III according to the BET classification. A modified Caurie equation was found to best describe the relationship of equilibrium moisture content, water activity, and temperature for copra. The critical moisture contents of copra due to growth of *Aspergillus flavus* were 9.6%, 8.2%, and 7.0% dry basis for temperatures of 22, 30, and 38°C, respectively, while aflatoxin production had critical moisture contents of 13.5%, 11.1%, and 9.3% dry basis for the same temperature range. The results suggests that in specifying the critical moisture content of copra against mold growth, the corresponding temperature must also be included, since what is a safe moisture content at low temperatures is no longer safe at high temperatures.

14. PRODUCTION OF ANTISERA AGAINST ABACA/BANANA VIRUSES USING SDS-PAGE PURIFIED PROTEINS

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Antisera against abaca/banana bunchy top (A/BBTV) and abaca mosaic viruses (AMV) were produced using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) purified proteins. Proteins extracted from isolates of bunchy top and field samples of abaca infected with mosaic were fractionated in SDS-PAGE. Gel slices containing the unique proteins for each virus disease were used to immunize separately a White New Zealand rabbit at regular weekly intervals, for 4-6 weeks. The antisera (As) produced were reactive to their homologous antigens (i.e., protein extracts) in enzyme-linked immunosorbent assay (ELISA) and through western blot (WB) analysis. In ELISA, anti-A/BBTV was able to distinguish healthy from the field-infected as well as from the inoculated samples at dilution 1:100. For anti-AMV serum, dilution as low as 1:1024 was effective in detecting AMV antigen from field-infected abaca and sugarcane mosaic virus-infected corn plants. In WB experiments, anti-A/BBTV (1:25) or anti-AMV (1:10,000) serum was able to detect or recognize the specific protein band used as antigen for As production. These indicate that the As produced were specific and sensitive enough to be used for A/BBTV or AMV diagnosis. These studies demonstrate alternative and effective procedures for preparing plant viral antigens for antiserum production which are necessary for conducting immunoassay analyses of plants suspected to be infected with viruses.

15. UTILIZATION OF RAW RICE-HULL AS AN ENERGY SOURCE FOR NATURAL CONVECTION FLUE-CURING BARNs

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The use of raw rice hull as fuel for natural convection flue-curing barns was evaluated to reduce if not to eliminate the use of fuelwood in flue-curing tobacco. A furnace was developed consisting of a grate and a hopper for the semi-automatic feeding of the rice hull into the furnace. Testing and evaluation of the system both

in the laboratory and in the farmers' field indicated that raw rice hull could eliminate the use of fuelwood from 70 to 100%. The use of the rice hull does not change the system of post-harvest operation.

The combustion process of rice hull using the system is high compared to ordinary burning. The rice-hull ash produced can be used as a raw material in the manufacture of insulators and can also be used in ceramic glazing.

16. EFFECTS OF WATER REGIMEN ON THE REPRODUCTION OF RICE ROOT KNOT NEMATODE, *Meloidogyne graminicola*, IN *Sesbania* spp. AND *Aeschynomene* spp.

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The reproduction of *Meloidogyne graminicola* in 20 *Sesbania* spp. and 22 *Aeschynomene* spp. was studied in permanently flooded and well drained soils to identify resistant green manure crops for use in irrigated and rainfed rice production systems.

Permanent flooding generally reduced nematode reproduction in *Sesbania* spp. and *Aeschynomene* spp. However, higher nematode densities were observed in UPLRi-5.

Aeschynomene afraaspera 14142 and 14143, *A. aspera*, *A. denticulata*, *A. elaphroxylon*, *A. indica* 13016, 13019, and 13071, *A. schimperi* 12156, *Sesbania rostrata*, *S. cannabina* 21044 (syn. *S. aculeata*), *S. javanica*, *S. punctata*, *S. sesban*, *S. speciosa* 22026, *S. tedraoptera*, and *S. varadero* were susceptible and supported high nematode population in well drained soil. Their use in rainfed conditions could increase the risk of yield loss caused by *M. graminicola*.

A. afraaspera 14054, *A. ciliata* 13144, *A. denticulata* 13003, *A. evenia*, *A. nilotica*, *A. pratensis* 13006, *A. scambra*, *A. sensitiva*, *Aeschynomene* sp. from Australia, *S. cannabina* 21035, 21047, 21076, 21037, and 21132, *S. emerus*, *S. oleracea*, *S. speciosa*, *S. spiritus*, *S. virgata*, and *Sesbania* sp. from El Salvador that were found resistant under both water regimens could be potential green manure crops in rainfed and irrigated rice fields infested with *M. graminicola*.

17. PYROLYSIS RATE OF SELECTED AGRICULTURAL AND FOREST WASTES

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Utilization of biomass from agricultural and forest wastes is important both in energy and environmental conservation considerations. Combustion, pyrolysis, and gasification are the available thermal utilization methods for the utilization of agricultural and forest biomass. In order to achieve a better design of a thermochemical conversion equipment, knowledge of the behavior of the fuels undergoing thermal decomposition should be known. The information that can be derived enables one to determine the reaction rate of thermal decomposition or pyrolysis (the incomplete thermal degradation in the absence of air and resulting in charcoal, condensable liquids or tars, and gaseous products).

One method to examine the pyrolytic properties is through the use of thermogravimetric analysis (TG). This method entails the measurement of the rate of weight loss of a treated sample as a function of time and temperature. TG analysis offers a semi-quantitative understanding of the pyrolysis process under well controlled laboratory conditions.

In this study, the pyrolysis rate of 16 agricultural and forest wastes was determined using the dynamic TG analysis. The effects of heating rate and purge gas (N_2) on the pyrolysis rate of a representative fuel were also analyzed along with the evaluation both by simple first-order reaction and multi-reaction models. The effect of operating conditions of the TG-DTA system was investigated and the kinetic properties of the materials were determined and discussed.

The results showed that fractional conversion of the waste materials during pyrolysis can be described by both the simple first-order reaction and the multi-reaction models. Heating rates below 20 K/min and flow rates of N_2 gas below 180 ml/min had no effect on the pyrolysis rate. Regression analysis indicated that the pyrolytic activation energies of the materials, with the exception of rice hull which has a high ash content, had significant relationships with the carbon, hydrogen, and oxygen contents.

18. MULTIPLE SHOOT PROLIFERATION AS A TECHNIQUE FOR PROPAGATING BAMBOOS

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Multiple shoot proliferation was induced from germinating excised embryos of *Bambusa arundinacea* and from excised nodes of seedlings, of *Gigantochloa levis*. Proliferation from excised embryos of *B. arundinacea* was observed on modified Vasana et al. medium (1985) and Vongvittra medium (1988). Both media contained 4-4.5 ppm benzylaminopurine. The multiple shoot clusters yielded smaller clusters which broke off from the main growth at weakened sections of the rhizome. For *G. levis*, proliferation of explanted nodes was noted in culture media containing 5 ppm of cytokinin.

Multiplication of shoots by timely subculture and rooting was demonstrated. A follow-up R & D activity could lead to optimization of the propagation technique.

19. INTEGRATING UPLAND CROP PRODUCTION IN RAINFED LOWLAND RICE AREAS

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The inadequacy of irrigation water supply in the Philippines during the dry season leaves vast rice areas idle. Production of high value crops is one strategy to increase farmers' income during this season.

On-station trials were conducted at the University of the Philippines Los Baños (UPLB) testing two or four varieties each of mungbean, cowpea, sweet potato, green corn, and baby corn, and three to four fertilizer rates after wetland rice. Simultaneously, on-farm trials were conducted in farmer's fields in Bulacan. Irrigation water from small farm reservoirs was applied when needed. Two to four varieties each of mungbean, peanut, sweet potato, and green corn, and three to four fertilizers levels, using bio-organic and inorganic fertilizers, were superimposed

in cropping pattern plots. Results showed that all the upland crops evaluated can be grown after lowland rice under UPLB conditions, while it is only mungbean that did not perform well under Bulacan conditions. Yield performance, however, differed for each crop. The combined use of bio-organic and inorganic fertilizers gave a comparable yield to that of sole inorganic fertilizer use.

20. BABY CORN PRODUCTION AS A BUSINESS ENTERPRISE IN SMALL FARMS

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Baby corn production was found to be feasible at the small farm level. However, the market for the produce should be established first before planting is done. This can be accomplished with greater success if farmers are organized and are willing and committed to venture in this enterprise. This is important because of the high labor requirement especially during the harvest period. Regarding the post-harvest aspect, cheaper packages are advised if the corn cobs will be sold at nearby markets and not held/stored for more than two days. For specialty markets, like supermarkets, the styrofoam tray in a polypropylene bag (PPB) is a cheap and presentable package that can keep the corn cobs in excellent condition whether the source is a distant or nearby farm. This type of packaging allows the corn cobs to be held in excellent condition for as long as eight days.

The provision of a sustained forum to educate farmers on the techniques of baby corn production and post-harvest handling and storage will likewise contribute to the success of technology dissemination efforts and, consequently, adoption, at the farmer's level.

21. PERFORMANCE EVALUATION OF PUREBRED AND CROSSBRED DAIRY COWS UNDER TROPICAL CONDITIONS

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The selection of suitable dairy animals for a given set of conditions and objectives requires evaluation of the actual field performance. This paper aims to determine the productive and reproductive performance of dairy cows reared under tropical conditions as influenced by their blood composition.

Using Completely Randomized Design (CRD), animals were grouped according to the following treatments: 100% Holstein-Friesian (100HF), Holstein-Friesian x Sahiwal (HFSH), and Holstein-Friesian x Red Shindi (HFRS) using milk yield, length of lactation, services per conception, days open, calving interval, age at first breeding, age at first calving, and post-partum breeding as productive and reproductive parameters.

Total milk production and average daily milk yield were found to be higher in both HFSH and HFRS than in 100HF under local management conditions. Better reproductive parameters such as lower number of services per conception, younger age at first breeding and calving, shorter days open, and calving interval were found likewise in HFSH and HFRS than in 100HF animals. Details of the study are presented in the paper.

22. PLANT REGENERATION FROM MICROSPORE-DERIVED CALLI IN RICE *Oryza sativa* L.

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The responses of microspores in IR-8 and Nipponbare, *indica* and *japonica* rice, respectively, to callus induction and plant regeneration *in vitro* were studied. Callus induction media containing MS or N6 basal salts supplemented with different levels of auxins and cytokinins showed relatively higher callus induction frequency in Nipponbare than in IR-8. Visible calli appeared between 28-90 days after inoculation in Nipponbare, while in IR-8 it appeared between 40-60 days after inoculation. At 2 mg/l 2,4-D and 3% sucrose in medium containing MS basal salts, no calli formed in IR-8 while the same variety showed 1.4% callus induction on the

medium containing N6 basal salts. In Nipponbare the MS and N6 media containing the same supplements showed 28% and 22% callus induction frequency, respectively. The best regeneration medium contained MS basal salts supplemented with 0.2 mg/l NAA, 2 mg/l 6-BA, 2mg/l kinetin, and 3% sucrose. This medium demonstrated that calli induced on N6 based media exhibited higher number of regenerable calli, and higher number of plant regeneration, particularly in Nipponbare. A one-step callus induction and plant regeneration medium was also observed on N6 based medium supplemented with low auxin to cytokinin ratio.

In IR-8, regenerable calli were obtained only in N6 based media supplemented with 0.2 mg/l 2, 4-D, 0.2 mg/l NAA and 5 mg/l 6-BA. Scanning electron microscopic observations on calli differentiation showed that the mode of plant regeneration in microspore-derived callus in IR-8 and Nipponbare occurred by organogenesis.

23. PARASITOID-BASED MANAGEMENT OF DIAMONDBACK MOTH, *Plutella xylostella* (L.) ON CRUCIFERS IN THE PHILIPPINES

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The larval parasitoids, *Cotesia plutella* (Kurdj.) and *Diadegma semiclausum* Hellen, of diamondback moth (DBM) were mass produced at UPLB and BSU. *C. plutellae* was released in farmers' fields planted with crucifers in the lowland and *D. semiclausum* in the highland as core component of an integrated pest management (IPM) technology; supplemented with microbial insecticides [*Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) or var. *aizawai* (*B.t.a.*)] applied at the economic threshold level (ETL), i.e., 2 larvae/plant 1-4 weeks after transplanting (WAT) and 5 larvae/plant 5-10 WAT.

The effectiveness of the IPM technology versus the farmer's control practice (FCP) in the lowland was demonstrated in Dolores, Quezon. The two releases of 10,000 *C. plutellae* cocoons/ha/release and 1-2 *B.t.a* sprayings suppressed DBM. The level of DBM control by the FCP-managed field, sprayed 4-8 times with synthetic insecticides, was very low. Yield increases of the IPM field were 48% better than FCP and 123% better than the untreated control resulting in a net income of 87% more than FCP.

The introduction of *D. semiclausum* reduced the farmer's frequency of insecticide application from 32 times to 8 times during the dry season and from 16 to 5

times only during the wet season. An increase in yield and net income of 9 and 17%, respectively, was realized with the field releases of *D. semiclausum*.

The technology for the highland has been transferred to farmers of Benguet and Mt. Province while the technology for lowland has been transferred to farmers of Laguna, Batangas, Quezon, Cavite since 1992 and is currently being demonstrated in Ilocos Sur, Nueva Ecija and in the Bicol provinces.

24. AGRONOMIC CHARACTERISTICS OF F₂ PURE MACAPUNO PALMS

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Two new types of pure macapuno palms grown in vitro from embryos of dwarf x tall hybrids exhibited fair to good growth. VMAC-1 resembled the dwarf female parent of the F₁ in early growth and morphology while VMAC-2 showed the characteristics of the dwarf x tall hybrid.

VMAC-2 flowered 36 months after field planting. VMAC-1 flowered a month later. Intrapadix overlapping of the male and female phases ranged from 54-100% in VMAC-1 with a mean of 88.3%. VMAC-2 had 50-100% intrapadix overlapping of the male and female phases with a mean of 73.4%.

Macapuno yield per bunch ranged from 67-100% in both VMAC-1 and VMAC-2. However, VMAC-1 had a higher mean of 91.8% while VMAC-2 had a mean of 82.8% only. Unwanted pollination could be due to insect pollinators.

Dehusked macapuno nuts weighed from 292-644 g in VMAC-1 and 728-998 g in VMAC-2.

25. CONSERVATION STRATEGIES FOR WHITE POTATO UNDER LOW ELEVATION HUMID TROPICS

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The strategies for in vitro maintenance of a breeder's collection of white potato under low elevation humid tropics were developed. These strategies include

growth under "normal" propagation protocol, slow growth protocol, and use of microtubers. The development of the protocols that led to the standardization of procedures is described.

For the normal propagation protocol, shoot tips or nodes were maintained on Murashige and Skoog's (MS) medium with 10% coconut water, while for the slow growth protocol, shoot tips or nodes were cultured on MS with 2% mannitol. Microtubers for storage were produced from shoots propagated on modified MS (macronutrients at double the concentration) with 2% sucrose and induced to form tuberlets ranging in size from 5 to > 10 mm diameters in MS with reduced N, 50 ppm coumarin, 1 ppm BAP, and 8% sucrose under complete darkness for four weeks.

The bigger-sized microtubers (>10 mm) could be stored for 12-18 months in an airconditioned room (25-27°C). The cycle for renewal would be yearly for microtubers, 6-12 months under slow growth, and 1-2 months for normal growth protocol.

26. EFFECTS OF CASSAVA FLOUR ON THE QUALITY OF SELECTED BAKERY PRODUCTS

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Cassava flour has been previously considered as an inferior substitute for wheat flour in the preparation of yeast-leavened products. This study was, therefore, conducted to utilize cassava flour combined with all-purpose or cake wheat flour in selected bakery products. Evaluation was based on product acceptability, proximate composition, and physicochemical aspects following standard procedures. Formulations of potential products were optimized using response surface methodology (RSM).

Enhanced quality of the products was observed in the presence of cassava flour especially in terms of texture and flavor. Lady Finger, Pan Cake, Binangkal, Butter Cake, Cassava Cookies, and Muffins containing cassava flour at a range of 50-100% were found by consumer panels to be more acceptable than counterpart products with 100% wheat flour. Furthermore, their characteristics were almost similar to wheat cake flour. RSM also proved to be suitable by generating optimized formulations which were readily adopted by some cooperators.

27. FARMING SYSTEMS AND LANDSCAPE SUSTAINABILITY ANALYSIS: THE CASE OF MT. BANAHAW DE LUCBAN-PALOLA LANDSCAPE

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This paper analyzes the changes in farming systems and landscape of Barangay (village) Palola of Lucban, Quezon, Philippines. The case provides information on Palola's physical land resource such as location, geography, landform type, and soils, as well as on its climate and water resources.

It discusses the interacting factors that are contributing to the changes in the present land use and farming systems namely: biophysical condition, population needs, peace and order situation, policy, and availability of support services.

This information can provide a basis in agricultural planning for sustainable agriculture and resource management. It is very clear that a wholistic view of the situation and integrated actions in the total landscape must be employed in order to have a successful development program for the area.

This study proved that the present land use is one of the very important indicators and prerequisites in determining the set of potential land uses in developing an area. It can also be now regarded as an expression of the kind of crops preferred by farmers in the locality.

The existing farming systems that are found across its landscape are described. Coconut, the most dominant cover, is predominantly planted all over the project area. Rice, irrigated or rainfed, is found to be the second major crop preferred by farmers in the locality. Briefly, recommendations for sustainable farming systems are also stated.

28. ASES: AN EXPERT SYSTEM FOR CROP SUITABILITY EVALUATION

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The Farming Systems and Soil Resources Institute (FSSRI) at U.P. Los Baños and PCARRD embarked on the development of a computer-aided system which

would provide accessible and understandable agricultural information. Agrotechnology Suitability Evaluation Systems (ASES), an area crop-suitability analysis system, is composed of an area database which deals with inventory and interpretation of information on land qualities and characteristics of an area and a crop database capable of retrieving agro-environmental requirements of 33 forest species and 64 economically important crops.

To be able to obtain suitability, ASES uses its subsystem that matches data of crop requirements with the relevant agro-environmental attributes of the area. A limitation method was employed to determine the suitability of each land quality and the overall suitability rating.

Prolog version 2.2 was initially used to develop the computer program for the storage and retrieval system. FoxPro software was then employed to modify this former computer program.

This computer friendly software will be useful for agricultural land use planning and zoning at barangay, municipal, and provincial levels. It can now be utilized in farming systems resources management in different agro-ecosystems.

29. CITRIC ACID PRODUCTION USING CASSAVA AS SUBSTRATE

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The batch fermentation process for citric acid production was carried out using *Aspergillus niger*. The effect of pH (3.0, 4.0, and 5.0) and initial sugar concentration (50, 100, and 150 g/L) on citric acid production was optimized in a stirred tank bioreactor equipped with complete accessories to maintain automatically dissolved oxygen level, pH, and temperature in the culture medium. The combination of pH4 and 50 g/L initial sugar concentration gave the highest citric acid concentration and maximum sugar consumption. The acid produced was 38.2 g/L which is 79.0% of the sugar consumption. These optimum conditions were applied to hydrolyze cassava flour used in fermentation media for citric acid production. The cassava flour was gelatinized and liquefied by α -amylase. The liquefied cassava flour was saccharified by glucoamylase into simple sugars. The process also indicated that the efficiencies of fermentation and product yield coefficient were 98.75% and 1.42, respectively with additional oxygen supply in the aeration rate.

30. CONSTRUCTION OF A PARTIAL GENOMIC LIBRARY AND CLONING OF A REPETITIVE ELEMENT IN *Pseudomonas solanacearum*

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Partial genomic library of a strain of *Pseudomonas solanacearum* infecting banana was constructed. Genomic DNA was isolated, digested with *Sau*3A, ligated to *Bam*H1 digested DNA of the plasmid Bluescript, and transformed to *Escherichia coli* DH5 α . Transformants were colony blotted and probed with the alkali-labile digoxigenin-labeled genomic DNA of *P. solanacearum* banana and tomato strains. Colonies giving strong hybridization signals were selected and plasmid DNA was isolated. The plasmids were then used to probe genomic blots of *P. solanacearum* to confirm the presence of repetitive DNA segments. Out of the four clones with strong hybridization signals, two (pM114 and pM38) harbored repetitive elements as based on the Southern blot analysis of the genomic DNA of banana-infecting isolates of *P. solanacearum*. The clones which harbored repetitive elements were labeled with alkali-labile digoxigenin and used to probe the *Eco*RI digested genomic DNA of this organism. Results revealed the presence of 0 to 18 hybridization bands depending on the strains tested. The size of the insert is 2.28 kb for pM114 and 3.49 kb for pM38. These repetitive elements will be used to detect genetic variation in *P. solanacearum*.

31. PESTICIDAL EFFICACY OF FORMULATED PESTICIDAL PRODUCT FROM PHYSIC NUT, *Jatropha curcas* L.

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The crude *Jatropha curcas* seed oil formulated as an emulsifiable concentrate had contact toxicity to stored grain insects, *Sitophilus zeamays* and *Callosobruchus chinensis*; molluscicidal effect on golden snail, *Pomacea* sp.; moderate fungicidal effect on damping-off and wilt pathogens, *Rhizoctonia solani*, *Sclerotium rolfsii*, and *Fusarium oxysporum*; and chronic toxicity to *Musca domestica*.

Cotton sprayed at either 800 or 1250 ml crude oil/ha produced a comparable number of bolls with that sprayed with deltamethrin (12.5 g.a. i./ha), profenofos (400 g. a.i./ha), and untreated check. The cotton boll weight was not affected by the application of the different test chemicals. The cottonseed yield was highest on profenofos-treated cotton, followed by that sprayed with deltamethrin with the latter comparable to that sprayed with the product at 800 ml crude oil/ha or untreated check. The comparable yield of the chemical-treated cotton to that of the untreated check was attributed to the population of natural enemies of the latter.

The product from physic nut, therefore, effectively controlled various pests and was safe to some beneficial insects.

32. INTEGRATED PEST MANAGEMENT FOR COTTON IN THE PHILIPPINES

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The Integrated Pest Management (IPM) scheme for cotton focuses on the reduction of pesticide usage. The components are as follows: Cultural method for insect control includes the use of resistant varieties such as leafhopper-resistant CRDI-1 variety; close- season planting, that is, within a 15-day period in a cluster; field sanitation; dense planting for compensation effect; optimum fertilizer; and water management. The use of trap crops like tobacco and tomato, physical destruction of flowerweevil-damaged flowers, and sundrying cottonseed to destroy pink bollworms are also included.

Weeds are effectively controlled by thorough land preparation, off-barring at 24 days after emergence (DAE), then billing-up at 44 DAE or spot weeding and mulching for rice-based areas using the minimum tillage.

The list of chemical pesticides for control of insect pests, diseases, and weeds indicate the recommended rate at specific crop stage and/or target pest.

The egg parasite, *Trichogramma chilonis*, is released before insecticide application at the rate of 67,000 parasitoids per hectare during the early squaring stage, that is, 45 DAE and weekly thereafter until the bolling stage, 85 DAE.

33. BIOCANE-ORGANIC FERTILIZER FROM SUGAR MILL RESIDUES: SRA TECHNOLOGY

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The Sugar Regulatory Administration (SRA) generated a technology that converts sugar mill residues into high value bio-organic fertilizer (BOF). The product conforms with the quality standards set by the Fertilizer and Pesticide Authority.

The production process involves the rapid decomposition of bagasse and filter cake mud using a liquid activator (cellulolytic decomposer) and a liquid enricher (nitrogen-fixing bacteria).

The technology has been transferred and commercialized to seven cooperators: BUSCO Milling Company in Bukidnon, Pampanga Sugar Development Company, Hacienda Luisita in Tarlac, Peñafrancia Milling Company in Camarines Sur, Central Azucarera de La Carlota in Negros Occidental, Hind Sugar Milling Company in Pangasinan, and J&E Development Corporation in Paniqui, Tarlac.

The cooperators produce BOF for use of planters in the districts. The conversion of mill residues in the districts not only has solved the pollution threat in the disposal of the wastes, but has also improved the soil condition of the farms long abused with chemical fertilizers, and has improved the yield of sugarcane.

34. GROWTH PATTERNS OF COTTON (*Gossypium hirsutum*) PLANT PARTS AND SOME PHYSIOLOGICAL PARAMETERS

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The developmental growth patterns of some cotton plant parameters under Batac, Ilocos Norte agro-climatic conditions were determined.

The model plants were based on the treatment spaced at 75 cm between rows and 25 cm between hills at two plants/hill fertilized at 225-25-0 kg of N-P₂O₅-K₂O. This treatment gave a yield level of 3.6 t/ha.

The plant height, total dry matter yield, dry matter yield of the vegetative parts, and leaf area index (*Y*) had growth patterns that best fitted the logistic growth regression or the sigmoidal curve model *y* is the predicted value of *Y*:

$$Y = \frac{\beta_0}{1 + \beta_1 \rho X}$$

where β_0 is the Y intercept, β_1 is the slope of the curve, and X is the number of days after emergence.

A logarithmic regression model:

$Y = a + b \ln X$, where a is the y intercept and b is the regression coefficient.

describes the pattern of growth increments on the number of mainstem nodes, sympodial branches, fruiting points, and bolls per plant, and the net assimilation rate.

On the other hand, a quadratic regression model,

$$Y = a + b_1 X + b_2 X^2, \text{ where } b_1 \text{ and } b_2 \text{ are regression coefficients,}$$

describes the growth patterns of the total leaf area, number of main stem leaves, and squares per plant, and the crop growth rate.

Meanwhile, the pattern of dry matter accumulation of the reproductive parts followed the power regression model,

$$Y = (a)(X^b),$$

while the R: V ratio fitted an exponential regression model,

$$Y = (a) (e^{bX}).$$

The identified regression and correlation models can be applied to analyze, prepare, and establish field crop monitoring growth models in 14 Cotton Development Enhancement Program areas in the country.

35. MODEL FOR IMPROVING CONVERSION OF AGRICULTURAL LANDS TO RESIDENTIAL LANDS

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A model for determining the approval of applications for conversion of agricultural soils to nonagricultural uses, especially residential uses, was developed. The model is simple, easy to use, and objective.

It considers the suitability of the soil for crop production and its site quality. Factors affecting the former include depth of soil, slope, texture, drainage, stoniness, and rockiness, whereas the factors affecting the latter include the number of resi-

dences within the 1/2 km radius of the soil, percent of the perimeter of the soil in noncompatible uses, and parcel size.

A table of ranges of values of each factor with their corresponding points, with the maximum point assigned to the most favorable range of values, is prepared.

The points for each factor affecting soil suitability and site quality of the soil being evaluated are assigned using the table and are summed up to get the soil score of that soil. The soil score is used as a basis for approval of applications for land conversion from agricultural to residential. A cut-off score was set so that an application for conversion of soils with a higher soil score will be disapproved whereas those with a lower soil score will be approved.