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A Holistic Approach in Establishing Food Security: Securing Food Supplies to Meet the Future Food Demand of the Increasing Population

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PLENARY PAPER ABSTRACTS

Inclusive Value Chains in the Indonesian Poultry Industry

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The poultry industry continues to play a significant role in meeting the demand of animal protein in Indonesia. Poultry meat contributes more than 60 percent of the total meat production in the country. The outlook for the Indonesian poultry industry appears optimistic because the country's per capita consumption of poultry meat is currently among the lowest in Asia. Sustained economic and income growth, a fast-growing urban population, and the increasing integration of global agri-food markets are fueling rapid growth in the demand for high-value food commodities such as poultry products. Growing demand for poultry products is opening up the opportunities for smallholders to diversify toward these high-value commodities. The major impediments for smallholders to participate in the poultry value chains are lack of access to markets, capital, inputs and technology and extension services. Improving the capability of smallholders to participate in the poultry value chains requires close linkages between farmers, processors, traders and retailers to coordinate supply and demand. Contract farming is an important means of linking producers with markets, as well as a source of credit, high quality inputs, improved technology, information and services. Contract farming is seen by proponents as a way to raise small-farm income by delivering technology and market information to small farmers, incorporating them into remunerative new markets. But there is evidence that contract farming may have a negative effect on the welfare of smallholders. There is also concern that contractors favour larger producers and hence poorer producers may be excluded from the value chains. Nonetheless, there is growing evidence that the advantages associated with contract farming outweigh its disadvantages.

Food Diversification in Japan: Recent Development in Functional Foods

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The term 'physiologically functional food', which first appeared in 'Nature' journal, 1993 with the headline "Japan explores the boundary between food and medicine" gave a strong international impact. Functional foods, defined as those that have the potential to reduce the risk of lifestyle-related diseases and associated abnormal modalities, have garnered global interest since the 1980s when the systematic research had humble beginnings as a national project in Japan. In 1991, the project led to the launch of the national food for specified health uses (FOSHU) policy; almost 1000 FOSHU products with eight categories of health claims have been approved up to the present.

Since 1991, food functionalities have been extensively researched, and novel functional food genomics based on nutrigenomics have also been introduced. The availability of these functional foods is evaluated by using the omics techniques to cyclopedically analyze how gene expression fluctuates in each intravital tissue after consuming a functional food or its component. Since the availability of functional foods has been adequately assessed, the focus has now turned to the evaluation of safety and the necessity of risk assessment.

The Food Safety Commission of the Cabinet Office assesses the risk and safety of foods including the “so-called health foods” and FOSHU. After the shapes of tablets and capsules were finalized and brought into effect by the health-promoting food system in April 2001, the assessment of safety has been specifically emphasized. As an initiative, the Food Safety Commission of the Cabinet conducted a safety evaluation on soy isoflavones, and issued a Notice: “Basic approaches to evaluating the safety of FOSHU containing soy isoflavones” in 2006.

During the past few years, only the validity, namely, the benefits, of FOSHU was evaluated. Therefore, lately, risk evaluation has been promoted in Japan. Risks and benefits posed by functional foods should be collaterally evaluated in the near future, and risk-benefit analyses should be performed to investigate the correlation between these two factors.

In this presentation, I will outline the recent trend by reviewing the history and background of functional foods in Japan, discuss the safety evaluation on soy isoflavones, and introduce some studies conducted on the functionality and safety of foods.

Development of Eco-agricultural Inputs for Sustainable Crop Production

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Agriculture is a leading and essential sector in the economy of many countries. It is important to meet the food security and provide raw materials to the manufacturing sectors. The typical commercial agricultural system uses high inputs in order to obtain and sustain the economical level of crop production. The high inputs are normally associated with the decline in diversity of crops, deteriorating of soil fertility and environmental and health impacts of pesticides. These negative impacts have intensified the need for the change of the crop production systems. The ideas of low-input, reduced-input, sustainable, organic, biological, regenerative, and alternative agriculture have been suggested and presented in many literatures. The terms usually refer to the utilization of ecological and environmental friendly inputs that will generate a sustainable crop production. The crop production system requires seed or planting material, fertilizers, crop protection and irrigation to get a maximum attainable yield. Sustainable crop production should begin with activities on conservation and storage of local plant genetic resources. Accessions of different crops collected should be registered and deposited in the collection centre. The documentation of efficient and sustainable use of the plant genetic resources should be investigated together with exchange of scientific and traditional crop production system among the parties involved. High yielding varieties normally need to be cultivated in a package, with chemical fertilizers and pesticides, and availability of efficient irrigation system. Often this is not attainable by the farmers due to lack of understanding on agronomic practices, over reliance on fertilizers and pesticides that have resulted in degraded soils, increased resistance to pesticides and decline yields. Any program on seed or planting material should take into account on the local environment and farmer’s knowledge for successful and sustainable crop production. The nitrogen fixing bacteria like *Rhizobium*, *Azotobacter* and *Azospirillum* are normally used for eco-agricultural biofertilizers. The bacteria can fix free nitrogen in

association with legumes and eventually are able to replace conventional inorganic nitrogen such as urea. The availability of phosphorus to the plant could be increased by using mycorrhizal fungi. Other technologies for sustainable use of fertilizers include the use of green manures and leguminous cover crops and utilization of controlled release technology for efficient use of conventional fertilizers. The pest management uses pesticides as the last resort and the pesticides must be compatible with other control methods. The use of naturally occurring compounds and microbiols should be able to meet the requirement of eco-inputs. The botanical pesticides are normally used by the farmers in the form of crude extract of plant material in water and applied directly to the crop. Often the result on pest control is not consistent due to the compounds are generally unstable and short-lived under that condition and inconsistency in term of the actual amount of active ingredients applied to the crop. Thus, these botanical compounds are needed to be formulated as the conventional pesticides. The technology to produce green formulation using plant based as carrier and additives should be explored. The production of bio-control agents (fungus, bacteria, nematodes, viruses and beneficial insects) and field utilization is in the early stage. The success of biopesticides in the field depends on the right choice of organisms and the manner they are formulated. The formulation should not only maintain the virulence and infectivity of the organisms but have physicochemical properties of conventional pesticides. Their use and field application should be similar to the current practices. All these factors are discussed in the paper. The use of eco-agriculture inputs could decrease the dependence on conventional inputs and provide a sustainable crop production.

Market Chain of Horticultural Products in Thailand

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In Thailand, the horticulture industries are heading the sufficient production quantity for both domestic market and export market. In these recent years, the industries also aim for superb quality horticultural products that support developing new consumer markets. The market chain focuses on efficient cultivation and elite cultivars. For example, durian, mango and some vegetable crops already have superb cultivars in the domestic and in the export markets, yet the breeding programs are still searching for new and high value cultivars, such as cultivars for nutrition-rich functional fruits. With recent efforts on researches, innovation and technological development, cultivation of superb product has been advanced from laboratory to production. These technological solutions also help resolving issues on increasing yield, pest and disease invasion, tolerance to both biotic and abiotic stress and also on production cost management on various horticultural crops. Food safety and quality are elemental concerns in the market chain. For export market, horticultural crops, harvesting and postharvest handling must be strictly following the protocol (i.e. Good Agricultural Practice - GAP) and be monitored by the industries and the government agency. The trade system also evolved from individual farmers towards contract farming and corporate farming. These changes redefine new roles in the marketing and the logistic practices in the free-trade market chain. The successes of Thai horticultural products build on technological development, appropriate cultivation, good practice and good cooperation from everyone – farmers, exporters, agriculture industries and government.

ABSTRACTS

Adaptation to Climate Change

Comparison CO₂ Emission from Corn Fields in Tropical and Subarctic Area

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Carbon cycling rate in the terrestrial ecosystem is influenced by climate. This research compares the CO₂ emissions from the mineral soils of the corn field in different climate area. Measurement of CO₂ flux from soil was conducted from August 2008 to September 2009 at dent corn field in Southeast Hokkaido, Japan and from November 2010 to June 2011 at sweet corn field in West Java, Indonesia. Two experiment plots, planted plot and bare plot, were established in each site. All biomasses were removed from the bare plot. Growing period was defined from the next day of harvesting previous crop until the harvest date of corn. We carried out the measurements for one growing period in Japan and for two growing periods in Indonesia. CO₂ flux was measured by closed chamber method. Total net primary production (NPP) of corn including the roots and residue was measured at eight replicates at the time of harvest. Growing period was 394 days in Hokkaido, 91 and 90 days in Java. The NPP was 8.09±2.2 Mg C ha⁻¹ in Japan, 4.62±0.55 and 4.33±0.65 Mg C ha⁻¹ in Java. There was a residue of 1.36 ± 0.53 Mg C ha⁻¹ in Hokkaido, but zero in Java (all stalks and roots were harvested as a feed for cattle). For a growing period, CO₂ emission from planted plot (soil organic matter decomposition + root respiration) was 7.88±1.56 Mg C ha⁻¹ in Hokkaido, 4.03±0.12 and 3.31±0.10 Mg C ha⁻¹ in Java. CO₂ emission from bare plot (soil organic matter decomposition only) was 5.74±0.17 Mg C ha⁻¹ in Hokkaido, 3.08±0.53 and 3.24±0.13 Mg C ha⁻¹ in Java. C cycling rates were almost doubled in Java compared to Hokkaido. The rates of soil organic matter decomposition and corn growth compared to root respiration rate was higher in Java than Hokkaido. It is interesting that higher corn growth rate and soil organic matter decomposition were maintained although the residue of corn was not applied to the field in Java. There may be a mechanism of organic matter enrichment through crop rotation. Further research focusing on the relationship between C cycling and crop rotation is required.

CO₂ Gas Emission Evolved from Agricultural Lands of Corn, Peanut, and Cassava at Bogor, Indonesia

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Climate change is one of global issues that became a warm topic of discussion over the world. Three greenhouse gases (GHG) that most contribute to the increase in GHG emissions are CO₂, CH₄ and N₂O. Besides industrial areas, CO₂ gas emission from agricultural land is considerable higher than from the other areas. However, researches on CO₂ emissions from tropical agricultural land are very limited especially on mineral soil. This study aims to measure the amount of CO₂ emissions on different landuses as well as to understand the controlling factors of CO₂ emission at mineral soil. This research was conducted on corn, peanut and cassava fields at Bogor, West Java, Indonesia. The climate variables such as air temperature, soil temperature at 5 cm depth, and relative humidity were measured every two weeks from planting until harvest. In order to compare each site,

we assumed that these fields were continued to be planted same crop for one year for calculation. CO₂ emission from corn field was 12.68 tons C/ha/year, followed by 10.19 tons C/ha/year in cassava field and 8.32 tons C/ha/year in peanut field. In corn field and cassava field, CO₂ flux on row was higher than inter row. Soil water content was positively correlated with CO₂ flux on row, but did not correlated with CO₂ flux inter row. These results suggest that plant activity may influence CO₂ emission and high water content could increase CO₂ emitted from the soil.

Vulnerability to Climate Change of the Indigenous People in the Bicol Region, Philippines

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It is widely accepted that indigenous peoples (IPs) are severely impacted by climate change. Climate change impacts are already being observed, indicating an urgent need for measures to minimize vulnerabilities. For the vulnerable communities like the IPs, living on fragile and degraded lands, these measures are urgently needed. The Bicol region, Philippines is highly vulnerable to the impacts of climate change. The IPs have to cope with an average of 20 tropical cyclones a year. Most of these occurred during October to January with wind velocity greater than 117 kilometers per hour. The El Niño and La Niña phenomena greatly affected the region's agricultural productivity, aggravating the poverty situation in the region. The study described the profile of the indigenous peoples (IPs) in the Bicol region and determined their vulnerability to climate change in terms of their livelihood and well-being. Survey, participatory rapid appraisal and transect walk were conducted to gather the data. Majority of the IPs belonged to Agta-Tabangnon tribe with an average family size of five and reached elementary level. Majority informally used lands with the owner's permission and earned an average monthly income of \$72. Since the main source of income of the IPs were either farming or fishing, their livelihood were very vulnerable to disease and pest infestation, droughts, floods, landslide, typhoons, storm surge and sea water rise. Due to the kind of dwelling, source of water and location of their houses, their well-being were very vulnerable to droughts, floods, landslide, typhoons and storm surge.

Assessment and Valuation of Greenhouse Gases Mitigation of Climate-Friendly Farming Practices in Lowland Rice Agroecosystems in Isabela, Philippines

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Greenhouse gases (GHGs) trap heat in the atmosphere that results to global warming or enhanced greenhouse effect. Major GHG emitted from rice cultivation is methane (CH₄) produced by anaerobic decomposition of rice straws in flooded fields. GHG assessment based on 2006 IPCC Guidelines was conducted in 30 selected Irrigators Associations (IAs) covering 7,789.34 ha lowland irrigated rice service area in NIA-Magat River Integrated Irrigation System (MRIIS) District 2 in CY 2008. Existing farming practices emit 5,882.93 tons yr⁻¹ CH₄ while shifting to mid-season drainage, rice straw aerobic composting and simultaneous drainage and composting results to 2,823.81, 3,756.44, and 4,777.16 tons yr⁻¹ or 48, 64 and 81% CH₄ emission reductions, respectively. Values of emission reductions using 2009 World Bank price of US\$12 ton⁻¹ CO₂e assuming Php48 1US\$⁻¹ are Php34.16, Php45.44, and Php57.78 million yr⁻¹ for mid-season drainage, aerobic composting and simultaneous drainage and composting, respectively. Partial budget analysis indicates incremental benefit of Php138.95 million yr⁻¹ if farmers shift the existing practices to climate-friendly practices. STELLA simulation results indicate that: keeping on existing farming practices results to linear accumulation of 5,882.93 tons yr⁻¹ CH₄; annual CH₄ emission stabilizes at 13,000, 10,000 and 8,000 tons within 12 years for mid-season drainage, aerobic composting and simultaneous draining and

composting, respectively. This information were shared to farmers, IAs, NIA-MRIIS and LGUs through production of IEC materials (posters, flyers, brochures) and conduct of awareness-raising seminars, fora as well as other policy advocacy activities. On-farm trials need to be established.

Adaptation to Climate Change of Farmers in Northern Isabela, The Philippines

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Climate change is one of the biggest environmental, social and economic threats the world is experiencing at the moment. Projections on climate change show that the global temperature is continuously increasing. The Philippines is vulnerable to climate change. In the recent years, natural disasters such as floods, droughts, and typhoons are becoming frequent. The extreme climate variabilities experienced in Isabela include strong typhoons such as typhoon Imbudo, and supertyphoons Paeng and Juan in July 2003, November 2006, and October 18, 2010 respectively. Due to the poor infrastructure and location, the northern towns of Isabela are particularly vulnerable to climate change. In November 2008 and November 2010, some *barangays* (villages) in the municipalities of Cabagan and Santo Tomas in Isabela were flooded. This study documents some climate change adaptation strategies of farmers in Northern Isabela in the Philippines. It also discusses the perceptions of the farmers on climate change. The study was done in the municipalities of Cabagan and Santo Tomas. The agricultural sector in these areas is vulnerable to climate change. The data in this study were obtained from interviews with farmers. The adaptation strategies that are directly related to climate change as experienced by the farmers include the following: Use of multicropping to increase soil quality or planting other crops in between cropping;; use of organic fertilizer or compost; adjusting the plant calendar or changing the planting schedule; optimizing rice productivity and optimum use of fertilizers and other inputs; irrigating the farm; planting drought-resistant varieties of corn; use of disease-and-pest-tolerant crop varieties of rice; delay in planting until flood subsides; and planting when there is still soil moisture.

Effects of Climate Change at Pinacanauan de San Pablo Watershed: Land Use and Infrastructure Assessment

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The study was conducted to assess land use and infrastructures due to effects of climate change in the Pinacanauan de San Pablo Watershed the northernmost part of Isabela, Philippines. The methods used were review and analysis of existing maps and development plans; site assessment, i.e. photo documentation, site observation and informal interviews; secondary data at the local government unit, Department of Environment and Natural Resources and National Irrigation Administration; preparation of base maps, i.e. road and irrigation maps. The watershed covers thirteen barangays with an aggregate area of 33,553.72 hectares. Its vast aquatic resources include the Cagayan River and the tributaries like the Pinacanauan River in the center, and Balulu Creek in the south as source of fish, transport and irrigation water. The effects of climate change is evident on the drying up of some of its water resources during dry season. On the other hand during wet season and or occurrence of heavy rain during typhoons almost all of the barangays located on the lower areas are flooded and the overflow of the Pinacanauan River and Cagayan River causes soil erosion on fifty (50%) of the barangays. The infrastructure i.e. irrigation facilities, road network were poorly managed and has not been fully operational due to the unpredictability of climate change. With the frequency of

flood during the rainy season, there is indeed a watershed degradation due to soil erosion, sedimentation and landslides that affects the productivity of the land. This results to unstable water flow that floods lower areas, and leads to low agricultural yield, loss of income and induced increase in poverty. The study recommends rehabilitation and reforestation of the watershed area, the need for river control protection, upgrading, repair and concreting of roads, construction of pump wells as a source of potable water and rehabilitation of irrigation facilities and expansion of its area of coverage.

**Promoting Agroforestry as a Climate Change Adaptation Strategy in Southeast Asia:
Experience of the Philippine Agroforestry Education and Research Network**

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Climate change is the one of the pressing issues in the world today. The causes and challenging issues of climate change, particularly its negative impacts to the vulnerable countries and communities have become the interest of research and development-oriented groups and organizations. This paper argues that agroforestry is one of the key climate change adaptation strategies in the agriculture sector, particularly the smallholder farmers in Southeast Asia. Agroforestry is a land use management system that integrates woody perennials and agricultural crops, livestock and/or aquatic resources in the same piece of land for the twin purpose of achieving economic productivity and environmental stability. With this potential, agroforestry has always been integrated as a major production technology in the community-based forest management programs in vulnerable communities. Likewise, several studies have been pointing out the many uses of agroforestry in carbon sequestration, and in restoring the degraded and marginal upland areas. Recognizing the need to disseminate and publicize the potentials of agroforestry in climate change adaptation, PAFERN embarked on a regional project involving the collaboration of five collaborating countries of the Southeast Asian Network for Agroforestry Education (SEANAFE). The project's end goal is scaling-up agroforestry promotion towards climate change mitigation and adaptation. Specifically, the project focused mainly on creating public awareness about the potentials of agroforestry in adapting to the impacts of climate change. These include information materials development, training of junior lecturers, National Agroforestry Roadshows and seminars, and production of a policy brief. The outputs and outcomes of the project implementation led to the development of the Second Phase of the Project which calls for institutionalizing agroforestry as a climate change adaptation strategy through local capacity and policy development in Southeast Asia. The current state of the uplands and natural resources management, coupled with global climate change, calls for the integration of agroforestry as a key strategy in development-oriented programs.

Climate Change Adaptation of Priority Faunal Species in Mount Isarog Natural Park

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Mount ISAROG is one of the few mountains in the Philippines abounding with great variety of wildlife species. Its possible threats for biodiversity decline come directly from climate change and population pressure of the human settlers at the base slopes of the mountain. The study aimed to determine the effect of climate change to the biodiversity trends of priority faunal species and the threats in Mount Isarog Natural Park using the Biodiversity Monitoring System and Threat Reduction Assessment tool. The trends on the population of faunal species have shown that Baboydamo (*Sus*

scrofa), Bayakan (*Pteropus speciosus*), Unggoy (*Macaca fascicularis*) and Punay (*Gallicolumba luzonica*) are remaining as the dominant species, while population decline has become evident among the species of Sawa (*Phyton reticulates*), Sabit (*Spizaetus philipensis*), Usa (*Cervus marianus*) and Salibad (*Microhierax erythrogynys*). No significant difference was obtained in terms of presence, frequency and population density of faunal species. These findings are indicative of a continuing reduction in the biodiversity population of faunal species. One important finding in this study was the significant differences in the biodiversity population among the sites. This finding may imply that species are forced to move out of their habitats they are accustomed to resulting to reduction in "species richness" and biodiversity conservation was differentially implemented among the research sites. Scalogram analysis also indicated that the most common biodiversity threats exerted by the communities to the mountain ecosystem involve the utilization of the mountain resources for subsistence and other basic needs of the household.

Climate Change Adaptation in Selected Lowland Rice Areas in Bicol Region, Philippines

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Existing literature has indicated the vulnerability of agriculture to climate change. It is expected that changes in temperature and precipitation will result in changes in land and water regimes that will subsequently affect agricultural productivity. Due to its geographic location and physical environment, the Bicol Region is highly vulnerable and at risk to climate and weather-related changes. Climate change will, therefore, exacerbate the poverty condition in the region because of its dependence on agriculture. A technical cooperation project is being implemented in the region by the Food and Agriculture Organization in collaboration with the Department of Agriculture, selected local government units, PAGASA, and selected universities. One of the objectives of the project is to improve the livelihood resilience and food security of households who are highly vulnerable to the frequent occurrence of extreme climatic events thru the introduction of good practice options for climate change adaptation. Early maturing rice variety was introduced in selected sites to reduce the risk of crop failure due to typhoon and flooding. Stress-tolerant varieties were also introduced in selected sites to address the risks due to flooding and saline water intrusion. Results revealed a significant difference in yield performance between early maturing variety and local variety at 5% significance level. On the other hand, yield of stress-tolerant varieties was not significantly different from the local variety planted by farmers. The results indicate that planting early rice maturing varieties would be an effective climate change adaptation strategy for lowland rice areas.

Good Practices Options for Climate Change Adaptation in Upland Agro-Ecological Zone in the Bicol Region, Philippines

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Natural disasters have severely destabilized the socio-economic fabric of the Bicol Region in the last four years, with the most devastating impacts experienced in 2006. Typhoon *Reming*, which hit on 30 November 2006 was the most destructive, severely affecting all the six provinces of the Bicol Region. Typhoon *Reming*, which brought 466 mm of rainfall, the highest in 40 years, damaged 18,786 hectares planted to rice at varying stages of growth and the damage to investment losses in terms of input costs such as seeds, fertilizers and labor was valued at PhP 153.8 million. The project aimed to develop and implement climate risk management measures that will contribute to improve

the livelihoods and food security of small-scale farmers in disaster prone areas in the upland. The project was implemented in three disaster-prone villages in each of the three municipalities of the provinces of Bicol Region. Thirty farmer per village were selected as cooperators based on set criteria. Among the GP options tested, coconut leaf pruning (CLP) and strip cropping (SC) were found to alleviate the impact of climate change. Crops like early maturing cassava and peanut were feasible for wet season panting and corn, hot chili and sweet potato for dry season cropping for CLP technology. In SC, the crop combination that provided good results during the wet season were combination of cassava and peanut, and corn. During the dry season combination of corn, string beans, snap bean, squash, okra, hot chili, tomato and eggplant proved to be highly feasible.

Changes in *Jatropha* Annual Production Pattern as Influenced by Climate Alteration

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In recent years, *Jatropha curcas L.* has been suggested as the alternative source for biofuel production. Mutation breeding program in CAIRT has obtained five homogeneous *Jatropha* mutant lines with high seed oil content. It was necessary to learn the production capacity of these lines before they can be officially released as varieties. Since *Jatropha* is a perennial tree plant, the observation must be carried out until the plant reached the optimal production age. The research was conducted in Pasarjumat, South Jakarta since 2006. The objective of this research was to analyse the influence of climatic factors in production of *Jatropha* mutant lines in the second to fourth year of plant age (2008 – 2010). It was observed that climatic environment has huge influence to monthly fruit production. Barlett's test proved that production weight among five mutant lines and the parental variety as control has no significant difference. The data analyses showed that the monthly productions were highly varied within a year, and in general correspond to the monthly rainfall precipitation, day of rain per month, and average temperature data from BMKG Jakarta. The alteration in wet season pattern has corresponded to the shifting of peak production periods in *Jatropha* each year. In particular, the prolonged wet season in 2010 has resulted into three smaller peaks instead of the usual two high peak periods. This research provided an example of how the climate alteration would affect the perennial tree phenology.

Crop Production and Improvement

Screening and Evaluation of Some Wild Rices for Potential Traits in the Improvement of Cultivated Rice

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Anatomical and physiological characteristics of selected “stay-green” wild rices were determined. to select the most slowly senescing rices from the 19 genotypes initially collected. Significant variation in chlorenchyma thickness and distance between vascular bundles were found among the selected “stay-green” rices. Evaluation of their “stay-green” characteristics revealed that the amount of chlorophylls a, b and total chlorophyll were significantly highest in *O. ridleyi* and lowest chlorophyll b and total chlorophyll in *O. officinalis 100896 x O. officinalis 10116*). However, the initial measurements of chlorophylls from fresh leaf samples showed that these pigments were significantly highest in *O. officinalis 100896 x O. officinalis 10116*. The very weak linear correlations obtained between initial and final chlorophyll a and total chlorophyll were not statistically significant.

The senescence of the rices, therefore, was not dependent on initial chlorophyll content but on the rate of chlorophyll breakdown which seemed to be slowest in *O. ridleyi*. In addition, senescence was delayed longer in rices belonging to *O. ridleyi* and *O. meyeriana* complex than the rices in *O. officinalis* complex. As a genetically controlled program, senescence behavior of the selected “stay-green” wild rices can also be attributed to differences in their genetic constitution, which could be further studied. The application of more sensitive bioassays can also be carried out to determine endogenous cytokinin levels. Moreover, other wild rices in the species-complexes can be evaluated for their potential as sources of “stay-green” characteristics for the improvement of cultivated rice.

Utilization of Bioinoculant and Different Fertilizer Materials in the Production of Drought Resistant Rice Variety (NSIC RC 192): An Approach to Enhancing Rice Self-Sufficiency and Food Security

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This study was envisioned to contribute to the domestic rice sufficiency in support to national food security program. The study utilized bioinoculant and different fertilizer materials to determine the agronomic and yield characteristics, arthropods diversity and economic return of NSIC Rc192 drought resistant rice variety. Experimentation was done following the Randomized Complete Block Design 2X6 Factorial. Utilization of bioinoculant influenced the plant height at vegetative growth stage and yield components in terms of productive tillers and number of filled grains but not in other agronomic and yield characteristics as well as the return on investment. Fertilizer materials did not affect the height of rice at 14 to 28 DAT but affected by Inorganic Granular (IG) and in combination with Natural Organic Foliar (NOF) at 35 to 75 DAT. Rice fertilized with IG and IG+ Chicken Manure (CM) showed the highest leaf color index at 14-42 DAT. From 49-70 DAT, IG and in combination with NOF and CM have the highest leaf color index. Rice has the same number of tillers even treated with different fertilizer materials. Fertilization of IG and in combination with NOF and CM influenced the length of panicle and number of field grains per panicle while, IG increased the number of panicle per hill produced and IG in combination with NOF attained the highest grain yield per hectare. High arthropods diversity was observed during the different growth stages of rice. Fertilization of IG in combination with CM gave the highest return on investment.

Influence of Bioinoculant and Organic Fertilizers in the Production of Traditional Upland Rice Variety

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The study was conducted to determine the influence of bioinoculant and organic fertilizers on the morphological and yield characteristics of traditional upland rice variety and arthropods population and diversity. The factors and the factor levels used in the study were: Factor A (A1- with bioinoculant and A2- without bioinoculant) while Factor B includes: B1-100% inorganic granular fertilizer, B2-100% natural organic foliar fertilizer, B3-100% chicken manure; B4-50% inorganic granular fertilizer + 50% natural foliar fertilizer, B5-50% inorganic granular fertilizer + 50% chicken manure, B6-50% natural organic foliar fertilizer + 50% chicken manure. The results revealed that bioinoculant did not influence the morphological, and yield characteristics of traditional upland rice variety as well as the population and diversity of beneficial and harmful arthropods. The rice applied with 100% chicken manure and or natural organic foliar and in combination with inorganic fertilizer have comparable height with those applied with 100% inorganic fertilizer. Rice plants exposed to 100% inorganic fertilizer and chicken manure and 50% inorganic

fertilizer+50% chicken manure produced the same weight of grain, yield (tons) per hectare, number of tillers and number of panicles. No effect was noted on other parameters. Utilization of 100% chicken manure or in combination with inorganic granular fertilizer gave better economic return, thus chicken manure as an organic fertilizer is a good alternative to inorganic fertilizer.

Utilization of Cocopeat on Lowland Rice in Lahar-laden Areas

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Natural calamities usually affect agricultural production in the Bicol Region. Agricultural areas were covered with volumes of mudflow hence, the agricultural lands became barren and unproductive. An experiment was conducted for two years to determine the effects of cocopeat utilization in the production of rice in lowland lahar-laden areas specifically in Padang, Legazpi City. The experimental site was located in a lowland lahar-laden area in Padang, Legazpi City. The soil is sandy loam and is classified as Typic Tropopsamment. It belongs to type II climate, with no pronounced dry and wet season. The following were the treatments: control, recommended inorganic fertilizer, recommended coco peat, 25% cocopeat + 75% inorganic fertilizer, 50% cocopeat + 50% inorganic fertilizer and 75% coco peat + 25% inorganic fertilizer. These were replicated three times. During the third and fourth cropping, the split-plot design was used with cocopeat frequency of application as main plot and rate of cocopeat plus the inorganic fertilizer as the subplot with 6 treatments and 3 replications. The following were the subplot treatments: control, recommended inorganic fertilizer, recommended cocopeat, 25% cocopeat + 75% inorganic fertilizer, 50% cocopeat + 50% inorganic fertilizer, 75% cocopeat + 25% inorganic fertilizer while the mainplot treatments are: application of cocopeat for the first year only and application of cocopeat for the first and second year. In all cropping seasons, rice was not affected with cocopeat fertilization alone. Response of rice plants under full cocopeat amendment was the same with those without fertilizer application. Response of plants to inorganic fertilization was quite pronounced as indicated by significantly higher yield of grains. A smaller amount of cocopeat (25%) with inorganic fertilizer (75%) was observed to be comparable with the full recommended inorganic fertilizer. Cocopeat could be an excellent organic material for improving lahar laden lowland rice fields because of its excellent physico-chemical properties. These characteristics were manifested in all cropping seasons because the material had very slow disintegration and decomposition. Reapplication of cocopeat did not significantly increase yield of rice in all treatments. The treatment with 25% recommended cocopeat plus 75% recommended inorganic fertilizer obtained the highest return on investment.

Performance of Lowland Rice Variety (NSIC RC 156) and Arthropod Diversity as Affected by Bioinoculant and Varied Fertilizer Materials Application

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The study aimed to determine the agronomic response of inbred rice, NSIC Rc 156 and arthropod diversity to bioinoculant and fertilizer materials. Factor A involves the application and non-application of bioinoculant while Factor B composed of six different fertilizer materials namely: 100% inorganic granular (100%IG), 100% natural organic foliar (100%NOF), 100% chicken manure (100%CM), 50% inorganic granular+50% natural organic foliar fertilizer (50%IG+50%NOF), 50% inorganic granular+50% chicken manure (50%IG+50%CM), 50% natural organic foliar + 50% chicken manure (50% NOF+50%CM). Bioinoculant promotes the development of productive tillers, however, no effect was observed on the other parameters tested. The height and color index of the test

crop were the same regardless of the kinds of fertilizer materials applied. Rice plants fertilized with 50%IGF+50% CM and 50% IGF+50%NOF have comparable response in terms of yield and yield components. Bioinoculant and the use of organic fertilizer enhanced arthropods diversity and species heterogeneity at the rice experimental area during vegetative growth stage of the test crop. Significant interaction effects between bioinoculant and fertilizer materials were evident on leaf color index, harvest index, aboveground arthropods diversity during vegetative and maturity stages. Inoculated NSIC Rc 156 fertilized with equal amount of inorganic granular fertilizer and chicken manure realized the highest Return on Investment (ROI).

Dynamics of Thai Maize Production towards Feed Security

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Maize is one kind of crucial farm production towards feed security in Thailand. Total production, accounting for 91.3% of 4.6 million ton per year is used in domestic livestock industrial sectors and exported as feed and hybrid seed. This paper determined trends in both maize production and competition crops and the impacts of maize production on favorable and unfavorable environments. The benchmark survey was conducted in crop year 2009/2010. Six sample villages were chosen to represent different production environments as comparison study between main production land and marginal land through multi-stage sampling technique. The results revealed that major maize growing belt located in the northern region, accounted for 62.4 of the whole maize cultivated area, with around 1.13 million hectares. The rest are in the northeastern and central region. From 1957-2010, despite declining trend of maize cultivated area, the average yield of the whole kingdom continues to be higher significantly as almost two times over 50 years or rose at 3.22% per annum. As a result, modern hybrid varieties are commonly grown. In addition, the limitation of land particularly the trends of other upland crops increased significantly as change was induced by the relatively higher price of those crops. During the past two decades, the major competitive crops such as rubber tree area rose at 5.52% per annum and sugar cane rose at 2.23 % per annum while maize area decline 1.92% per annum. From 2000 to 2010, it showed from the remote sensing areas that maize area both in main production land and marginal land of the northern and the central region declined significantly at 9.91% per annum and 22.12% per annum, respectively. On the contrary, maize area both in main production land and marginal land of the northeastern region rose 102.84% per annum and 78.66% per annum, respectively. Some backwards of modern technologies in sustainable maize cultivation particularly in marginal land caused the deterioration of environment and also low quality of yield inevitably. Moreover, climate change and energy shortage along with the long-term declining trend in maize prices, compared with the increased competitive crops, have raised concerns whether Thailand can maintain future competitiveness and food security towards sustainable maize production promotion.

Responses of Soilless Grown Tomato Plants to Arbuscular Mycorrhizal Fungal Colonization in Well-Watered and Water Stress Conditions

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An arbuscular mycorrhizal fungi (AMF) is known as the beneficial biological interactions that must be considered in the design of sustainable system. Mixed culture of AMF (*Scutellospora*

calospora and *Glomus mosseae*) was used to determine its effects on tomato physiological changes, yield and root infection of plants grown under well-watered and water stress conditions. The plants were irrigated based on substrate water holding capacity at 100% (well-watered) and 25% (water stress) of water availability (WA). This factorial experiment was evaluated using a split plot arrangement in randomized completely block design, with AMF inoculation as main plot and WA as sub-plot. Chlorophyll content per unit leaf area, photosynthesis, stomatal conductance and relative water content were significantly lower with reduction in WA at 4 week. The number of fruits, fruit dry weight and total fruit fresh weight were significantly reduced when WA was depleted. There were no significant effects by water availability on number of spores and root colonization. However, number of spores and root colonization absolutely increased with inoculation. There were no significant effect by AMF and interaction between AMF and WA on physiological changes and yield.

Promotion of Improved Off-Season Tomato Technologies for Sustainable Production

Tessie A. Boncato

Tomato is important cash crop among the vegetable growers in the province of Tarlac. However, production in the area is concentrated during the dry season which causes market gluts and shortage during the rainy season. New technologies to improve tomato production during the off-season were developed by the AVRDC and are being tested across environments in the Philippines. Studies showed that under protective structures, farmers tend to produce tomatoes continuously when grafted with eggplant variety EG 203 that tolerates flooding and showed considerable resistance to bacterial wilt. Since 2001, TCA had been involved in grafted tomato or “Kamlong” research, development and production projects through the collaborative effort of AVRDC and allies from CLSU and Bureau of Plant Industry, Los Banos, Laguna. Promoting and adopting the technology had been undertaken. The said technology has been tested in the municipalities of Sta Ignacia, Mayantoc, Anao, Gerona, Paniqui, Bataan and San Ildefonso, Bulacan based at Bulacan Agricultural State College and was proven to be effective since the use of grafted tomato under protective structures promotes longevity of tomato plants, thus increasing yield and benefits among farmers-adopters. Farmer-adopters from Sta Ignacia and Mayantoc, Tarlac continuously plant *kamlong*, and expanded their production areas considering their sustained increased income and benefits. An average ROI 80-100% was generated from a 200 m² tomato fruit production area. Furthermore, around 40% increase in the number of technology adopters including walk-in buyers in Tarlac and nearby localities such as Bulacan, Urdaneta City, Pangasinan and Bataan. Promoting these proven technologies in a commercial scale is essential in order to increase off-season production, maximize available resources, increasing farming household’s productivity and eventually broaden impact while year round supply of affordable fresh tomato is ensured.

Increasing Productivity through an Environment-Friendly Package of Production Technology for Multiplier Onion (*Allium cepa* L.) in Region 1, Philippines

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The Ilocos Integrated Agricultural Research Center (ILIARC) of the Department of Agriculture, Regional Field Unit I (DA-RFU I) in the Philippines pilot tested enhanced production technology for multiplier onion or shallot, *Allium cepa* L., for wet and dry seasons in four sites of two provinces of Northern Luzon: Ilocos Norte and Ilocos Sur, Philippines involving 58 farmers-partners. The enhanced technology components tested are combined into TC1 (bioorganic fertilizer, bio-fungicide, (organism/fruit extract), bio-insecticide, insect light trap, GA3, bio-control agent); TC2 (bioorganic fertilizer, bio-fungicide (organism and fruit extract), bio-insecticide, insect light trap, liquid bio-fertilizer, bio-control agent, and TC3 (bioorganic fertilizer, bio-fungicide (fruit extract),

bio-insecticide, insect light trap, GA3, bio-control agent). For wet season, TC2 yielded 11.54 tons/ha, or 4.5 tons (64.12%) higher than comparative farm, TC1 yielded 8.23 tons/ha or 9.23% higher than comparative farms but TC3 yielded low, 5.6 tons, 6.55% lower than comparative farms. Dry season yield of TC2 was 8.3 tons/ha or a yield difference of 1.8 tons/ha or 22% higher than comparative farmers. Bioorganic fertilizer improved soil friability, reduced use of inorganic fertilizer; bio-fungicides controlled spread of the anthracnose disease resulting to as high as 20 tons/ha shallot yield; bio-insecticide, bio-control agent and light trap controlled the insect pests reducing pesticide use and organophosphates residue in multiplier onion. The TC 2 for two seasons is technically feasible and environment-friendly, thus recommended for promotion to farmers planting multiplier onion in locations similar to the growing environment of the test site during wet and dry seasons.

The Effect of Number of Grafted Scions and Productive Branches Remained on the New Shoot Growth and Flowering of Side-Grafting Cashew (*Anacardium occidentale* L.)

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The productivity of cashew trees usually decline with age, and up to now there is no appropriate technique of rejuvenation, other than conventional method, to improve the productivity. A method is urgently required to simply and quickly increase the crop productivity in cashew centre areas, such as in East Leser Sunda Island (NTT) Province, as also in other places in Indonesia. Two field experiments were conducted at cashew centre areas in East Flores Regency, NTT Province. The first experiment was aimed at studying the effect of relative humidity on the growth of scions. The relative humidity of 74.57% (air humidity) was found to give scion survival percentage of 100%, comparable to higher relative humidity. The second experiment was a factorial experiment with two treatment factors (number of grafted scions and number of remained productive branches per tree) in a randomized complete block design with three replications. One (S1) and two scions (S2) were grafted per tree, and all (P1), two (P2) and three (P3) productive branches remained on the tree. The treatments were replicated three times. Treatment combination of two scions grafted per tree and two productive branches remained on the tree (S2P2 treatment) resulted in the highest ($p < 0.05$) figures for all variables measured such as new shoot length (24.85cm), number of leaves (27.91 leaves) and 69.57% of flower bearing fruits. The survival percentages of scions grafted were reached 81.55 % at 210 days after grafting (DAG), 75% new shoot flowered at 113 DAG and 69.57% flower bore fruits. It is concluded that side grafting technique of two scions were grafted combined with two branches remaining on the tree can be used as a simple and quick technique to rejuvenate cashew trees, however a longer term experiment is required to study whether the technique can restore the productivity of old cashew trees.

Artificial Seed Production and Regeneration from Encapsulated Protocorm-like Bodies of *Dendrobium* ‘Savin White’

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Micropropagation is currently the most popular method for orchid propagation through the production of protocorm like bodies (PLBs). PLBs are active material thus; it either continues to proliferate or form plantlets hindering the process of arresting PLBs development for storage and transport. It is suggested that converting the PLBs into artificial seeds by encapsulation can be useful

especially in overcoming the above mentioned problems as well as in using the artificial seeds for direct establishment in the field. Prior to the production of artificial seeds, the best developmental stage of PLBs for increased conversion to plantlet has to be determined. Stage of development is often related to PLBs size therefore three PLBs sizes namely 2 mm, 2–4 mm and 4–6 mm diameter were obtained from three months old *Dendrobium* Savin White cultures. Both PLBs of 2–4 mm and 4–6 mm gave significantly higher conversion percentage (85% and 90% respectively) as compared to 2 mm (30%). Thus, all PLBs of 2 mm were not used for the production of artificial seeds. For uniformity PLBs of 3-5 mm were used for encapsulation with sodium alginate to form artificial seeds. The encapsulated PLBs were cultured onto semi-solid ½MS basal medium devoid of plant growth regulators and were allowed to regenerate in order to observe the effects of encapsulation on PLBs regeneration. Naked PLBs were used as a control. Encapsulation had no effect on PLBs regeneration nor did it affect the speed of emergence where both encapsulated and naked PLBs gave comparable results on all data observed, namely germination percentage, days taken to germinate, conversion percentage, days taken for conversion, number and length of shoot and number and length of root.

Transgenic *Dendrobium* ‘Sonia’ Earsakul Possessed Antisense *CPACO* Gene Exhibits Similar Morphological Characters to the Non-transgenic Line

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As one of the major cut flower of Thailand, *Dendrobium* orchid has been export world-wide. However, the production of ethylene by their flowers caused the shorter vase-life of this type of orchid. According to the new technology of plant genetic transformation, this problem can be solved by transformation of the orchid plants with the genes that control ethylene production in an antisense orientation. The *ACC oxidase* (or *ACO*) gene, the gene in the last step of ethylene production pathway, is one of the most interesting gene for this purpose. The transgene will block the expression of native gene thus cause the lower to none of ethylene production in that transgenic orchid plant. From our previous research work, we successfully transferred *ACO* gene from papaya (*CPACO* gene) which was about 70% similar to *ACO* genes in orchids into *Dendrobium* ‘Sonia’ Earsakul using *Agrobacterium*-mediated transformation. In order to transform the target gene into *Dendrobium* plbs, *A. tumefaciens* strain ALG-1 possessed pCAMBIA 1301a*ACO1* containing reverse orientation of *CPACO1* cDNA from papaya and *hygromycin phosphotrasferase* (*hpt*) selectable marker gene under the control of 35SCaMV was used. Four transgenic lines were obtained after 6 weeks of selection in hygromycin containing selective medium. The stable transformation was confirmed in those lines using PCR, Southern PCR hybridization and dot blot analysis. Evaluation in laboratory, at 6 and 12 months after transplanted, the morphological character of transgenic orchid lines, in overall, similar to original, non-transformed line, however, demonstrated the better growth.

Improving Potato Production through Sul-Po-Mag Supplementation and Promoting Potato Chips Processing

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Sul-Po-Mag is unique in nature as water-soluble source of magnesium, sulphur and potassium. Sul-Po-Mag contains 22 or 22.4% water soluble K_2O , 11% Mg and 22% S. For that reason, it is often referred to as the 3-in-1 fertilizer materials. It can be used to cover the nutritional needs for sulphur and magnesium for the majority of crops, while supplying a portion of the overall potassium requirement. A science and technology based intervention which was aimed to improve productivity and income of farmers by providing additional Sul-Po-Mag fertilizer was implemented in Atok, Benguet, Philippines from September 2009 to April 2011. Sul-Po-Mag application had increased yield of the farmer scientist by 35% during the first cycle (September 2009 to January 2010) and 24% during the second cycle. For the first farmer adopter, 3rd cycle. Sul-Po-Mag application had increased the yield by 20% (December 2010 to April 2011). Similarly, the intervention had increased the dry matter content of harvested potato from 21% to 24% which have lowered the perceived oiliness of chips. The profitability however, depends on the farm gate price of potatoes. When the farm gate price of potatoes is P25/kg and below, processing is profitable. However, when the farm gate price of potatoes is above P30/kg, marketing of potatoes is more appropriate than processing of chips.

Potato Pea-sized Tubers for Tuber Seed Production on Farmers' Field

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Pea-sized tubers (< 5g) resembles the size of a pea seed hence its description. These are basic tuber seeds from staggered harvesting, rooted stem cuttings and from the mother plants where stem cuttings are derived in the greenhouse. However, pea-sized tuber is not common to farmers. Thus, the feasibility of the potato pea-sized tuber as planting material for G-one seed production was validated on-farm. Its optimum plant density and its comparison to the usual tuber seed sizes (6 to 50 g per tuber) were demonstrated on farmers' field. The pea-sized tubers that were planted at a distance of 10 cm between hills (24.87 t/ha) out yielded the pea-sized tubers that were planted at a distance of 15, 20, 25, and 30 cm between hills with tuber yield that ranges from 9.96 to 12.19 t/ha. Moreover, pea-sized tubers planted at a plant density of 3 tubers per hill at a planting distance of 25 cm between hills significantly showed the highest yield per hectare with 16.33 t/ha than those tubers planted at 1, 2, and 4 pea-sized tubers per hill with tuber yield that ranges from 9.43 to 14.09 t/ha. Further, return on cash expenses (ROCE) was apparently greater on 3 tubers/hill. On the other hand, bigger seed size tubers distinctly had higher tuber yield than the pea-sized tubers per plant, either in terms of weight, number of tubers per hill and profit. However, when pea-sized tubers were planted at 3 tubers/hill, the yield and profit were comparable to bigger sized tubers (6 to 50 g/tuber). In one on-farm trial, the percentage profit for bigger size tubers (20-40 g/tuber) was 58.4% while pea-sized tubers (3-5 g/tuber) had 56.0%.

Effects of Al^{3+} and H^+ on Rice Root Elongation, Surface Area and Exudation of Organic Acids

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Low pH and high Al concentration are affecting the growth of rice seedlings, which in the end reduces yield. A study was conducted to determine the effects of pH and/or Al on the morphology rice root and organic acids release. Two experiments were carried out: 1) Rice seeds (MR 219) undergoing germination were exposed to 0.5 mM $CaCl_2$ solutions containing various concentration of Al (10, 20, 30, 40 and 50 μM); and 2) The seeds were soaked in water taken from an acid sulfate soil area in Malaysia for which the pH was adjusted to a range of values using 0.01 M HCl or NaOH. Under acidic condition, Al^{3+} is the most common species in solution. The study showed that root

length decreased with increasing Al concentration. On the other hand, root length increased with pH. The trend in the change of root surface area with Al concentration and pH is the same as that of the root length. The critical Al concentration for rice seedling growth is 15 μM . This means MR 219 (grown on 90% of the granary areas in Malaysia) is relatively less tolerant to acidity compared to other varieties. At high Al concentration, the rice roots secreted citrate and/or oxalate which subsequently formed Al-citrate and Al-oxalate, respectively. This is the mechanism how rice is able to reduce Al toxicity.

Introduction, Evaluation and Utilization of Chickpea (*Cicer arietanum* L.) in the northern Philippines

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Chickpea (common name is 'garbansos') which can be grown profitably in Cordillera Administrative Region (CAR) specifically in Benguet where cool season prevails. Aside from being an alternative high value crop for CAR farmers as source of livelihood, chickpea can also serve as an additional or supplementary legume food because of its high protein content. Selected varieties from the study on germplasm, collection, characterization and evaluation of chickpea varieties under lowland (Desi type varieties namely; ICCV 10, ICCV 93952, ICCV 07114, and Kabuli-type; ICCV 92311, ICCV 95332 and ICCV 07307) and highland (Desi-type varieties; ICCV 93954, ICCV 93952, ICCV 06102, and Kabuli-type varieties; ICCV 92311, ICCV 95334 and ICCV 07307) conditions of Benguet were used for the package of technology (POT) trials. These were planted in Benguet State University (highland condition with 1,245 masl) and in Dalupirip, Itogon Benguet (300 masl), Gumatdang, Itogon, Benguet (380 masl), Tuel, Tublay, Benguet (420 masl) for the lowland condition to produce technology on appropriate planting distance, best source of organic fertilizer, optimum level of NPK/ha, minimum duration of weed control, optimum frequency of irrigation and to determine the postharvest and processing qualities of chickpea under lowland and highland conditions of CAR. Results showed that in the highlands, ICCV 93952 (Desi-type) and ICCV 92311 (Kabuli-type) produced the highest seed yield when planted at 30 cm x 20 cm, applied with Sagana 100 at 5 tons/ha for organic farming, 45-100-45 kg NPK/ha, weed free from sowing to first pod stage and was irrigated every 15 days after seedling stage. For the lowland conditions, ICCV 93952 and ICCV 07114 (Desi-type), ICCV 95332 and ICCV 92311 were the highest yielder when planted at 30 cm x 10 cm with either processed chicken manure or Sagana 100 at 5 tons/ha for organic farming, 45-100-45 kg NPK/ha, weed free from sowing to harvest and irrigated every 5 days from seedling stage. ICCV 07307, (Kabuli-type) had the highest milling percentage recovery when harvested at brown pod stage and has the highest cookability of whole seed and dhal. Initial fungal development of cooked whole seed of ICCV 95332 and cooked dhal of ICCV 92311 when harvested at yellow brown pod stage was observed after 3 days. Based on sensory evaluation, ICCV 92311 harvested at yellow pod stage had the highest acceptability rating with regards to color, odor, texture and taste. Desi type varieties were utilized for flour, cookie and puto. Kabuli type varieties were made into fingerfood.

Performance of Yam (*Dioscorea alata* L. var. Ubeng-Ube) at Different Period and Concentration of Naphthalene Acetic Acid Applications

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Naphthalene acetic acid, a growth hormone was applied on yam at different period and concentration. Its effect on growth and yield performance was determined. The period of application

significantly affected the percentage emergence and average number of shoots developed 14 DAHA, percentage emergence of yam 15DAP, average number of leaves 30 DAP, average days to emergence, days to maturity, number of marketable tubers, and the average length of tubers. Similarly, the applications of the different concentration NAA affected the number and length of roots and shoots developed 14 DAHA, percentage emergence 15 DAP, average number of leaves 30 DAP, average days to emergence, and average days to maturity, average number of marketable tubers, and average length of tubers. Interaction effects between the period and concentration of NAA applications were observed to be different on the percentage emergence and average number of shoots developed 14DAHA, percentage emergence 15DAP, average days to maturity, and average number of marketable tubers. These showed that the application of at least 100 ppm of NAA inhibits the emergence and shoot formation of yam setts. Root formation was enhanced by the application of 1000ppm while root elongation was inhibited by the application of 550ppm. Shoots and leaf development was also initiated by the use of NAA .Early maturation was stimulated by its application but it has no influenced on the number, weight and diameter of tubers as well as the ROI.

Effects of Tuber Weight and Cutting Method on Growth and Yield of Safed Musli (*Chlorophytum borivillianum*)

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Safed musli, or *Chlorophytum borivillianum* is a new potential herb in Malaysia. As a new herb, there is lack of information regarding its cultivation practices. Safed musli is grown using tubers which play a dual role of being the organ of economic importance as well as the planting material. In this crop, it is necessary to utilize the planting material efficiently, as the increased use of tuber as planting material will increase the production cost as well as limit usable yield. Therefore, it is necessary to study the quantity of planting material (by weight) required for effective field establishment and the potential of cutting method in order to minimize the production cost. Safed musli tubers were separated into three weight categories (3, 6 and 9 g) and tubers belonging to the three categories were either whole or cut tubers. Experiment was conducted in randomized complete block design with two factors namely weight and cutting method. Results showed that there was no interaction between tuber weight and cutting method. All tubers in different weight categories did not show significant difference in all parameters studied, but cutting had significantly higher leaf area index and fibrous root length compared to whole tubers. Cut tubers was also able to produce bigger tuber diameter (6.64 mm) with higher number of tubers (21 tubers per bulk) compared to the use of whole tubers as the planting material with 18 tubers measuring 5.36 mm in diameter. It was also found that cut tubers from all tuber weight category resulted in 13.5% increase in yield. Therefore, it is proposed that the use of cut tubers weighing 3 g alone is sufficient to obtain optimum yield. This recommendation, will allow a saving of 66% in the cost of planting material.

Silvicultural Treatment on *Gigantochloa ligulata* Bamboo to Increase Bamboo Shoot Production for Food Consumption

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In Malaysia, bamboo shoots have been relished as food since the early days. At present, bamboo shoot of *Gigantochloa ligulata* (buluh tumpat) is considered one of the commercial bamboo species in Malaysia. Owing to its demand as food, especially in the northern part of the country, and since there has been no study done on the thinning of this species, a study on the effect of thinning intensity as one of the silvicultural treatment on *G. ligulata* bamboo was conducted at Taman Wetland, Putrajaya, Malaysia. The study was done from March to June 2005. Thinning intensities of 0% (control), 30% and 60% were applied twice every two months within the four months period. The three thinning intensities including the control were done in replicates and there was six replicates altogether comprising of 18 samples clumps. Thinning was based on the selection of culms three years old and above out of the total available culms within the clump. Thinning of 30% means 3 culms out of ten culms within the clump were cut. Each clump in all the replicates was applied once with 3 kg of goat dung in granule form. The organic fertilizer was applied in a circular form around the clump's periphery. Parameters involved were number of shoots sprouted, weight of shoots and the number of culms. This included the clump expansion pattern of the selected treatment clumps. New shoots were tagged and recorded every week. A shoot which up to 30 cm and from the ground was considered as a shoot. The weights of shoots with or without sheath were recorded on a weekly basis. The distribution pattern of the shoots' sprouting was also observed. It was found that 30% thinning intensity gave more shoots compared with other intensities including the control.

The Stability and Expression of β -Glucuronidase Gene in Transgenic *Dendrobium* 'Sonia' Earsakul

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Dendrobium orchid is the major export cut flower not only in Thailand but also for several ASEAN countries. There are attempts to improve yield and quality of this orchid conventionally. However, with the new technology of genetic transformation, it's offer the mean of non-barrier genetic transfer throughout the living organisms. Thus plant transformation is the challenge technology for orchid improvement. For *Dendrobium* orchid transformation, we successfully transformed protocorm like bodies (PLBs) of *Dendrobium* 'Sonia' Earsakul using *Agrobacterium*-mediated transformation technique. *A. tumefaciens* strain EHA 105 possessed pCAMBIA 1301 vector plasmid containing β -glucuronidase (*gus*) reporter gene and hygromycin phosphotrasferase (*hpt*) selectable marker gene under the control of 35S CaMV promoter was used. The plbs were co-cultivated with *A. tumefaciens* suspension (5×10^8 cells/ml; OD₆₀₀ ~ 1) on VW solid medium supplemented with 500 μ M acetosyringone. After co-cultivation for 2 days, *A. tumefaciens* were eliminated and transgenic cells were selectyed on VW solid medium supplemented with 30 mg/l hygromycin and 250 mg/l cefotaxime for 3 month. The 5% plbs were regenerated to the stable transformed plbs and all of them still exhibit the stable transformed event after 1 year of culture. The existent and expression of *gus* gene in 1-year-old *in vitro* plantlets were respectively confirmed by PCR and GUS histochemical assay.

***In vitro* Propagation of Limau Purut (*Citrus hystrix*)**

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Citrus hystrix belongs to the family Rutaceae. Citrus and its relatives is one of the most important commercial crops based on its nutritional, medicinal and economic value. Recent researches reveal vast potential of this underutilised species for commercialization. Essential oils extracted from *C. hystrix* peels contain antibacterial properties and induce calming effects on users. Its fruits contain high antioxidants. In citriculture, *C. hystrix* can be utilised as a rootstock or interstock to *C. reticulata* to increase resistance against greening disease. These novel properties have great potential for citrus breeding. An efficient *in vitro* propagation protocol will greatly accelerate breeding via genetic transformation. In this study, 7 week-old *in vitro* seedlings were excised into five parts, which consisted of shoot tip, epicotyl, cotyledon, hypocotyl and primary root. The explants were cultured on shoot induction medium consisting of MS medium supplemented with various concentrations of 6-benzyl amino purine (BAP) ranging from 0.125 to 3 mg/L. After 8 weeks of culture, optimum shoot induction was obtained on hypocotyl explant placed on medium containing 0.5 mg/L BAP. High percentage of shoot senescence occurred on shoot tip culture. The addition of calcium gluconate in medium containing 0.5 mg/L BAP improved shoot number and reduced shoot senescence for shoot tip culture. However, the presence of calcium gluconate reduced the number of shoots regenerated from epicotyl, cotyledon, hypocotyl and primary root.

Tolerance Estimation of Hybrid Rice towards Droughts by Using Polyethylene Glycol (PEG 6000)

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The polyethylene glycol (PEG) use in testing the seed resistance towards the droughts has been used many times. PEG 6000 is expected can be used to detect initially the rice hybrid genotype in which is drought tolerance so it can solve the problems of many cultivars that will be tested in the field and accelerate the selection cycle in improving program and variety assembling. The aim of this research is to get the method of initial testing and accurate character of hybrid rice towards droughts tolerance that has potential can be developed in the rainfed lowland rice. Designing of the research method consists of : (i) complete random designing by treatments of PEG concentration levels and (ii) split plot designing by treatments of PEG concentration and hybrid rice genotype. The result research indicates that PEG concentration of 25% (w/v) can significantly decrease the seedling growth of drought sensitive check variety (IR 64), but it is not significantly decrease the seedling growth of drought tolerance check variety (Limbot, Situbagendit and Inpari 10). PEG concentration of 25% can be used to estimate initially the hybrid rice drought tolerance. Based on the length of root, density of root (quality of root dry), ratio of crown root and level of leaves dryness indicators at seedlings phase, so genotype BI485A/BP3, BI485A/BP12, BI485A/BP15 and BI559A/BP15 estimated are drought tolerance. Genotype BI559A/BP15 is most consistent and indicates the criteria of drought tolerance, so it is estimated to have potential for being developed in the rainfed lowland rice.

Improvement of Production and Quality of Komatsuna Vegetable by Adding Chicken Manure Composts

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The use of animal manure in fields is considered to be one of the most effective method in reducing the use of industrially produced chemical fertilizer as well as utilizing the minerals nutrients in farm wastes. Furthermore, animal manure have an ecological advantage in the development of sustainable agriculture. In most circumstances, the uptake of nitrogen by a growing plant and the accumulation of mineral nitrogen in soil are both preceded by, and dependent on nitrogen mineralization. The study was conducted in two consecutive experiments to observe the effect of ten chicken-manure composts with different nitrogen content and to investigate their residual effect on the crop yield and its quality (the content of vitamin C, reducing sugar and nitrate accumulation of plant). Equivalent to 1 g N/pot of chicken-manure composts were applied to 2 kg soil for pot experiment. Komatsuna vegetable was used as a sink of mineralized-N from chicken-manure composts. Unmanured pot was used as control, whereas pot fertilized with urea (0.5 g N/pot as standard of comparison for chemical fertilizer. The addition of KCl and Triple Super Phosphate (TSP) at rate of 0.5 g P₂O₅/pot and 0.5 g K₂O/pot in the urea plot to assure the good initial growth. In the second experiment in the urea plot was added again by KCl and TSP with the same rate as the above mentioned. The addition of chicken-manure composts indicated significant difference than control to the yield of Komatsuna but Ch-5 and Ch-8 had no significant differences with urea. The effect of residual Ch-5 and Ch-8 still showed the increase in Komatsuna yield, and it enhanced significantly than residual urea; whereas the other treatments exhibited lower yield than those in the first experiment. The increase of Komatsuna yield might be caused by the higher N mineralization by which a residual inorganic N remained in the soil. Nitrate accumulation in plant induced by increased N mineralization in soils. The application of Ch-5 and Ch-8 and urea greatly increase nitrate accumulation in Komatsuna plant, while Ch-1 which had slower N mineralization induced a small nitrate accumulation. The content of glucose and reducing sugar was low with the increase of nitrate content of Komatsuna.

Performance of Yam (*Dioscorea alata* L. var. Ubeng-Ube) at Different Period and Concentration of Naphthalene Acetic Acid Applications

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Naphthalene acetic acid, a growth hormone was applied on yam at different period and concentration. Its effect on growth and yield performance was determined The period of application significantly affected the percentage emergence and average number of shoots developed 14 DAHA, percentage emergence of yam 15DAP, average number of leaves 30 DAP, average days to emergence, days to maturity, number of marketable tubers, and the average length of tubers. Similarly, the applications of the different concentration NAA affected the number and length of roots and shoots developed 14 DAHA, percentage emergence 15 DAP, average number of leaves 30 DAP, average days to emergence, and average days to maturity, average number of marketable tubers, and average length of tubers. Interaction effects between the period and concentration of NAA applications were observed to be different on the percentage emergence and average number of shoots developed 14DAHA, percentage emergence 15DAP, average days to maturity, and average number of marketable tubers. These showed that the application of at least 100 ppm of NAA inhibits the

emergence and shoot formation of yam setts. Root formation was enhanced by the application of 1000ppm while root elongation was inhibited by the application of 550ppm. Shoots and leaf development was also initiated by the use of NAA. Early maturation was stimulated by its application but it has no influenced on the number, weight and diameter of tubers as well as the ROI.

Nutritional Quality of *Cosmos caudatus* in Response to Fertilizer Rates and Sources

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Nutrient management is important for sustainable production of quality herbal plants. Besides its direct impact on vegetative growth, fertilizer has been reported to influence nutritional quality which includes vitamins and antioxidant activities, of green vegetables. However, its effect on phytonutritional quality is still contradictory. Since documentation on local herbs in relation to fertilization and phytonutritional is scarcely available, this experiment was conducted to evaluate the effects of fertilizer rates and sources on phytonutritional quality of *Cosmos caudatus*. Commercial organic fertilizer 8%N: 8%P₂O₅: 8%K₂O and inorganic fertilizer 15%N: 15%P₂O₅:15%K₂O were evaluated based on N element at 0, 30, 60, 90, 120 kg ha⁻¹. The fertilizer was applied at 2 and 4 weeks after transplanting. The young expanded leaves were used to determine nutrients, chlorophyll, nitrate, vitamin C and antioxidant activity. The leaves were dried, ground and analyzed for total N and P, K, Ca, Mg, chlorophyll and nitrate content. Mineral content in leaf tissue was highly influenced by fertilizer rates. Application of fertilizer significantly improved nutrient elements and chlorophyll contents. The chlorophyll was linearly increased with the higher N content in leaf tissue. Organic fertilized plants, the leaves contain higher ascorbic acid and lower nitrate compared to the inorganic plants. For maximum ascorbic acid content, regardless of fertilizer sources, this crop did not require a high amount of fertilizer. In both cases, the ascorbic acid content decreased with increased in fertilizer rates. Within the rate ranges tested, this crop probably requires only 30 to 60 kg ha⁻¹ of N. Regardless of fertilizer sources, fertilized plants exhibited higher antioxidant activities than those without fertilization. The activity however was not significantly different amongst fertilized plants. The 30 to 90 kg ha⁻¹ N treatments exhibited a stronger antioxidative property. The strong activity exhibited by fertilized plants suggesting that in herbal production nutrient application is necessity for quality herbs. Organic fertilizer should be used as a source of nutrients and 60 kg ha⁻¹ of N should be sufficient for quality *C. caudatus*.

Biofertilizer and Biopesticide Effects of Goat Manure Tea on Rice and Tomato

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Goat manure tea (GMT) was evaluated as a biofertilizer cum biopesticide on rice (var. PSB RC 82) and tomato (var. Magilas). GMT was produced by steeping shredded goat manure in water at 1:2 goat manure:water ratio for 15 days. A dark brown liquid with shelf -life of more than three months, GMT was initially pungent whose odor gradually faded upon storage. NPK analysis showed a highly reduced content in comparison with the raw shredded goat manure and vermicast. Under laboratory conditions, GMT exhibited molluscicidal action against golden snails, *Pomacea* sp. a serious pest of lowland rice, at 2.5% to 15% concentration. Plant damage was inversely proportional to GMT concentration. Based on a choice test, GMT caused a slight antifeedant effect on *Helicoverpa armigera* larvae. GMT also inhibited larval growth by lengthening number of days to pupation; although their respective pupae had shorter days than control. GMT soil-drenched on tomato seedlings showed the nutrient enhancing property with taller, more robust and greener leaves than

untreated ones. However, GMT inhibited tomato seed germination more than rice seeds but no antagonistic effect on damping-off organisms infecting tomato seedlings. Microbial analysis showed bacteria as the major component of GMT. Presumably, in addition to the beneficial bacteria, the cocktail of partially and undigested foods, digestive juices and urine are the components responsible for the dual properties of GMT. The potential of GMT as biofertilizer cum biopesticide for lowland rice and tomato will be ascertained under field conditions.

Likas Saka: Promotion of Farm Wastes Recycling and Re-Use for Organic Based Crop Production

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Phanerochaete chrysosporium, is a new fungal strain isolated and developed as Likas Saka inoculant found to shorten the decomposition of agricultural wastes. Piles inoculated with Likas Saka at 100 and 200 g matured in 33 days as results of the trials conducted at Bicol Experiment Station, San Agustin, Pili and Bombon, Camarines Sur from 2007 to 2011. Piles inoculated with *Trichoderma* BIOCON™ matured in 38 days. Samples taken in Day 36 revealed lower levels of C:N ratio during the period when stable temperature lower than 40 °C was achieved. The *Azotobacter* enriched compost obtained higher organic carbon (OM), and nitrogen, phosphorous, and potassium (NPK) content than the unenriched compost. OM ranged from the enriched compost was between 15.59% to 19.11% while those from the unenriched from between 2.14% to 2.46 %. The average increase in NPK contents were 1.40%, 1.36%, and 1.37%, respectively. At 50% recovery of Likas-Saka at total NPK of 8.69%, one could get 150% more of organic fertilizer pegged at 385,952.5 tons (385,952,500 kg) or approximately 7,719,650 50-kg bags of organic fertilizer or 1,608,260.42 bags of complete fertilizer (14-14-14). With the enactment of the Organic Agriculture Act of 7010, it provides another option for the promotion of organic agriculture.

Genetic Variation among Okra (*Abelmoschus esculentus* L. Moench) Varieties

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Abelmoschus esculentus or okra is valued for its edible green fruits that are harvested immature and eaten as a vegetable. There are many available okra varieties that differ for traits such as fruit characteristics, maturity and height. An evaluation was conducted at two sites in Universiti Putra Malaysia, to compare agronomic performance of 18 commercial varieties and 7 varieties from AVRDC. The varieties were planted in a randomized complete block design with three replications. The planting arrangement was 60 cm x 45 cm. Principal component analysis was performed and four groups were distinctly identified based on qualitative traits. For quantitative traits, the okra varieties showed highly significant differences in plant height, fruit length, number of nodes, days to flowering, stem diameter, fruit firmness, and weight per fruit. However, there was no significant difference among varieties for number of fruits per plant and yield per hectare. The highest heritability value was found for days to flowering (71.6 in Field 2 and 77.2 in Field 10), while the lowest value was yield per hectare (1.9 in Field 2 and 9.3 in Field 10). Highly significant correlation was observed between number of fruits per plant and yield per hectare, with values of 0.87 in Field 2 and 0.91 in Field 10. Combined ANOVA of both sites also gave highly significant effects of varieties for these traits.

Results showed that the variety Trio gave the best performance in Field 2, while 989 Jackpot gave the best performance in Field 10. These varieties can be suggested for commercial planting and have potential to be used in breeding programs.

***Agrobacterium*-mediated Transformation of Teak (*Tectona grandis* L.f.)**

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Teak (*Tectona grandis* L.f.) is one of the most important tropical hardwood species widely planted in Thailand and Southeast Asian countries. However, teak plantation has various problems including susceptible to various pests and diseases. Genetic engineering is a possible approach to overcome these problems. *Agrobacterium*-mediated gene transformation is effective method for gene transfer in various plant species. However, as with many woody species, teak has appeared recalcitrant to genetic transformation. The proposition of this study was to introduce foreign gene into teak via *Agrobacterium*-mediated gene transformation, thus parameters including bacterial strain, type of teak tissue and inoculation techniques were tested. The *A. tumefaciens* strain EHA105 and AGL-1 possess the binary vector pCAMBIA1304 containing *gus* gene as a reporter gene and *glyphosate resistance gene (aroA)* gene as selectable marker gene were used to transform leaf base and nodal segments of teak. The transient expression of *gus* gene revealed that nodal segment was more suitable to be used as explants than the leaf base tissue. Extra wounding by sonication promoted transformation efficiency in nodal segment as well. The *Agrobacterium* strain EHA105 and the inoculation period of 5 hours followed by 3-5 days of co-cultivation were successfully used for teak transformation. The existent and the expression of *aroA* gene were confirmed by polymerase chain reaction (PCR) in putative transformed lines after 6 weeks of selection in glyphosate-containing selective medium. The results of GUS histochemical assay was also confirmed the expression of *gus* gene in those lines.

**(*Elaeis guineensis* Jacq.) Polyembryoids from
Cell Suspension Based on Micromorphological Evidence**

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Oil palm is economically one of the most important oil producing crops in the world. It is an important source of vegetable oil and the most traded vegetable oil in the International market which is increasingly used in the food industry. Therefore, with worldwide yearly increases in demand for palm oil, the cultivation of oil palm has expanded enormously in recent years. Oil palm, a perennial crop species with long breeding cycle and a single growing apex is generally propagated using hybrid seeds, however, in recent year micro-propagation of oil palm via somatic embryogenesis has become the key method for multiplication of oil palm elite genotypes. Shoot segments are cultured and embryogenic callus is induced, which is then converted into suspension culture. The growth and developmental stages from cell suspension to the formation of polyembryoid was traced using

scanning electron microscopy in order to clearly distinguish the morphological sequence of events. Five major stages in development are reported inclusive of distinct morphological and structural conformation. This report also reveal that the transition from one stage to another is time consuming and the whole chain from cell suspension culture to the production of polyembryoid require circa one and half year .

Induction of Hairy Roots from *Eurycoma longifolia* a Difficult-to-Transform Valuable Medicinal Plant Using Wild Strains of *Agrobacterium Rhizogenes*

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Production of hairy roots from the difficult-to-transform medicinally important plant *Eurycoma longifolia* will ensure continuous supply of secondary metabolites thus minimizing the use of plants from the wild. Seed morphology and histology analysis of *Eurycoma longifolia* by light microscopes revealed seeds structures of this important medicinal plant at different growing stages. The seed development phases and the development of the vascular system on the progression of germination provide insights on the cotyledon development period. Seeds may facilitate the generation of the hairy roots, as it evidently has the essential features like tracheas, which are the main site of infection for *Agrobacterium rhizogenes*. Chemotaxis using the swarm agar plate method initiates the process of bacterial infection towards the plant cells and thus conferring beneficial attributes to the host. Strong positive chemotactic response was observed in most of the tested bacteria strains towards the *in vitro* root and somatic embryos. Hairy roots were successfully initiated using three wild strains of *Agrobacterium rhizogenes* namely MAFF 210265, MAFF 301726, and MAFF 720002 at the hypocotyls region of *Eurycoma longifolia*. Amplification of the *rol* gene at 1100 bp by PCR analysis confirmed the T-DNA integration of the Ri plasmid in the hairy roots. Generating hairy roots in *Eurycoma longifolia* will be highly beneficial to the pharmaceutical industry with valuable secondary metabolites which is directly linked to its root differentiation at a low biomass starting material.

The Expression of *rol* Genes in Plantlets Regenerated from Hairy Root of *Plumbago indica* L. Leads to the Phenotypic Deformation and the Increased in Plumbagin Content

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The hairy root culture of *Plumbago indica* L., induced by *Rhizobium rhizogenes* strain K599, was found easily to regenerate plantlets. However, morphology of the plantlets was differed from the original plant. These phenotypic deformed such as wrinkled leave surface, dwarf phenotypes cluster branching, abnormal stem growth and short internodes were observed. The detection of *rol* genes by

PCR technique revealed the integration of the *rolA*, *rolB* and *rolC* genes from *R. rhizogenes* into those plantlets genome with the variation in the gene transferred events. According to the deformation of the plantlets and the presence of each *rol* gene, it can be suggested that *rolA* gene might be involved in the dwarfism. For *rolB* and *rolC* genes, the correlation to the phenotypic deformation was not clearly relevant. However, plants contained *rolA*, *rolB* and together with *rolC* genes were found to be much more abnormal than those contained only 1 or 2 of these genes. The quantification of plumbagin, the main secondary metabolite accumulated in the root part of this plant species also suggested that *rolC* gene might be involved in the increase of plumbagin content as the roots of the *rolC* containing plants showed higher plumbagin content than those of the control roots. Thus, the use of plantlet regeneration from *R. rhizogenes*-induced hairy root might offer the way to induce genetic variation in the regenerated plantlets and can be useful especially in the case of *in vitro* production of plant secondary metabolite.

The Scale-Up of *Plumbago indica* L. Hairy Root Culture in Stirred Tank Bioreactor

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The plant tissue and organ cultures are preferred over the conventional source for a number of proteins, secondary metabolites and biologically active substances. Hairy root obtained from genetic transformation by *Rhizobium rhizogenes* are genetically stable and express faster growth rate and secondary metabolite production than the normal root. This study was conducted to scale-up the hairy root culture of *Plumbago indica* L. in 5 l stirred tank bioreactor. The 2.0% (w/v) hairy root were cultured in 3 l of ½ MS media supplemented with 20 g/l sucrose under 25±2 °C, dark condition and stirred at 80 rpm. The growth and plumbagin production of hairy root were affected by root morphology, aeration rate and medium circulation. Using small root clump and 0.6 volume of air per liter of medium per minute (vvm) aeration rate exhibited higher growth and higher plumbagin production than using large root clump and the aeration rate of 0.3 vvm. For medium circulation, the all-time stirred for 20 days showed the higher in growth but lower plumbagin production than 16 days stirred followed by 4 days pause.

Land Resources Management

Study of *Pekarangan* Agro-Biodiversity in the Upper Stream of Kalibekasi Watershed, Bogor District, Indonesia

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Pekarangan, an Indonesian typical home garden, has several ecological potential of agro-biodiversity. On the other hand, *pekarangan* management in Indonesia is facing several problems, such as decreasing plot size, decreasing plant species for production function, but increasing ornamental plants for aesthetic function. The objectives of research are to analyze *pekarangan* agro-biodiversity, particularly in relation with agroecological zones of watershed, urbanization and conservation of agro-biodiversity resource. This research was conducted in Cimandala, Landeuh and Leuwijambe Hamlets which represented of the upper part, the middle part and the lower part of the

upper stream of Kalibekasi Watershed. Totally 36 samples of *pekarangan* were observed and analyzed for the structure and function of plants and live stocks species. The numbers of Margalef index, Shannon-Wiener and index Sørensen coefficient show that the upper part has the highest plant's diversity. While, the middle part is the species similarity connection place of the upper and lower part. Spatial analyzed regarding agro-ecological zones found that *pekarangan* size influences the plant and live stock diversity. In addition, front yard (*buruan*) has the higher biodiversity than right and left sides (*pipir*) and back yard (*kebon*) of *pekarangan*. It was found that urbanization caused increasing of exotic species of ornamental plants and pet in *pekarangan* due to smaller plot size and adapting urban lifestyle. We concluded that *pekarangan* in the upper stream of Kalibekasi Watershed still has a potential as a site for ex-situ agro-biodiversity recourses conservation.

Edible Landscaping: A Promising Technology for Urban Agriculture in the Philippines

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In the Philippines, the practice of urban agriculture aims to augment the availability of food for the increasing population particularly in urban areas. However, these practices are less appealing in the urban communities which edible landscaping tries to solve. Edible Landscaping (EL) is a new concept of blending aesthetic and functionality of space with an extra reward of producing safe and nutritious food for the family and the community. It utilizes vegetables, herbs and fruit trees as major softscape materials to substitute for the ornamental plants used in conventional landscaping. EL is governed by various principles in designing, implementation and maintenance as similarly done in conventional landscaping. It combines the traditional and new methods of crop production applicable from seedling establishment to harvesting but with a different twist to increase people's interest while providing suitable conditions for better growth of the crops. Currently, EL is open for further development and is intensively promoted through creation of various demo-gardens, providing lectures and seminars to different organized groups, television and radio interviews and participation in different congresses and conventions. Production of instruction manual and brochures are also in the pipeline to cater the raising number of possible adaptors of the technology.

Enhancing Watershed Resources Management for Food Security and Climate Change: Is There A Role of Institutions, Trusts, and Collective Action?

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This research examined the institutional and collective behaviour of households within the Pinacanauan de San Pablo River Watershed. There were eight barangays covered with 306 household-respondents sampled through systematic random sampling and afterwhich data were generated using an interview schedule. Results of the study showed that the households are too dependent on traders for their credit needs indicating and imperfect credit market situation in the study sites. This condition may entail a manipulative behavior on the part of the lender-trader in the absence of formal credit institutions which could lead to abject poverty of the households. Few households (21%) are members of cooperatives because households reasoned out that they have no time required for cooperative membership which indicates high transaction cost for cooperative membership. The participative behavior of households in community activities indicates that the more formal institutional structures like the local government units (LGUs) and leadership factor may enhance community or group participation, such as roads and bridges construction and maintenance. The high and favorable rating

for collective social behavior of the respondents in the study areas indicate the potential for positive involvement of the households in the sustainable management of watershed resources. The respondents' willingness to participate in finding solutions to community problems is positively related to willingness. Several researchers, on the other hand, suggested the support or involvement of NGOs and external agencies (notwithstanding the critical role of LGUs), especially in the initial stages not as the main drivers or implementers but as facilitators.

Evaluation of Major Agricultural Soils Towards Rational Land Area Allocation for Food and Biofuel Feedstocks Production in Cagayan Valley, Philippines

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The Biofuels Act of 2006 mandates the use of biofuel as a measure to ensure availability of alternative energy without detriment to the natural ecosystem, biodiversity and food reserves of the country, and production shall be done within marginal areas. The study aimed to identify sites considered prime agricultural lands for food and feed production and in the process delineate marginal lands that may be allocated for biofuel feedstock growing in Cagayan Valley. It employed soil characterization and suitability assessment of agricultural soils. With the total delineated agricultural area of 911,167 hectares, there were about 360,193 hectares considered as prime agricultural lands to meet the regional requirement up to the projected 40 years period. There were also about 431,044 hectares of marginal lands with high to moderate suitability to cassava, coconut, *Jatropha*, oil palm, sweet sorghum, sugarcane, and switch grass. The productivity of these marginal areas were limited by shallow rooting depth, topography, acidity and low inherent fertility, surface run-off and drainage conditions of the soils. To enhance productivity, investment on soil management and improvement has to be done. A second level suitability assessment showed that 84% of the marginal land is suitable for switch grass and 54% for cassava, coconut, *Jatropha*, oil palm, sweet sorghum and sugarcane. About 16% were considered permanently not suitable for biofuel crops and were recommended for afforestation for watershed purposes. Switch grass, sugar cane, cassava and oil palm proved to be more productive in terms of biomass yield, biofuel potential, and soil suitability than *Jatropha*, coconut and sweet sorghum. Based on the above findings, national and local planners may find this study valuable land allocation. Foremost is to ensure food security and at the same time allow Cagayan Valley to locally produce alternative energy to conform to the national program of promoting biofuel production.

State of System of Resident Areas in Quang Xuong District, Thanh Hoa Province, Vietnam

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The study analyzed the nature of resident areas of Quang Xuong district in response to “A Set of National Criteria for Renewing Rural Areas” and “Tam nong” policy in Vietnam. The data were gathered from all of 392 resident areas of district. The results show that Quang Xuong district locates in the center part of Vietnam with its population 265,249 people, 65,172 households, and its total area 22780.12 hectares. The land for residential areas is 4353.79 hectares, including 3350.35 hectares for housing; 261.30 hectares for public construction systems; 526.33 hectares for transportation; 97.59 hectares for growing green trees; 114.27 hectares for small scale industries; and 3.76 hectares for other purposes. It consists of 41 communes with 392 resident areas. In average, each commune has 10 resident areas and there are 676 people and 166 households in each resident area. “A Set of National

Criteria for Renewing Rural Areas” includes 19 Criteria with 5 groups: planning, socio-economic infrastructure, economics and productive organizing, culture-society-environment; and politic system. Based on that, 392 resident areas of Quang Xuong were classified into 3 levels: level 1 with 71; level 2 with 134; and 187 level 3 with 187 resident areas. There are some drawbacks in terms of landscape architecture and there is great difference between urban and rural resident areas. By 2020, the system of resident areas will develop for 4 regions with 5 towns and 1 center of commune group according to regional advantages. At that time, QuangXuong district will have 363 resident areas: level 1 with 140; level 2 with 158; and level 3 with 65 resident areas. In which urban resident areas are 46 and urban resident areas are 317. To develop a united residential areas and enhance living quality of local people, local authority should improve all types of planning and make appropriated policy to get capital from government, NGOs, and people.

Thermal Distribution Analysis in a Tunnel Greenhouse by Coupling Ventilation

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Many types of greenhouses had been assembled in Indonesia. This research was conducted in Bogor area, West Jawa, and to study a modified tunnel greenhouse using a couple of ventilation. The added second ventilation was built at the roof construction, as an effort to find the appropriate condition of the suitable tropical environment for establishing *Chrysanthemum* plantation. Efforts to change the environment by adding the fan, was expressed in changing the temperatures around the plants. The environmental condition of this area affected photosynthesis of plants and produced O₂. The prerequisites optimal growth of plants in a greenhouse need the humidity around 70% to 85% and the temperatures in range of 18 – 22 °C. It means that the temperature distribution pattern in the greenhouse tunnel is important. Heat transfer that occurs in these greenhouses was radiation, convection and conduction. The combination of the natural ventilation and fan are used to convert the heat transfer inside the greenhouse to cool the air. The aims of this study were looking for patterns of temperature distribution inside the building and find the place to move out the heat. The temperature distribution patterns and changes in the movement of air flow are mapped using a method of graphically mapping program Surfer 8. The observation is done as the temperature changes inside the greenhouse from 6:00 a.m. to 18:00 p.m. It showed that the maximum humidity was more than 85% especially around 06.00-08.00 a.m. and after 14.00 p.m. The coefficient of magnitude radiation (kr) in several surface types such as $k_{r_{floor}}$ was 27.24 W m⁻², $k_{r_{roof}}$ was 26.57 W m⁻². The coefficient of convection of air (hc) among roof environment outside is 630.45 W m⁻², at roof was 209.1 W m⁻², at the floor surface inside the greenhouse was 1369.4 W m⁻². The coefficient of conduction of soil (k_{soil}) was 156.68 W m⁻², at roof (k_{roof}) was 20.62 W m⁻².

Microstructure and Properties of the Bionanocomposite of Polypropylene Reinforced with Cellulose Nanoparticles Biomass of Rattan

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Cellulose is the most abundant natural polymer, found in plant cells walls. Recent interest in greener cellulose materials for general applications, especially in the automotive industry have sparked the development of green composite materials. Our aim have been to develop

bionanocomposites by ultrasonic and injection moulding method, analysis of the microstructure and morphology of the nanocomposite have been characterized by Scanning Electron Microscope (SEM), Particle Size Analyzer (PSA), Energy Dispersive X-Ray Spectroscopy (EDS) and tensile mechanical properties. Bionanocomposite were successfully developed using cellulose nanoparticles biomass of rattan as the reinforcing and polypropylene as the matrix. Bionanocomposite with cellulose nanorattan are of great interest due to their renewable nature, small density, good mechanical properties, develop an energy efficient and cost effective processing methodology. It was to development of new biodegradable and environmental friendly nanocomposites. This new type of nanocomposites is expected to have remarkable improvement of material properties when compared with milli, micro composite materials and compared to that obtained for fiber glass reinforced PP composites. The cellulose nanoparticles rattan were previously prepared by ultrasonic method ($f = 20$ kHz, $t = 1, 2, 3$ h) and the maximum size particle was ultrasonicated 3 hours. PSA shows diameter particle 146,3 nm, number distribution 32% and volume distribution 15%. The excellent compatibility between these matrix and the natural reinforcing cellulose, observed by SEM was reflected in the element's atomic structure analysis or EDS characterization of the bionanocomposite consist mass percent of C = 81,59%, O = 17,68% and Si = 0,20%, K = 0,34%, Ca = 0,18%.

Potential Use of Sugar Cane Slash as Organic Mulch - An Effective Method to Reduce Soil Compaction, Weeds, and Surface Run-Off

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Soil compaction has been a serious matter in sugar cane plantation for long time. The problem occurred due to accumulative effect of field machinery traffic during cultivation i.e. land preparation to harvesting activities. Direct influence of soil compaction to plant growth found when the plant in the stage of vegetative growth. It is because during that stage, plant root is affected by mechanical impedance. There is also problem in sugar cane field which is considered serious is weed and surface run-off. During the early stage, plant is suffered by competition with weeds to get nutrition, air, water from the soil. In order to minimize the use of chemicals, organic based approach is considered to be an effective method to control weed, surface run-off as well as soil compaction. Organic matter used in this study was sugar cane slash which is available in the field after harvesting. The objective of this study was to examine the effectiveness of sugar cane slash to control soil compaction, weeds and surface run-off as well. The observation of soil compaction effect was done up to the depth of 40 cm, while for the effect of weeds was conducted until 2 months plant stage. To see the effect to surface run-off, the measurement was done up to the depth of 20 cm. From this study, the method of using organic material i.e sugar cane slash was found very effective.

Food Production Strategy Through Infrastructure Development in the Irrigated Paddy Field

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Food production tends to decrease due to conversion of agricultural land. Uncertainty of food production in Indonesia also caused by traditional farming and farmer's income below the poverty line. To overcome low production of food and farmer's income is the development of farm infrastructures on agricultural land. Thus, a specified model of farm infrastructure development for Indonesian irrigated field is necessary. The purpose of study were (1) to identify the integrated infrastructures development model, (2) and to make recommendations on development of

infrastructure for food production in the irrigated paddy field. A dynamic modelling was adopted in this study. Steps of the systematic approach in dynamic modelling were done, such as analysis of farm infrastructures, problem formulation, system identification, model development using STELLA, model validation, sensitivity analysis, and model simulation. As a result were: farmers need more suitable farm infrastructure, such as pipe irrigation and farm roads as for on-farm infrastructures and also rice processing complex and goat processing machine as for off-farm infrastructure. The model was tested in the infrastructure development planning in Cihea irrigation system, Cianjur Indonesia. Infrastructures development should be done in integrated farming system with minimum total area of 3000 hectares. It provided the benefits for the farmers if every farmer had a minimum of 3 hectares of land area.

Insect Ecology and Pest Management

Key Factor Analysis of Brown Planthopper *Nilaparvatalugens* (Stal) (Hemiptera: Delphacidae) Outbreak in Klaten Regency, Indonesia

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Outbreak of brown planthopper, *Nilaparvata lugens*, occurred during the year of 2010-2011 in rice producing area mainly in Java. The objective of this research was to analyze environmental factors and agricultural practices related to brown planthopper outbreak in Klaten Regency, Indonesia. Data of infestation level, biotic environment, field landscape, and agricultural practices such as rice varieties, fertilizer usage and pesticide spraying were collected from five districts in which outbreak was firstly reported, by using a structured questionnaire and direct observation. Cross tabulated followed by chi-square test were applied to analyze determining factors. Key factors related to brown planthopper outbreak were rice varieties, presence of predators as well as entomopathogenic fungi and colonization of endophytic fungi in rice plant, presence of other pests, active ingredient of insecticides, interval of insecticide spraying, and nitrogen fertilizer application.

The Population Fluctuation of *Apanteles* sp., Parasitoid of Rice Leaf Roller

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Apanteles sp. is one of the most abundance parasitoids found in rice field in Malaysia. However little is known about the ecology of this species. Therefore this study was initiated to investigate the population fluctuation of *Apanteles* sp. for one rice season and also to determine the active period of the species. Four malaise traps were set up randomly at the edge of a paddy plot a month after paddy was planted. Specimens was collected weekly for 11 consecutive weeks. The collected specimens were brought to the laboratory for sorting and counting of *Apanteles* sp. The number of individuals collected weekly were recorded. For the active period experiment, four malaise trap were placed at the edge of the paddy field. The samples will be collected at three different time which are at 12.00 p.m., 18.00 p.m., and 07.00 a.m.. The number of individuals obtained per period was counted and recorded. The experiment was repeated 3 times. Data from both experiments was analyzed using one-way Anova performed in SAS 9.2. The number of *Apanteles* sp. obtained was significantly different ($p < 0.001$) by week. The highest number of *Apanteles* sp. obtained was during the second week of sampling, when the paddy was between 39-45 days after transplanting. At this stage the population of pests was high which explain the high abundance of the parasitoids. The

abundance decreased in the following weeks until the sixth week when the population increased until the seventh week. At this period, there was no pesticide being applied to the crop. The abundance drastically went down on the eight week until harvesting. This was when the farmers had intensified the management of pests and diseases by chemical control. *Apanteles* sp. is significantly active during the morning hours (07.00-12.00 a.m.). This study gives the basic knowledge on the ecology of *Apanteles* sp. in order to further study the potential of this species as the biological control agent of rice leaf roller.

**Performance of Entomopathogenic Fungi Endogenous Strains
in Rice Pest Control towards Biological Method**

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Rice insect pests are classified as major or key rice pests to control rice insect pest as augmentative biological control that could be carried out by using native or endemic natural enemies together with conservation programs and designed as a component of the integrated pest management program as well as to support rice organic farming. Overall objectives of this research are to evaluate the basic criteria and the feasibility of an augmentative biological control program for the rice insect pests, emphasizing on the utilization of endemic entomopathogen, *Beauveria bassiana* and *Metarhizium anisopliae*. In this study, the most virulent strain of *B. bassiana* and *M. anisopliae* will be selected from indigenous strains that collected from paddy fields in Phitsanulok Province, northern Thailand. The collected strains were tested for preliminary screening in laboratory and greenhouse experiments based on its pathogenicity potential on the rice insect pest. The results revealed that the attempts on the use of biological control, the naturally-occurring entomopathogenic pathogens in rice insect pests, the green rice leafhoppers and brown planthoppers were infected by various entomopathogenic fungi such as *M. anisopliae*, *M. flavoviride*, *B. bassiana*, and *Hirsutella citrififormis*. In addition, biological control is mainly augmentative using the native or endemic natural enemies together with conservation programs.

**Diversity of Sheath Endophytic Fungi and the Role in Protection of Rice against Brown
Planthopper, *Nilaparvata lugens* (Stål) (Homoptera: Delphacidae)**

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The objectives of the research were to study the diversity of endophytic fungi of rice sheath in two rice cultivars and two regencies in West Java, Indonesia and to examine its importance in rice protection against brown plant hopper (BPH) *Nilaparvata lugens*. Endophytic fungi was isolated from rice sheath samples collected from two regencies in West Java, each location consisted of two cultivars Ciherang and Pandanwangi. Further sample collection was done in Cianjur regency with three level of field BPH infestation i.e. zero, low and high. Some predominant fungi were further tested their activity against BPH under greenhouse experiment. Number of isolated fungi, diversity index and total colonization of endophytic fungi in cv. Cianjur was higher than in Subang. Diversity index and total colonization of endophytic fungi in cv. Pandanwangi was higher than of Ciherang. *Nigrospora* sp. 1, *Nigrospora* sp. 2 and *Nigrospora* sp. 3, which were predominant endophyte in free BPH rice increased host resistance against BPH indicated by suppressing nymph-adults survival, make host non preference and furthermore suppress population growth.

Preferences and Oviposition of Egg Parasitoid *Ooencyrtus erionotae* Ferr. in Various Age of Banana Skipper *Erionota thrax* L. Host Egg

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An egg parasitoid *Ooencyrtus erionotae* Ferr. is one potential biocontrol agent to control the banana skipper *Erionota thrax* L. This study aims to determine the age of host eggs that suit for parasitoid *O. erionotae* development until the imago. The experiments were conducted at the Parasitoid and Predator Bioecology Laboratory, Department of Plant Protection, Faculty of Agriculture, Bogor Agricultural University (IPB) and IPB's Cikabayan experimental field. The results showed that parasitoid *O. erionotae* are gregarious and tends to choose younger host eggs (1-2 days) than the older ones (5 days). Oviposition occurred from morning to afternoon time. Oviposition time lasted between 10-15 minutes on the host eggs aged 1-2 days and 25-35 minutes on the host eggs aged 3-4 days.

Egg parasitoids of *Chrysocoris javanus* Westw. (Hemiptera: Scutelleridae) on *Jatropha curcas* L. in Bogor, West, Java, Indonesia

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Physic nut (*Jatropha curcas*) is one of biofuel plants which is planned to be cultivated on large scale areas in Indonesia. *Chrysocoris javanus* is an important sucking pest attacking physic nut. To control this pest, various pest control measures have to be studied and implemented. The objectives of this research were to find out egg parasitoids which are potential as biological control agents and their parasitization level at three physic nut plantations in Bogor, West Java, Indonesia. Egg parasitoids found during the study were *Anastatus* sp. (Eupelmidae), Pteromalidae, and Scelionidae (Hymenoptera). Parasitized eggs of *C. javanus* were black in color, whereas the unparasitized eggs were orange. The pteromalid wasp was the dominant parasitoid found in two plantations. Parasitization level of three parasitoids ranged from 60.1% to 97.0%. Almost all of *C. javanus* egg clusters were parasitized (88.7% - 100%).

Some Bio-Ecological Characteristics of Larval Exoparasitoid *Elasmus* sp. (Hym.: Eulophidae) on Sesami Leafroller *Antigastra catalaunalis* (Dup.) (Lep.: Pyralidae) in Vietnam

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Sesami is one industrial plant with many advantage characters. But as other plants, sesami is infested by many insect pests. Sesami leafroller *Antigastra catalaunalis* (Dup.) is one of most important pest which appeared very common and damaged sesami production. To control this insect pest, farmer use chemical insecticides. But using chemical insecticides is not good any more for not only natural enemies, but also effect on biological balance, environmental pollution, impact negative on human health. So, in order to protect sesami production and our environment, investigate studying on parasitoid of sesami leafroller *Elasmus* sp. (Hym.: Eulophidae) is needed. The life cycle of *Elasmus* sp. was about 9.17 ± 1.68 days under conditions of 29.9 ± 2.8 °C temperature and $78.5 \pm 3.7\%$ humidity at photoperiod of 12L:12D. Supplemental food quality affected adult longevity, as

well as oviposition capacity. Individuals which were fed pure honey can outlive those fed with 50 and 10% honey solution (10.7 days compared to 8.8 and 5.7 days); while those fed pure water lived only 3.9 days. And female can parasitised 57.5, 44.8, 31.2, and 21.9 individuals of host with a number of egg of 241.4, 179.7, 128.5 and 87.1 eggs/female respectively. The behaviour of laying egg on host larvae of *Elasmus* sp. is aggregated. Average number of egg laid by female on one larval host of third or fourth instar is about 4.38 eggs/individual. In condition of laboratory (average temperature and humidity of 29.9 ± 2.8 °C and $78.5 \pm 3.7\%$), the emergence ratio of *Elasmus* sp. was $83.1 \pm 17.9\%$ and sex ratio of male to female was 1:2.4. The suitability of larval host was second to fourth instars.

Parasitoids of *Aphis gossypii* Nymphs from South Sumatra and Their Parasitization Performance

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The objectives of this research were to determine parasitization by three parasitoid species, i.e. *Aphelinus* sp., *Lipolexis* sp., and *Tryoxys sinensis* on nymphs of *Aphis gossypii* (Hemiptera: Aphididae), and to study the biology of *T. sinensis*—the parasitoid species that exerted the highest parasitization rate (based on mummification rate) on *A. gossypii* nymphs. Parasitoid species collected from exploration on lowland and highland areas in South Sumatra were mass reared on *A. gossypii* nymphs in the laboratory. Mated females *T. sinensis* was infested on 100 nymphs of *A. gossypii* per female parasitoid every day until the parasitoid died. The number of *A. gossypii* nymphs mummified by *T. sinensis* (24.8 mummies per female) was the highest and significantly different from mummification rate by *Aphelinus* sp. (4 mummies per female) but not significantly different from that by *Lipolexis* sp. (15.4 mummies per female). The percentage of adult emergence of *T. sinensis* was not significantly different from that of the other parasitoids. The mean developmental time from egg to adult emergence of *T. sinensis* on *A. gossypii* was 5.66 days with a range of 4-8 days. The mean longevity of the adult parasitoid averaged 2.20 days. The sex ratio was slightly predominated by female (54.19%). Eggs were laid at an average of 47.20 eggs per female.

Efficacy of Some Essential Oil Extracted from Tropical Plants to Hairy Caterpillar

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Efficacy of some essential oils extracted from tropical plants to hairy caterpillars was evaluated in order to find out the method to control population of hairy caterpillars which increased drastically in 2010-2011 in Indonesia. The caterpillars were reported to attack some plants such as wooden plants; horticulture crops, especially, mango trees and some ornamental plants, but hitherto these caterpillars have not been found to attack food crops. This caterpillars caused some problems: scary, causing skin etches, etc., especially when these insects entered the residential housing. To control the caterpillars, recently, people used chemical insecticides, however the impact of chemical insecticides is dangerous to human being, livestock, and environment. Therefore to minimize those problems, the control methods should be environmental-friendly and safe against human being. One of those methods is utilizing botanical pesticides extracted from tropical plants. Six tropical plant species, i.e. clove (*Syzigium aromaticum*), citronellagrass (*Cymbopogon nardus*), lemongrass (*Cymbopogon citratus*), neem (*Azadirachta indica*), ginger (*Zingiber officinale*), and nutmeg (*Myristica fragrans*) were tested in this experiment to utilize them as botanical pesticides. The result showed that at a concentration of 10%, all of the essential oils were effective to kill the caterpillars

(90-100%). Therefore efficacy evaluation of essential oils at lower concentrations was conducted (5%, 2%, and 1%). Lemongrass oil at 1% was the most effective in killing the caterpillars (98%). The evaluation of lemongrass effectiveness was continued at concentrations lower than 1% (0.75%, 0.50%, and 0.25%), Lemongrass oil at 0.50% could kill the caterpillars up to 90%, while at 0.25% was moderately effective (mortality 50%).

Joint Action of Mixed Extracts of *Brucea javanica* (Simaroubaceae), *Piper aduncum* (Piperaceae), and *Tephrosia vogelii* (Leguminosae) as Botanical Insecticides Against Cabbage Head Caterpillar, *Crociodolomia pavonana*

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Extracts of *Brucea javanica* seeds, *Piper aduncum* fruits, and *Tephrosia vogelii* leaves were tested separately and in mixture (3:2.5:1) in the laboratory for their insecticidal activity against the cabbage head caterpillar, *Crociodolomia pavonana*. *B. javanica*, *P. aduncum*, and *T. vogelii* plant materials were extracted with ethyl acetate-methanol (9:1), ethyl acetate, and ethyl acetate, respectively, by maceration method. Insecticidal bioassays were done by a leaf-residue feeding method. Second-instar larvae *C. pavonana* were fed extract-treated broccoli leaves for 48 hours and then were presented untreated leaves until the surviving larvae reached the fourth-instar stage. Larval mortality was assessed at 5 days after treatment, and the data was analyzed by the probit method. The results showed that larval mortality started at first day treatment and increase at second day's treatment, after change with untreated leaves the mortality decrease significantly. Based on LC₅₀ and LC₉₅ value, *T. vogelii* leaf extract was the most toxic (LC₅₀ 0.05%, LC₉₅ 0.16%) among the three extracts, followed by *P. aduncum* fruit extract (LC₅₀ 0.24%, LC₉₅ 0.32%) and *B. javanica* seed extract (LC₅₀ 0.17%, LC₉₅ 0.41%). Based on LC₅₀ (0.06%) and LC₉₅ (0.12%) value, the toxicity of a mixture of *B. javanica*, *P. aduncum*, and *T. vogelii* extract (3:2.5:1) against *C. pavonana* larvae was less toxic. Based on the combination index according to the independent joint action model, the extract mixture had a strongly synergistic joint action against *C. pavonana* larvae, at LC₉₅ level, with combination index of 0.445.

Antifeedant, Repellency and Adult Emergence Inhibitory Effect of *Piper nigrum* L. and *Jatropha curcas* L. Extracts Against Rice Moth, *Corcyra cephalonica* (Stainton)

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To determine the antifeedant, repellency and adult emergence inhibition of petroleum ether and chloroform extracts from fruits of *P. nigrum* and petroleum ether extracts from seeds of *J. curcas* on 3rd instar larvae of *C. cephalonica* in laboratory conditions. Order of serial dilution was prepared from petroleum ether extract of *P. nigrum* and *J. curcas* and chloroform extract from *P. nigrum*. Results showed that the plant extracts efficacy on feeding of *C. cephalonica* larvae, were significantly different among plant extracts (F = 28.16; df = 2; P < 0.0001) and also were significantly different among applied doses of plant extracts (F = 297.24; df = 5; P < 0.0001). Lower percentage of weight

loss was observed at a concentration higher than 4 µl/g of plant extracts. But the plant extracts at the calculated dosage did not show any repellency against *C. cephalonica* larvae in treatments and untreated as a control. The mean percent of F1 adults of *C. cephalonica* that emerged from the treatment rice kernels more marked on chloroform extracts of *P. nigrum* with 1.2 % and this followed by petroleum ether extracts of *P. nigrum* and *J. curcas* with 5.5 and 6.7%, respectively.

Joint Action of Mixtures of *Tephrosia vogelii* Leaf and *Piper aduncum* Fruit Extracts on the Cabbage Head Caterpillar, *Crociodolomia pavonana*

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Laboratory bioassays were conducted to assess the joint action of three mixtures of *Tephrosia vogelii* (Leguminosae) leaf and *Piper aduncum* (Piperaceae) fruit extracts on the cabbage head caterpillar, *Crociodolomia pavonana*. *T. vogelii* leaf and *P. aduncum* fruit powder were extracted with ethyl acetate (1:8 w/v) four and three times, respectively, by immersion method. The number of immersion was arbitrarily optimized based on extract yield and insecticidal activity among the extracts obtained with two to six times immersion of plant materials. Based on LC₅₀ and LC₉₅ at 72 hours after treatment (HAT), *T. vogelii* extract was about 1.27 and 1.09 times, respectively, more toxic to *C. pavonana* larvae than *P. aduncum* extract. At the LC₅₀ level, *T. vogelii* and *P. aduncum* extract mixtures at 1:1, 5:1, and 1:1 concentration ratios (w/w) were 2.51, 2.40, and 3.48 times, respectively, more toxic than *T. vogelii* extract alone, and 3.28, 3.13, and 4.55 times more toxic than *P. aduncum* extract alone. Based on the independent joint action model, *T. vogelii* and *P. aduncum* extract mixtures at the three concentration ratios were strongly synergistic on *C. pavonana* larvae, both at LC₅₀ and LC₉₅ level; the combination indices of extract mixtures at the LC₅₀ level - 96 HAT ranged from 0.240 to 0.419 and those at the LC₉₅ level - 96 HAT ranged from 0.235 to 0.347. Thus, the synergistic *T. vogelii* and *P. aduncum* extract mixtures are potential to be used as alternatives to synthetic insecticides for the control of *C. pavonana*.

The Impact of Bio-Control Agents on the Occurrence of Major Insect Pests and Diseases on Rice in West Java

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Resistance of plant to plant pathogens or insect pests can be induced by applying some bio-control agents such as plant growth promoting rhizobacteria (PGPR), endophytic fungi, and guano. These bio-control agents can also stimulate or promote plant growth. Therefore, they can be incorporated as integrated pest management components. The objective of this research was to evaluate the role of PGPR, endophytic fungi, and guano to increase plant resistance against some insect pests and plant pathogens on rice. Those bio-control agents were applied either singly or in combination as seed treatment and sprayed at nursery and in the field. Rice variety used was Ciherang and planted with System Rice Intensification. Observation was conducted on rice stem borer, rice leaf folder, brown plant hopper, bacterial leaf blight, brown spot, and narrow spot. Results showed that combination of three bio-control agents can suppress the attack of those pests and diseases. In addition, productive tillers and rice production per plot were increased.

**Population Correlates and Critical Pest Level (CPL) of the Leafhopper,
Amrasca biguttula and Associated Insect Pests Attacking Okra, *Hibiscus esculentus* (L.)**

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This study was conducted in two locations; San Manuel and Capas, Tarlac, respectively, from 2008-2010. It aimed to determine the population density of major insect pests attacking okra as affected by time of planting, establishment of critical pest level (CPL) of *Amrasca biguttula* and other associated insect pests, and to assess phenologically the rate of first instar larval/nymph emergence from an eggmass. Feeding tests of insect pests with host were conducted in an experiment nethouse with sufficient batches of trials which had established the critical pest level. *Amrasca* sp. and *Dysdercus cingulatus* were found with high population density during the dry seasons planting of 2009-2010, while *Spodoptera litura* registered a population mean ranging from 16.0-22.0 regardless of observation sites. High population of *Amrasca* sp. was evident during January and onwards which has exceeded the 10 percent critical yield reduction level of the crop which confirmed that planting of okra during dry seasons would entail significant damage of the crop. With a series of feeding interaction tests conducted for *Amrasca biguttula*, its critical threshold level was established with a population ratio of 45.53 per 50 plants with an allowable yield reduction threshold of 10%. The generated data is recommended for adoption which contributes to reduced frequency of chemical application and production of quality exportable green okra. Moreover, phenological forecast on the eggmass hatchability of two major insect pests, namely *A. biguttula* and *D. cingulatus* were found correlated with temperature which is recommended as an input in pest management.

**Evaluation of Five Chili Varieties and Some Insecticides for the Control of
Fruitfly *Bactrocera dorsalis* (Diptera: Tephritidae)**

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The objectives of this research were to evaluate the resistance of five chili varieties to fruit fly *Bactrocera dorsalis* and the efficacy of some insecticides against the fruit fly. This research was done at Megamendung and Katulampa, Bogor, West Java, Indonesia, since June 2010 until May 2011. The varieties of chili used were F3 (12x10), F3 (10x14), Hot Pepper Tornado, Keriting 09, dan SP Hot 77. The insecticides used were mixture of *Piper retrofactum* and *Annona squamosa* extract, *Cymbopogon nardus* extract, spinosad, and imidakloprid. The experimental design used was completely randomized design for evaluation of chili varieties and split plot design for insecticide efficacy test. The data of fruit fly attack was analyzed by analysis of variance followed by Duncan's multiple range tests at 5% significant level. The result of this research showed that Keriting 09 was more resistance to fruit fly than other varieties. Insecticide treatment did not significantly affect chili yield, but the treatment with *C. nardus* extract can prevent fruit fly attack.

Effect of Insecticide Used on Insect Diversity in Rice Field

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Rice (*Oryza sativa* L.) is one of the most important and leading cereal crops in the world and is the staple food of over half of the global population. In Malaysia, the planted area for paddy is 670,000 hectares, which only fulfilled 70% of the country self sufficiency level. Pest is one of the main problems in rice production; it has caused 30% reductions in field and 10-12% in storage.

Chemical control remains the major controlled strategy for the pest. However, over reliance of pesticide has caused insecticide resistance, environmental pollution and reduction of biodiversity. The study sought to assess the effect of different insecticide used on insect diversity in rice ecosystem. The experiment was conducted in Sekinchan, Selangor, Malaysia with a control and three insecticides (Regent[®]; Padan[®] and Prevathon[®]) as treatments with different modes of action. Insecticides were applied every two weeks. All the samples were identified until family level for the purpose of insect abundance study and up to morphospecies for the insect diversity study. The result shown, there were 43 families collected with total of 4465 individuals from all treatments. From the total, 21% are pest (12 families) and 79% are beneficial (21 families). There was no significant difference in the abundance of individuals obtained in each treatment. The highest numbers of pest was from Padan[®] (425 individuals) and the highest numbers of beneficial insect was from treatment Prevathon[®] (1082 individuals). However, there was a significant difference in the numbers of morphospecies obtained between treatments, with highest value was from Regent[®] (58 morphospecies) and the lowest value from Prevathon[®] with (43 morphospecies). There was a significant difference in the number of pests and beneficial insects obtained between sampling periods. This was due to the weekly increment of species richness for both pests and beneficial insects as the crop approached maturity. There was no significant difference of rice yield between the treatments. In this study, although Prevathon[®] gives the highest numbers of insect abundance, but it has lower value of insect species. However, the use of Regent has highest number of insect diversity.

The Potency of Siam Weed Compost on Crop Chili and Arthropods

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Some experiments have shown the potency of Siam weed *Chromolaena odorata* (L.) R.M. King & H. Rob (syn. *Eupatorium odoratum* L.) as organic compost since it has high biomass and it also contains calcium, manganese, potassium and nitrogen in high concentration. It is then emerging an idea to utilize Siam weed as good substitution of synthetic fertilizer. The experiment has been conducted in the field experiment at Bangutapan, Bantul. The aim of this research was to answer questions on the effects of siam weed compost on chili performances, arthropod as herbivores and natural enemies. The results indicated that application of composted siam weed increased plant performances in terms of fruits number, weight fresh and weight dry of fruits, weight fresh and weight dry of plant, total leaf nitrogen, compared to control and the others fertilizer (cow dung, synthetic fertilizer). It was suggested that composted weeds plant enhanced the resistance mechanism called pseudoresistance on plants. This experiments also showed that syrphid larvae as natural enemies increased significantly on plant treated with composted siam weed and it has direct influence on abundance of aphid as herbivores.

Microbial Ecology and Plant Disease Management

Molecular Diagnosis of Para Rubber White Root Disease in Indonesia

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White root disease (WRD) is known as one of the major diseases of para rubber (*Hevea brasiliensis*). WRD is very destructive and thus economically significant in natural rubber production. *Rigidoporus microporus*, a basidio-mycete fungus is the soil-borne pathogen of WRD and produces

large fruiting bodies at the foot of infected trees. To support rapid and accurate diagnosis of WRD, several *R. microporus*-like isolates were obtained by tissue transplanting technique from infected roots and fruiting bodies which were collected in North Sumatra and Purwakarta, Indonesia. White-flat mycelial colony, which was difficult to identify through microscopy, was observed on PDA medium 6 days after incubation at 28 °C. The internal transcribed spacer (ITS) regions of rDNA were amplified by PCR with fungus specific primer pair (ITS1/ITS4). The partial nucleotide sequences of the ITS region were determined by 3130xl Genetic Analyzer HITACHI (Applied Biosystems) and analyzed using Sequencing Analysis v5.2. Results showed high homology on some of the tested isolates with *R. microporus* isolates (HQ400707, HQ400708, HQ400706, HQ400709) from Malaysia. Some of the isolates however, found to be not *R. microporus* by molecular analysis.

The Use of Spent Mushroom Substrates to Control Late Blight Disease (*Phytophthora infestans* [Mont] de Barry) in the Field-Grown Potato

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One of limiting factors in potato production is late blight disease caused by *Phytophthora infestans* (Mont) de Barry). The most common control measure of the disease is application of synthetic pesticides that is potentially harmful to human and the environment. One of environmentally-friendly control measure is the use of organic matters such as spent mushroom substrates. The objective of the research is to determine types of spent mushroom substrate and application interval of their water extract which suppress late blight disease in potato in the field. The experiment was conducted in the experimental field of Vegetables Crops Research Center, Lembang West Java, Indonesia. The experiment was arranged in Randomized Block Design, with 10 treatments and 3 replications. The treatments examined included spent substrates of *Plerotus ostreatus*, *Lentinula edodes*, *Auricularia auricula*, or their mixture applied in the planting site and spraying their water extract every 3 or 7 days, check and pesticide. The result showed that the application of spent substrates of *P. ostreatus*, *L. edodes*, *A. auricula*, applied in the planting site and spraying their water extract 3 or 7 days suppressed late blight disease in potato in the field by 16.7%-47.7%. Application of spent substrate of *L. edodes* in the planting site and spraying its water extract every 3 days showed the best disease suppression (47.7%).

Effects of Straw Mulch, PGPR, and Varieties on the Bacterial Pustule Disease and Abundance of Rhizosphere Bacteria of Soybean

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Bacterial pustule caused by *Xanthomonas axonopodis* pv. *glycines* is one of the important bacterial diseases of soybean in Indonesia. In the frame of Integrated Pests Management for sustainable agriculture, the development of alternative way to control the disease is needed. This research was conducted to observe the effects of straw mulch, plant growth-promoting rhizobacteria (PGPR) on the incidence of bacterial pustule disease and the abundance of chitinolytic bacteria, heat tolerant bacteria, and fluorescence bacteria on two soybean varieties. All of the factors as combinations were not significantly affected the value of total area under disease progress curve (AUDPC) of bacterial pustule. Factor that significantly affected the values of AUDPC was varieties. AUDPC value on Anjasmoro variety was significantly higher compared with those on Gepak Kuning variety. Abundance of fluorescence bacteria on soybean rhizosphere treated with PGPR was

significantly higher compared with those on plants without PGPR. The other treatments did not significantly affect the abundance of rhizosphere bacteria.

Organic Waste as Cultivation Media for *Pseudomonas fluorescens* to Control Dumping Off Caused *Sclerotium rolfsii* and Promoting Plant Growth of Pepper

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Biological control has been paid a lot of attention from scientists in order to provide alternative plant pathogen control methods. Among of biological control agents, *Pseudomonas fluorescens* is the most popular Gram-negative bacteria caused of their capability to suppress many kind of plant pathogens and promoting of plant growths. Microbes which capability to suppressed plant pathogen and induced plant growth is called plant probiotic. The aims of our research are to explore organic liquid waste as media for cultivation of *P. fluorescens*. *In Vitro* and *in vivo* test were performed to determine the effectiveness of organic waste composition as growth media for *P. fluorescens* with high activity in suppressing plant pathogen and inducing plant growth. We have formulated organic liquid waste as alternative media for cultivation of *P. fluorescens*. Combination of coconut water, liquid waste of toufu and extract of fish processing waste (80:19:1) in pH 7.0 gave the good composition as alternative media for growing *P. florescens*. Application of these formulation suppressed *Sclerotium rolfsii* growth *in vitro* up to 90-100%, and suppressed diseases incidence of damping of 53%. On he other hand, seed treatment by formulation on pepper seed did not affect seed germination compared to control. Aplication 5% formulation on pepper seedling periodically once a week significantly increased pepper seedling growth.

Utilization of Coffee Leather Waste Compost Enriched by Selected Microbes, Humic Acid, Fulvic Acid and Zeolit for Increasing Suppression of Foot Rot Disease (*Phytophthora capsici*) on Lampung Black Pepper

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The aim of this research are to increase suppression of foot rot disease (*Phytophthora capsici*) on Lampung black pepper and to get the best formula of bioactivator compost to control foot rot disease by using coffee leather waste compost enriched with selected microbes, humic acid, fulvic acid and zeolite. Based on isolation from the root zone (rhizosphere) and the tissues of Lampung pepper plant (leaves, roots and fruits), 178 potential microbial isolates were identified. After selection of microbial isolates obtained 2 lignin-degrading microbes, 32 bacterial isolates which have ability as endophytic diazotroph bacteria (N₂-fixer based on activity of nitrogenase enzyme), 18 microbial isolates of rhizosphere capable of dissolving phosphate and 15 microbial isolates as antagonist of *P. capsicii*. After selection of microbes based on their function, 15 microbial isolates were chosen as the best isolates for formulating bioactivator compost, then as many as 3 formulas of bioactivator compost that every formula consist of 5 isolated, were tested in field treatment in pepper farmer land in North Lampung. The formula 2 that is formulated from compost of coffee leather waste enriched humic acid, fulvic acid, zeolite and selected bacteria (consist of bacterial isolates P2SH2, D10, C, A2 and E2) is the best formula for controlling fot root disease of *P. capsicii* which suppress the attacks of *P. capsicii* as much as 94.1%.

Study of the Antifungal Activity of *Ralstonia pickettii* TT47 to the Rice Sheath Blight Pathogen *Rhizoctonia solani* K hn

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Ralstonia pickettii TT47 was selected isolate having the potency of strong inhibited to growth of *R. solani* in vitro and suppress the development of rice sheath blight disease in vivo. The antifungal activity test of the filtrate from fermentation broth of the isolates proved that the growth of *R. solani* reduced significantly. Thus, in the culture broth of the isolates were contained antifungal compounds. Antifungal activity in the culture broth of the isolates was significantly correlated with the cell growth of the isolates. Antifungal compounds from culture broth of TT47 isolate able to extracted by using buthanol or hexana solution. The active metabolites in filtrate from the fermentation broth of the isolates were relatively stable to acidic condition but were sensitive to thermal.

Populations of *Aspergillus* sp. from Field-Grown Maize and Groundnut Plants Treated with *Trichoderma harzianum* CB-Pin-01

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Aspergillus sp. causes seed contamination of maize and groundnut with aflatoxin bringing a problem to food production that is one important sources of its inoculum originates from soil – infested with plant debris. *Trichoderma harzianum* strain CB-Pin-01 that was antagonistic to the causal *Aspergillus* sp. in laboratory, had been studied the effects of seed, plus soil and foliar treatments of maize and groundnut grown under field conditions on population in soil; and harvested seeds, and aflatoxin infestation. Not surprisingly, population of *Aspergillus* sp. at 15 days before harvest were 4-and 3-fold lower in maize and groundnut–treated field soil than non-treated control respectively. Higher antagonistic population than pathogenesisistic *Aspergillus* sp. was also observed throughout 8 times of twice weekly evaluation. However, their seed infestation with either pathogen population or aflatoxin were not differently significance, compared to non-treated control. This seems likely that there is other important sources of inocula except in soil, that will be discussed in this paper.

Reducing *Cercospora* Leaf Spot and *Fusarium* Crown and Root Rot of Strawberry Using *Trichoderma* and Soil Amendments

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Field trial of 1.8 and 2.4 kg *Trichoderma*, 10 kg vermicompost and 10 kg chicken manure added with triple-14 and applied singly was done to determine their potential in reducing *Cercospora*

leaf spot and *Fusarium* crown and root rot strawberry; and their effect on yield. The experiment utilized a plot size of 1 m x 10 m following the randomized complete block design with four replicates. Results showed that 1.8 and 2.4 kg *Trichoderma* with a spore concentration of 1×10^6 /ml applied in plots before transplanting the strawberry runners resulted in low *Cercospora* leaf spot infection (severity) and smallest lesions (spots) on leaves. Similarly, the lowest crown and root rot infection of 18% with slight vascular discoloration was obtained in plants applied with the same rate of *Trichoderma*, an indication that *Trichoderma* induced resistance in strawberry. A total yield of 13.7 and 14.6 tons/ha was obtained in plants applied with *Trichoderma* and was significantly higher than the 11 tons/ha produced by plants applied with 10 kg chicken added manure added with 1.2 kg triple-14. Yield from *Trichoderma* treated plants was also comparable to the 16.3 tons/ha obtained from the chicken manure treated plants at 10 kg/plot. The highest return on cash expenses (ROCE) of 3.0 was provided by the *Trichoderma* treated plants. Applying the biological control agent in the soil before transplanting helped minimized *Cercospora* leaf spot and *Fusarium* crown and root rot enabling the strawberry plants to produce acceptable yield.

Outbreaks of *Begomovirus* Associated with Eggplant Yellow Leaf Curl Disease in Indonesia

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Since 2009, outbreaks of yellowing and/or leaf curling disease in eggplant (*Solanum melongena* L.) crops have been occurred in Central Java Province, Indonesia. Disease incidence ranged from 30% to 90% and resulted in 50% to 80% yield loss. Symptomatic eggplant leaf tissues were positive in PCR assays using universal primers for *Begomoviruses*. The PCR products of the expected size (i.e. approx. 684 bp) was cloned and sequenced. The nucleotide sequence and BLAST search revealed the highest homology with *Tomato yellow leaf curl virus* Kanchanaburi from Thailand. To our knowledge, this is the first record of *Begomovirus* associated with eggplant yellow leaf curl disease in Indonesia.

Tolerance to *Fusarium* Wilt through induction of Defense-Related Mechanisms in the Plantlets of Susceptible Berangan Banana Pre-inoculated with *Pseudomonas* strain UPMP3 and *Burkholderia* strain UPMB3

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Banana production world-wide is under severe threat due to *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *cubense* (Foc). *Fusarium* wilt has destroyed thousand hectares of bananas in many tropical countries and, once established in an area, *Fusarium* cannot be controlled chemically or through cultural practices. Recently research has been carried out focusing at re-introduction of naturally occurring endophytes into banana plantlets before the plants are sold to growers. However, effectiveness of endophytes as a biological control agent depends largely on host specificity, ability to move within host tissues and ability to induce systemic resistance. A systematic study was carried out to determine the effect of pre-inoculation of bacterial endophytes (*Pseudomonas* strain UPMP3 and *Burkholderia* strain UPMB3 isolated from healthy oil palm (*Elaeis guineensis*) roots in eliciting the production of biochemical response related to defense mechanisms and improving plant vigor, which could contribute to the suppression of *Fusarium* wilt development caused by *F. oxysporum* race 4 (FocR4) in susceptible Berangan banana. Increased accumulation of resistance-related enzymes such as peroxidase (PO), phenylalanine ammonia lyase (PAL), lignithioglycolic acid (LTGA) and

pathogenesis-related (PR) proteins (chitinase and -1, 3-glucanase) has been observed in plantlets treated with endophytic bacteria UPMP3 and UPMB3 singly or as mixture under glasshouse conditions. Pre-inoculation of banana plantlets with UPMP3 showed a significant reduction in *Fusarium* wilt incidence after challenged inoculation with FocR4. UPMB3 was less effective in suppressing *Fusarium* wilt compared to UPMP3, whereas, the mixture of both endophytes showed an intermediate effect. Based on these results, it is concluded that UPMP3 could be a promising biological control agent that can trigger resistance against *Fusarium* wilt in susceptible Berangan banana.

The Elimination of *Cymbidium mosaic virus* in *Dendrobium* Orchid PLBs by Tissue Culture Technique

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Orchid is one of the major exported crops for Southeast Asian countries. However, orchid production both for cut flower and potted plant is threatened by viral diseases. Virus infection is not only the cause of severe losses of yield and quality but also the serious problem for export due to the international trade barriers. Since the viral diseases cannot be cured, thus farm management is the vital part of production in which the first step is planting of virus-free orchid plants. The elimination of virus from elite orchid clone will offer the mean to the orchid production business. Several reports were confirmed the successful events of virus elimination *in vitro* using meristem culture. However, due to the very small size, meristem is difficult to extract and the low survival rate of meristem tissue is usually observed. In this report, we reported the easier but successful tissue culture technique to eliminate *Cymbidium mosaic virus* (CymMV) for the production of CymMV-free protocorm-like bodies (plbs) in *Dendrobium* orchid. The CymMV infected plbs were cultured in liquid and solid VW medium supplemented with BA or TDZ at the concentration of 0-2.0 µM with weekly subculture. The virus dilution concept was applied to the technique of subculture. As confirmed by ELISA and RT-PCR, at the 6th weeks of culture in 2.0 µM containing VW liquid medium, 2 out of 15 plbs (13.3%) were CymMV-free. For the other treatments, none of CymMV-free plbs observed.

Investigation of Biocontrol Activity of Endophytic Bacteria from Upland Rice to Fungal Pathogen *Rhizoctonia solani*

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Endophytic bacteria resident within plant tissues have attracted attention due to their interesting features related to plant growth and for the protection of plants against plant pests and diseases. In this study, Endophytic bacteria was collected and isolated from defferent varieties of upland rice from defferent regions in Indonesia. The isolation of bacterial endophyte was conducted using surface-sterilized method with alcohol and sodium hypochloride (NaOCl). More than 220 isolates of bacterial endophyte were isolated. The isolates were tested to determine their effect on plant growth and the biocontrol activity against fungal pathogen *Rhizoctonia solani*. The results

showed 34 isolates of endophytic bacteria were able to promote the plant growth and 41 isolates of bacterial endophytes with antibiosis activity on potato dextrose (PDA) and tryptic soy broth (TSA) medium to *Rhizoctonia solani*.

Detection and Genetic Diversities of Geminivirus on Weeds

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Geminiviruses are important plant virus for some cultivated plants and weeds. Weeds showing vein yellowing (netting) were analysed for the present of a geminivirus. Total DNA were extracted from leaves of thirteen weeds species collected from all the mayor chilli peppers producing areas from West Java (Bandung, Cianjur, Sukabumi, Bogor, Garut), Central Java (Brebes and Magelang), Yogyakarta (Sleman) and East Java (Malang and Kediri). Nine of the 13 samples were positive by PCR using coat protein specific primers. Seven samples are AgrBgr, AgrSkm, AgrMgl, AgrJgy, SplMgl, CtpMgl and PrlBgr of the nine samples were successfully sequenced. Virus isolates further genetic analysis showed that those geminivirus can be differentiated into two clusters, showing the possible genetic differences among them. They neither have a close relationship with other geminiviruses published earlier in the GenBank.

Evaluation of Integrated Disease Management Strategy for Yellow Leaf Curl Disease of Chilli Pepper in Central Java

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Chilli pepper (*Capsicum annum*) is grown in all parts of Indonesia and has a high economic value. Incidence of virus infection becoming a major threat since early 2000. The most unique symptoms associated with the virus infection involved yellowing and leaf curling. The causal agent was known belong to Begomovirus group, and tentatively called pepper yellow leaf curl virus (PYLCV). Field experiment was conducted in Pakem, Yogyakarta in October 2009 to evaluate disease control strategies involving chilli varieties, botanical insecticides, and plant growth promoting rhizobacteria. Based on observation conducted since 3 weeks after transplant (WAT) to 10 WAT it was concluded that application of botanical insecticides (neems and cinnammon oil) and microorganism (PGPR and guano) potentially reduced disease incidence and increased plant growth as well as production. Application of neem oil, cinnamon oil, and the mixture of both oil reduced infection in average of 55.86%, 53.54%, 53.26% and increased production in average of 27.71%, 25.59%, 21.46%, respectively compared to the use of synthetic insecticide (imidaclopride). Application of PGPR -P, PGPR-B, and guano similarly caused reduction in disease severity in average of 58.67%, 62.81%, 64.68%, increased in plant height in average of 13.36%, 11.99%, 5.83%, and increased in production in average of 43.37%, 38.60%, 39.30%, respectively. Commercial varieties (TM 999, Hot Chilli, and Laris) performed better under high disease pressure than those of developing lines (IPB 12 x 14, and IPB 12 x 10). Integrated disease management for yellow leaf curl disease in chilli pepper is recommended which may include selected chilli variety, botanical insecticide and/or PGPR, border plants, and screen-protected nursery.

Exploration of Mild Isolates of Chilli Veinal Mottle Virus from Chilli Pepper in Java, Indonesia

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Among many viruses known to infect chilli pepper *Chilli veinal mottle virus* (ChiVMV) is reported as one important virus in chilli pepper in Indonesia. Due to its potential to cause yield loss, disease management has been practiced involving the use of tolerant varieties, controlling insect vectors, and other cultural practices aimed to suppress disease incidence. A research was initiated to employ cross protection approach for disease management to reduce the infection of ChiVMV. Initial exploration was conducted in chilli pepper growing areas in West Java, Central Java, and East Java to collect ChiVMV field isolates. In order to find mild and/or weak virus isolates the collection was focusing on plants showing mild symptoms and healthy looking plants surrounding plants with severe virus infection. Fifteen promising ChiVMV isolates was successfully collected and propagated in susceptible chilli pepper line (*Capsicum annum* L.), IPB C13. Based on percentage of disease incidence and symptom development, ChiVMV isolates can be differentiated into 3 groups, i.e. strong isolate (CKB), mild isolate (CKL, and BLN), and weak isolate (SKB, PGL, CGN, CBR, KRN, KMT, KRD, STG, KLT, BNT, SLO, and WTE). Further characterization of promising ChiVMV isolates was under going to confirm the potency of virus isolates to be used in cross protection strategy to suppress disease incidence.

Induced Systemic Resistance of Orchid against *Odontoglossum ringspot virus* by Using Salicylic Acid

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Odontoglossum ringspot virus (ORSV) is a new emerging virus infecting orchids in Indonesian and most species were susceptible to the virus. *Dendrobium nindii* is one of the susceptible cultivars to ORSV. To improve orchid resistance to ORSV, salicylic acid (SA) was used as systemic resistance inducer on *D. Nindii*. SA was applied in tissue culture media with concentration ranged from 0, 1, 2, 4, 8, and 16 ppm. The results showed that SA treatment in tissue culture media at those concentrations did not affect plantlet length, shoot number, additional leaf number, leaf width, root number, and root length. The addition of SA into growth media had no adverse effect on plant growth. Challenge inoculation of treated plants with ORSV showed that SA at concentrations of 4-16 ppm increased plant resistance and caused only local lesion symptom, suggesting that SA affects ORSV accumulation and disesease incidence. In comparison with SA treatment at 0-2 ppm, application of SA at 4-16 ppm increased the accumulation of SA and phenylalanine aminolase enzyme activit Incompare with 0-2 ppm, sugesting that induced resistance occurred in treated plants. The best SA concentration that can increase plant resistance and ORSV accumulation up to 95% was 16 ppm.

Application of Chitosan in Controlling *Bean common mosaic virus* Infecting Yard-long Bean

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Bean common mosaic virus (BCMV) is a major virus infecting yard-long bean worldwide and it caused yield loss economically. We tested the efficacy of chitosan against BCMV in greenhouse. Chitosan was applied as seed-treatment and leaf spray either before or after mechanical BCMV inoculation with concentration 0.1% and 1.0%. The incubation period, disease incidence, severity, viral accumulation and growth parameter were observed to determine the effect of chitosan against BCMV. All treated plants infected by BCMV showed longer incubation period, lower disease incidence, milder symptom and lower viral accumulation in compared with untreated control, respectively. The chitosan 1.0% and 0.1% able to reduced viral accumulation up to 86% and 82%, reduced the severity up to 65% and 55% in compared with untreated control, respectively. Application of chitosan 1.0% after BCMV inoculation gave higher inhibition of viral accumulation than prior inoculation, while opposite result showed by chitosan 0.1%. It suggesting that the effect of disease inhibition related with chitosan concentration and application time. The chitosan treated plants also showed better growth performance in compare with untreated control.

Construction and Transformation A Vector Containing Potyvirus Coat Protein to Generate Patchouli (*Pogostemon cablin* Benth.) Resistance to Potyvirus

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Patchouli (*Pogostemon cablin* Benth.) plant is important commodity for Indonesia, as it contributed about 50% of Indonesian total export of essential oil which valued about US\$ 27.171 billion. In Indonesia, one of problems is the mosaic virus disease which causes leaf malformation and reduction of oil content. *Potyvirus* is known associated with this disease. One approach to combat this disease is to modify patchouli plant by *Potyvirus* coat protein gene, since there is no trait of resistance to virus available in patchouli germplasm. This study was conducted to provide patchouli resistant varieties to *Potyvirus* that can contribute to increase farmer income via decreasing of yield loss caused by *Potyvirus* infection. In order to do it, RNA virus was isolated from plants infected by a virulent strain of *Potyvirus*. cDNA was then made from it using RT-PCR. A PCR product was inserted into pJET1.2 vector and sequenced. Sequence was aligned with sequences available in the gene bank. Sequence was also analyses for possible proteins and ORFs using the VNTI Advance11. Results showed that sequences had several stop codons, whilst the longest ORF has 137 proteins (415 bps) and one stop codon. Due to that reason, new forward and reverse primers with *Nco*I and *Nhe*I restriction sites were designed and PCR were carried out to amplify ORF (CDS). New PCR product was cut by *Nhe*I and blunt end by klenow fragment. The *Bst*EII is unique in the pCambia1301. A fragment was then inserted to a binary vector pCambia1301 at the *Nco*I and *Bst*EII sites. A vector expression containing 35S::JPG12ORF was constructed and transformed into *Agrobacterium*. Progress and future activities are discussed.

Root-knot Nematode Species, *Meloidogyne* spp., Can be Associated with Scabies Tuber Disease on Potato in Indonesia

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In Indonesia, Scabies Tuber *Disease* is a raising problem in potato cultivation. Until now the cause of the disease is not clearly known, so needs a comprehensive research. The identification of the pathogen were conducted at laboratory of Plant Nematology, Department of plant pest and disease, faculty of Agriculture, Universitas Padjadjaran; and Plant Virology, Department of Plant Protection, Faculty of Agriculture, IPB, involving conventional and molecular techniques. The research was conducted from Desember 2010 until July 2011. The results of conventional and molecular identification were found five species of RKN, namely *M. arenaria*, *M. falax*, *M. hapla*, *M. incognita*, and *M. javanica* can be associated with scabies tuber *disease* incidence.

Postharvest Product Management

Detection of *Listeria monocytogenes* by Conventional PCR Using DAS™ KIT BIOTECH-UPLB in Selected Raw and Processed Meat Products

Bhakti Etza Setiani

The Polymerase Chain Reaction (PCR) shortens the time duration of conventional microbiological methods used to detect food pathogens because of its direct use on pre-enrichment media or food products (Rijpens and Herman, 2002). This study was conducted at the Laboratory of National Meat Inspection Services, Visayas Avenue, Quezon City, Metro Manila, Philippines and the Food, Feed and Specialty Products Laboratory (FFSPL) in The National Institute of Molecular Biology and Biotechnology (BIOTECH), University of the Philippines Los Baños (UPLB). All the isolation and identification steps were strictly done under biosafety II laminar cabinet, considering *Listeria monocytogenes* as pathogenic bacteria. PCR detection was done on fifty seven samples from both cell lysis of *Listeria* Enrichment Broth (LEB), 225 mL of 1st level enrichment with 24 hours incubation time and 225 mL of VIDAS 1st level enrichment broth (LxB) with 24 hours incubation time, and 6 mL VIDAS 2nd level enrichment broth with 48 hours incubation time. In this study, the use of specific primers that were developed by BIOTECH UPLB had successfully detected the presence of *Listeria monocytogenes* from direct enrichment samples.

Effect of Low Temperature Storage on the Quality of Mango Fruits (*Mangifera indica* L.) cv. Gedong Gincu

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In this study, the changes in quality of mango fruits cv. Gedong Gincu stored in low temperature was examined and the chilling induced of mango fruits during storage was examined by the changes in the rate of ion leakage. The quality of mango fruits during storage was examined through the changes in firmness, total soluble solid, weight loss and visual appearance. The storage conditions was set at 8, 13 °C and room temperature. The results showed that the maximum value of

firmness for mango fruits stored at room temperature occurred at days 4. From the visual observation, mango fruits stored at room temperature remained in sound condition for up to 8 d. This showed that mango fruits were able to consume and physiologically those were on the optimum maturity during 4-8 d. The same value was achieved at days 14 for those stored at 13 °C. For mango fruits stored at 8 °C, there were no changes relatively until 20 d. Total soluble solid of mango fruits increased during its postharvest life which the value for those stored at room temperature was greater than that of 8 and 13 °C. For mango fruits stored at room temperature, the maximum total soluble solid was achieved at 4 d. The rate of ion leakage for mango fruits stored at 8 °C was higher than that at 13 °C, respectively. The increase in the rate of ion leakage indicates the chilling induced of cell membrane. For mango fruits stored at 8 °C, the slope of rate of ion leakage changed from 0.1533 at 0 d to 0.2121 at 4 d and decreased to 0.1720 at 8d. The different rate of ion leakage was found for mango fruits stored at 13 °C where the value was constant relatively until storage period of 8 d. From these findings it can be concluded that mango fruits stored at 8 °C beginning experienced chilling injury at days 4.

Development of Sweetpotato–Based Candies for Commercialization

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Sweetpotato is one of the most versatile nutritious crops available year round. It is rich in vitamin A, vitamin C, fibers and calcium. Consumption of sweetpotato provided 6–15% of the total RDA requirement for vitamin C, 3-5% vitamin A, 2-3% calcium, 1-3% iron, 1-2% energy, and less than 1% on protein. Promoting its commercialization is one strategy in helping reduce incidence of micro-nutrient deficiency. The study showed that product development involving consumers is important in developing quality attributes. It ensures that the products developed and marketed satisfy the needs and preferences of the consumers which is an important contributory factor in commercialization. The study showed that product development involving consumers is important in developing quality attributes. It ensures that the products developed and marketed satisfy the needs and preferences of the consumers which is an important contributory factor in commercialization. The sweetpotato based tamarind (camarind) and strawberry (camberry) candies has a sweet-sour taste. Specifically, camarind has a soft, leathery texture and seedless. Camberry has soft textural moistness. The quality of camberry was observed to change in three (3) months after processing. For camarind, the quality started to deteriorate eight (8) months after processing. At a selling price of P18.50/pack and a production cost of P13.55/pk and 14P.25/pk for camberry and camarind respectively, it can provide an estimated RCE of 36.51% and 29.82%, respectively.

Carbamates and Organophosphorus Pesticide and Residue Detection in Selected Vegetables from Benguet and Nueva Vizcaya: Its Implication to Food Safety and Farmers' re-Entry

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This research aimed to determine the presence of carbamate and organophosphate (OP) pesticides and residues in vegetables belonging to Cruciferae such as cabbage, Chinese pechay, and cauliflower from two Vegetable Provincial producers: La Trinidad, Benguet and Bambang, Nueva Vizcaya and distributed in Cauayan City Public Market using the colorimetric spot technique (Rapid Detection Kit) provided by the National Crop Protection Center, University of the Philippines, Los Banos, Laguna. Two factors were considered in this research: first the location where vegetables were produced (factor A.) and second, the type of vegetables (factor B). This study used the randomized complete block design in factorial with three replications to allocate treatments. The effect

of location and type of vegetables were both found to be not statistically significant on the amount of pesticide residue. Location and vegetable combination interaction had no statistical significance on the amount of pesticide residue. However, cabbage (T₁) was found to have the highest amount of organophosphate pesticide residue followed by Chinese pechay (T₂) and cauliflower (T₃). In terms of location or vegetable source, Benguet (S₁) showed the highest mean pesticide residue followed by Nueva Vizcaya (S₂). String beans, Baguio Beans and tomatoes registered positive with the carbamate detection kit. None of the treatments analyzed exceeds the safe level of toxic substances.

Animal Science and Husbandry

Effect of *Leucaena leucocephala* on the Feed Intake and Rumen Fermentation Parameter of Carabao and Cattle

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A study was conducted to determine the effect of *Leucaena leucocephala* on the feed intake and rumen parameter of carabao and cattle. Three ruminally-fistulated carabaos and cattle with *Leucaena leucocephala* (0, 6%, 12% of ration) were randomly allotted to treatments in a 2 x 3 Randomized Completely Block Design (RCBD). The amount of feed offered was 2.5% of live weight on DM basis at 60:40 roughage: concentrate in two equal parts at 800 and 1500 hrs. *Leucaena leucocephala* contained 4.6% (LQCC, 2008); 5.1% (Hess et al., 2007). Feed offered was recorded daily for each animal during the morning and afternoon while feed refusal was taken before morning feeding of the following day. Feed offered and feed refusal was analyzed in duplicate. The DM and CP content of feed samples and other samples were determined (AOAC, 1984); NDF content of the samples by Goering and van Soest, 1970 modified by van Soest et al., 1991). Rumen digesta sampling was manually done through the rumen fistula from the surface and deeper parts of the rumen. Sampling was done as scheduled based on the parameters to be measured. In this study, *Leucaena leucocephala* is not only a better source of tannin but also a source of dietary protein for the host animal without significantly effecting rumen pH, temperature and NH₃-N. Intake of DM, CP, and NDF in carabao and cattle was significantly decreased by LCT.

Antioxidative Effect of Antimicrobial Growth Promoters

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Restriction on the use of the antimicrobial as growth promoter (AGPs) in livestock production has prompted a search for the effective alternatives. However, none of the alternatives have been as efficient as AGPs. Thus, the knowledge about the mechanism of AGPs to improve the animal health and growth performance can be useful for searching the non-antimicrobial compounds with the similar effect. Anti-oxidative property is one of the possible hypothesis to explain the indirect effect of AGPs on gut health improvement. *In vitro* free radical scavenging activity of flavophospholipol on DPPH (2,2 diphenyl-1-picrylhydrazyl) radicals was investigated. Five concentrations of 4% flavophospholipol (50, 100, 150, 200, and 250 ppm.) were prepared by dissolution with methanol. The unpaired electron of DPPH radicals after reaction with AGPs was

detected by Electron Spin Resonance Spectroscopy. Results indicated that flavophospholipol had a free radical scavenging activity by decreasing the concentration of DPPH radicals. The 50% inhibition concentration (IC₅₀) of flavophospholipol was 154.8 ppm. or one ppm. of flavophospholipol was able to scavenge about 0.39 mole of DPPH radical. Furthermore, the *in vivo* study was conducted to confirm the anti-oxidative activity of flavophospholipol. Three hundred and twenty one-day old broilers (Ross 308) were divided into two groups with four replicates and consisted of 20 male and 20 female per each. The chickens were received one of the experimental diets (non-supplemented and supplemented with 5 ppm. flavophospholipol) for 42 days. The animals were kept under the housing condition recommended for the standard broiler production. Blood sampling were taken to measure the lipid peroxidation in serum in term of malondialdehyde (MDA) concentration. The *in vivo* result confirmed the anti-oxidative property of flavophospholipol, by decreasing the serum MDA concentration (P = 0.051) although the different was not significant.

Intensification of the Innovative Goat Production System for Sustainable Rural Enterprise Development in Region I, Philippines

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A development project implemented in Region I to transform goat raising from a subsistence type of farm activity into a profitable goat livelihood employing farmer participatory approach and technology based rural enterprises. One hundred ninety goat raisers served as farmer partners adopting housing, stall feeding and upgrading. A marked increase in growth and reproductive performance were registered. From an initial of 190 farmer partners, additional 271 additional raisers were encouraged to venture on goat enterprises. This covers 3 provinces, 14 municipalities and 45 barangays with nine (9) organized farmers association. Gender analysis accounted for 64.73% male farmer-partners and 35.26% farmer-partners. Farmers' knowledge, skills, attitude and social competence were enhanced. Increased farmers income was registered for a 10 doe level slaughter and 20 doe level breeder goat enterprise registered a monthly income of Php 1,836.33 and 5,899.33 with an ROI of 61.59% and 95.11% respectively. Beyond technology promotion thus, building sustainable goat enterprises through strengthened institutionalization effort of LGUs with organized and empowered rural communities, LGUs supported the expansion of the project and refocused their commodity priorities towards goat. As the project continues, goat raising is transformed from subsistence farming to vibrant and profitable enterprises.

Administration of Probiotics in Drinking Water on Growth Performance of Broiler

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Completely randomized design was conducted to investigate the effect of probiotics administration on the growth performance of broilers. Six hundreds one-day old chickens (Ross308) were divided into three groups with four replicates, which consisted of 25 male and 25 female per each. Broilers were kept in pen with 12 birds per square meter density in evaporative cooling house and were randomly received the experimental treatments. Effective microorganisms as probiotics such as *Lactobacillus* sp., *Bacillus* sp. *Pediococcus* sp. and *Saccharomyces cerevisiae* were used in two combinations, which were administrated through the drinking water at 1 ml/5 L compared with the non-treated group. Growth performance of broilers were studied in three period of growth (1-21, 22-35 and 36-42 day of age) and also in the whole period (1-42 day of age). In addition, the gut digesta were collected from at 10 and 21 day of age to measure the ammonia concentration as well as the

population of beneficial and pathogenic bacteria. Probiotics administration had the significantly effect on the body weight gain as well as the feed conversion ratio of broilers compared with the non-treated group. Especially in stress condition such as in period 1-21 and 36-42 day of age, the advantage of probiotics administration was clearly appeared by the highly significantly improvement of growth performance. The increasing of the beneficial microorganisms in gut as well as the reduction of ammonia concentration promoted the animal health and improved the nutrient utilization which caused the better growth performance in consequence.

Application of Lemongrass Volatile Oil Product for Controlling Mastitis in Dairy Cattle

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Mastitis, an udder bacterial infectious disease, is one of the most important diseases found in every dairy farm, causing high economical loss. One of the most important bacteria causing mastitis is *Staphylococcus* spp. Normally, treatment of this kind of bacterial mastitis is by intramammary infusion of appropriate antibiotics. However, to prevent the infection is advised and more practical. In Thailand, the prevention of infection in milking cows is performed by treat dipping with iodine solution after milking, which will be limited in the near future. The use of herbal product is common nowadays, not only for dairy farmers, but also for field crop farmers. Lemongrass (*Cymbopogon citrates* (DC.) Stapf) comprises 75.20% of citral, 9.82% of linalool and 4.37% of geraniol. The product of 1% lemongrass volatile oil is able to eradicate the prior bacteria causing mastitis, *Staphylococcus aureus*. Reducing antibiotics used through food safety concern, lemongrass volatile oil product for preventing infection of udders in milking cows is applied. The efficiency of bacteria eradication by using 1% of lemongrass volatile oil (product) is investigated *in vitro* using minimum inhibition concentration (MIC) and minimum bactericidal concentration (MBC) tests. Results revealed that lemongrass volatile oil product of 100%, 50%, 25%, and 12.5% can inhibit the growth of *Staphylococcus aureus*. In addition, *in vivo* study by swabbing the teats immediately after milking and 30 min. after post-milking teat dipping with lemongrass volatile oil solution was investigated. All swabs collected from 10 cows (40 teats) were negative. No *Staphylococcus aureus* was identified from all swabs. No significant difference was found between *Staphylococcus aureus* MPN in milk samples collected before and after the use of lemongrass teat dipping. Therefore, application of 1% lemongrass solution could be advised for controlling intramammary bacterial infection in dairy cattle.

Supplementation of Crude Extract Product from *Psidium guajava* L. Leaves in Broiler Diet

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One thousand-three hundreds and eighty one-day old broilers (Ross 308) were used to study the potential of crude extract product from *Psidium guajava* L. for using as the alternative for antibiotic as growth promoter. Feed additive product was prepared from ethanol extract of *Psidium*

guajava L. leaves and contained 1.17% quercetin. Completely randomized design was conducted and the animals were divided into six groups with five replicates, which consisted of 23 males and 23 females. The chickens were randomly fed one of these experimental diets for 42 days: basal diet, basal diet supplemented with 5 ppm. Flavo-phospholipol as positive control and basal diets supplemented with 20, 30, 40 and 50 ppm. crude extract product from guava leaves, respectively. The animals were kept in pen with 12 birds per square meter in evaporative cooling house, where feed and water were provided *ad libitum*. The body weight and feed intake were collected in three period of growth (1-21, 22-35 and 36-42 day of age). Results showed that dietary supplementation of crude extract product from guava leaves had significantly effect on the growth performance of broiler in period 22-35, 36-42 day of age (DOA) as well as the whole period of feeding (1-42 DOA). Weight gain as well as the feed conversion ratio were highly significantly improved ($P < 0.01$) by supplemented with 20 ppm guava leaves extract product compared with the non-supplemented group. However, the dose response was observed with more than 30 ppm inclusion rate of guava leaves extract product providing significantly detrimental effect ($P < 0.05$) on the growth performance of broiler. Furthermore, comparing with the antibiotic as growth promoter group, the broilers fed diet containing 20 ppm extract product from guava leaves showed the better growth performance in period 22-35 and 36-42 DOA. Thus, the feed additive product from *Psidium guajava* L. leaves can be used as natural growth promoter for broiler and the proper inclusion rate is 20 ppm.

Screening of Plant Extracts on *In Vitro* Anti-Coccidial Sporulation of *Eimeria tenella*

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Eimeria tenella has recognized as a significant protozoan parasite disease in commercial broiler production. Due to the less effective against coccidia of chemical disinfectants, the coccidiosis is controlled with the preventive drugs. However, the drug residue issues in animal products lead to the preventive drugs banned in recently, so the new effective alternatives are necessary. Plant extracts can be a potential choice due to their antimicrobial property. The aim of this study was the evaluation of the anti-coccidial sporulation of some plant extracts, which their antimicrobial activities were reported. Efficacy of 15 different plant extracts as following *Boesenbergia pandurata* (Roxb) Schitr., *Ocimum basilicum* L., *Suaeda maritime* Dumort., *Acacia pennata* L., *Leptonycnia heteroclite* Kurz., *Basella alba* L., *Spenoclea zeylanica* Gaertn., *Neptunia oleracea* Lour., *Flagellaria indica* L., *Glinus oppositifolius* Ktze., *Trianthema portulacastrum* L., *Sesuvium portulacastrum* L., *Musa sapientum* L., *Cymbopogon citratus* Stapf. were preliminary screened and only the potentially plant extracts were further evaluated about the effective concentration. The results showed the strong anti-coccidial sporulation of oil extracts with steam distillation from fingerroot (*Boesenbergia pandurata* (Roxb) Schitr. and sweet basil (*Ocimum basilicum* L.), whereas the other plant extracts were no or less active against oocysts sporulation. The exponential correlation between the oocysts sporulation and the concentration of plant extracts were found and the 50% inhibition concentration (IC₅₀) of fingerroot and sweet basil oil extracts were 151.78 µg/ml and 66.79 µg/ml, respectively. These results may have significant implications for the future development of fingerroot and sweet basil oil as an anti-coccidial agent. However, the *in vivo* study should be further investigated to confirm effectiveness.

Study of Essential Oils Administration in Broiler

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Six hundreds one-day old broilers (Ross 308) were used to investigate the effect of essential oils contained eucalyptus oil, mint oil, thyme oil and L-menthol on the growth performance and feed efficiency during three periods of growth (1-21, 22-35, and 36-42 day of age). Besides the productive performance, the anti-oxidative as well as anti-inflammatory properties of essential oils were also evaluated. The animals were assigned to two groups with six replications which consisted of 25 male and 25 female per each. The chickens were randomly received the experimental treatment, which were the control group and the essential oils-administered through the drinking water at 1 ml/10 L. group. The stocking density was 12 birds per square meter and broilers were kept in the evaporative cooling house, where the inside temperature of 28-30 °C and a light/dark cycle of 23:1 were maintained throughout the 35 days experimental period (from 15-42 day of age). The feed and water were supplied *ad libitum*. Results showed that the growth performance and the feed efficiency of broiler in period 1-21 and 22-35 day of age were not affected by administration of essential oils ($P > 0.05$), whereas the body weight gain and feed conversion ratio of treated group in period 36-42 day of age were improved about 11.9 and 6.7 percentage compared with the non-treated group. Additionally, supplementation of essential oils provided the significantly improvement of health and height of villi from jejunum, especially at 15 day of age. However, the anti-oxidative and anti-inflammatory properties of essential oils in term of lipid peroxidation in serum (TBARs concentration) and the score of tracheal lesion, respectively, were not clearly found in this study.

***In Vitro* Anticoccidial Sporulation and Antibacterial Activity of Synthetic Camphor**

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Coccidiosis is a parasitic disease that can cause severe losses in poultry production, caused by a one-celled parasite of the genus *Eimeria*. Besides, the pathogenic bacteria such as *Escherichia coli* and *Salmonella* spp. can be contaminated in animal products and cause the zoonotic disease. Normally, the chemical disinfectants in single or combination are used to control these microorganisms in animal housing and equipments, but they are not effective against coccidia because of their life cycle. Thus, the search for the effective anti-coccidial and anti-bacterial compound is needed. Due to the anti-microbial property of the essential oil such as synthetic camphor, the anti-coccidial and the anti-bacterial activity properties were evaluated. Camphor solution was prepared by dilution with ethanol, tween 80 and distilled water in ratio 1: 3: 2: 94. The result showed that synthetic camphor had a potential to inhibit the oocyst sporulation from *Eimeria tenella* *in vitro* study and the 50 percentage inhibition concentration (IC_{50}) was 0.0245 mg/ml. Furthermore, camphor was active against all selected food related bacteria. The minimum inhibition concentration (MIC) against *Escherichia coli*, *Salmonella enteritidis*, *S. typhimurium*, *S. infantis*, *S. hadar* and *S. virchow* were 5 mg/ml. These results support the notion that synthetic camphor may be an effective disinfectant against coccidia and zoonotic bacteria for poultry production.

Native Chicken (*Gallus gallus domesticus*) Management Practices in Selected Upland Barangays of Tanay, Rizal, Philippines

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In the Philippine scene, native chicken is commonly raised in backyards. It is the farmers' main source of protein. It is preferred to serve in the table for its incomparable taste. Increase production through improved management practices was the objective of this study. Outputs are beneficial to different government agencies, chicken meat and by product processors, and the farmer-raisers himself. Farmers raised chicken for home consumption and sell for additional income. They had long experience in raising and bred own stocks. Chickens were kept in semi-range/confinement. Feeds given were corn, rice bran, *sapal ng niyog*, kitchen discards and grasses. Hens lay eggs 3 to 4 times per year and 11 to 15 eggs per laying. Naturally incubating eggs for 21 to 23 days and brooding chicks till weaning. Hens layed eggs somewhere in the area, then come back with newly hatched chicks, which was a unique observation. Their low production up to consumable-marketable age is because the fowls were stolen or eaten by astray animals; got sick and had parasites, since farmers do not vaccinate and deworm the animals. They fence the area to keep the animals away from the thieves and use herbal medicinal plant for treatment of diseases and parasites. Undergo training on the proper care and management of raising to enhance higher production of this indigenous fowl is recommended to the farmer-raisers.

Sustaining Anoa (*Bubalus sp.*) as Prospective Meat Resources by Using Feeding Technology Processing in the *Ex Situ* Area

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Anoa is a prospective animal that has the potential to developed as a meat-producing animal livestock. Anoa advantages include the ability of local resources' utilization, climate adaptation and resistance to disease. This animal has the potential to be a potential of germplasm stock in the future. The research aims to help *ex situ* conservation of anoa (*Bubalus sp.*) Particularly through an efficient feeding. The data obtained were used as supporting data in conservation and use of anoa as a livestock. Materials research is a common type of feed given at preservation locations (Ragunan Jakarta Wildlife Park [RJWP]) which was feeded in form of fresh crops, hay and wafer and also three anoa that belongs to RJWP. Alternative feed preferences known by the method of cafeteria feeding. The observed variable is the total amount of consumption of each feedstuff, total collection of faeces, the amount of nutrient intake, eating behavior including eating period, feeding preferences and the period of rumination. Data were analyzed descriptively. Wafer is the result of feed processing technology with feedstuffs nutrient measured that can be given to the anoa concerning *ex situ* conservation and cultivation. General conclusion recommended that technology of wafer processing can be applied for anoa *ex situ* conservation efforts and its utilization as an animal that can be cultivated. Feeding behavior of anoa showed the majority is used for eating and drinking (29.51%) and rumination (29.17%).

Growth and Feed Cost of Native Pigs Fed *Trichantera* (*Trichantera gigantea*) in Partial Replacement of the Conventional Diets

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The Philippine Native Pig maintains its niche in the demand for a Filipino delicacy called “lechon” because of taste and crunchiness. But commercializing native pigs is constrained by high cost of feeds. So, this study was conducted to evaluate the performance of Native Pigs fed *Trichantera* foliage replacing different levels of their commercial diets. Nine native pigs were used for three treatments and three replicates in a Completely Randomized Design: (T₁, 100% commercial rations; T₂, 85% commercial rations+15% *Trichantera* and T₃, 70% commercial rations+30% *Trichantera*). Replacing the commercial rations with different levels of *Trichantera* did not significantly affect the weight gains of native pigs. On the other hand, the feed efficiency improved significantly ($P < 0.05\%$) with the 15% and 30% replacement of *Trichantera* and were different between any two treatment means. The cost of feed per kilogram gain in weight was highly significant ($P < 0.01\%$) and were different between any two treatment means; the increasing level of replacement of *Trichantera* recorded a decreasing feed cost per kilogram gain in weight. It is concluded that Philippine native pigs can be grown with better feed efficiency and lower feed cost per kilogram gain using *Trichantera* to replace up to 30% of the commercial rations.

Avian Diversity in Agricultural Areas in North-East Luzon, Philippines

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Field surveys were conducted in agricultural areas in North-east Luzon, Philippines to infer species present in this type of ecosystem. Survey methods include transect walk, point-count, and mist-netting. A total of eighty four (84) avian species in thirty eight (38) families were identified, of which fifteen (15) species were endemic (28.84% end.). Extensive rice and corn farms interspersed with grassland areas lying in between communities and the forest accounts to the numerous representative species inhabiting this type of ecosystem. Lowland agricultural areas exhibit higher species richness but lower endemism. Upland agricultural areas however have lower species richness but a higher percentage of endemic birds. As to the conservation status of birds as per listed in IUCN, a species is critically endangered (*Pithecopaga jefferyi*), one (1) is near-threatened (*Buceros hydrocorax*), one (1) is vulnerable (*Anas luzonica*) and the rest are of least concern. Though the present faunal species are still diverse, activities such as overhunting for food and pet trade impacts negatively on biodiversity in general. Other threats to bird diversity were swidden or slash-and-burn farming and small-scale logging due to the resulting habitat loss especially for site specific species. The effect of adopted agricultural practices by farmers in the area on bird diversity should be studied in detail. Biodiversity conservation should be taken into account when formulating and implementing management system especially for this type of ecosystem.

The Fishery for Macro-Invertebrate Gleaning in Catanduanes

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An assessment of the fishery for macro-invertebrates gleaning in Catanduanes side of Lagonoy Gulf was undertaken to document relevant information about gleaning fisheries. Rapid Resource Assessment (RRA) with survey questionnaire was used in the study. This was supplemented by data from actual gleaning field work and key informant’s interview. Results showed

gleaning as traditional practice of women with other family members. It is a subsistence fishing activity in shallow reef flats, mud flats, sand and rocky areas, sea grass including mangrove areas. Species caught include mollusks, crustaceans and other invertebrates. Fishing methods employed are simple such as bolo plastic strainer, metal scraping tools and other improvised harvesting tools. From economic standpoint, gleaning is treated as food source and additional income. Monetary benefits derived reveal an estimated annual average production of 26.748 tons valued at PhP 534,960.00. This translates roughly to PhP 704.20 per month or PhP 8,450.40 annual income per gleaner on the average. Since the activity use simple tools, exploited species are given time to regenerate with minimal impact. However, because invertebrates are lower down the food chain and are potential feed for larger species, the practice may result various forms of overfishing. In-depth studies along biodiversity conservation; management; health and safety hazards are recommended.

Socio-economic and Technological Assessment of Sustainable Agriculture

Factors Affecting Fluctiation of Exchange Rate: An Implication to Indonesian Trade Policy

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Managed floating exchange rate has been widely used by the Central Bank of Indonesia in a response to strong demand for more stable exchange rate. However rupiah recently experiences a strong position due to relatively high return in capital market as foreign investors change their investment portfolio by buying more assets in Indonesia. However this appreciation of rupiah would depress exports of agricultural products at the world market as a relative price of Indonesian product is perceived more expensive by foreign consumers. To investigate the factors affecting such rupiah appreciation, a Vector Error Correction Model is then applied for monthly data. A relative Gross Domestic Products of Indonesia to the United States reflecting a difference of demand potentials affect to what extent rupiah encounters appreciated or depreciated. Pro-long economic recession in the US would hamper Indonesian exports as rupiah appreciates. This is because rupiah appreciation leading to a change in relative interest rate in Indonesia would attract more foreign investors to re-allocate their investment.

Forecasting Methods of Spot Palm Oil Prices: Comparative Techniques

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The paper describes with a discussion of an outline of the research methodological issues of the short-term *ex-ante* forecasts of econometric models include single equation model and multivariate autoregressive–moving-average (MARMA) model (composite model), and the univariate model of autoregressive-integrated moving average (ARIMA) (Box-Jenkins model) of spot palm oil price using futures price in the Malaysian palm oil market. Both econometric models and the univariate model (ARIMA) were utilized using monthly data from January 1980-December 2010 as estimation period and data from January 2011-June 2011 was used as an *ex-ante* forecast. The time series model is estimated using vector error correction method (VECM) and co-integration method for residual error correction. The objective of the study is to compare the forecasting models accuracy between econometric models and the univariate model of ARIMA of spot palm oil price. Comparative forecasting models accuracy between single equation model, MARMA model and univariate model of

ARIMA, were made in terms of their estimation accuracy based on RMSE, MAE, RMPE and U-Theil criteria. The results revealed that MARMA model is more accurate and efficient measured in terms of its statistical criteria than single equation model and ARIMA model in forecasting the spot palm oil price using futures price in the next 6 months or so.

Foreign Trainees as Labor Force on Agriculture in Japan, The Characteristics and the Issues of the System for Foreign Trainees

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Japan had started the Industrial Training and Technical Internship Program System (ITTIPS) since 1993 in order to help the developing countries improve their human resource training and to let employers quit employing illegal immigrants. Japanese International Training Cooperation Organization (JITCO) managed contracts between farmers and trainees when farmers want to use foreign labor force. The system requires the farmers to deal with foreigners as not 'labor' but 'trainee.' The objectives of this study are, firstly, to overview the history of the system for foreign trainees on agriculture in Japan, and then secondly, to analyze actual activities of farmers who bring in foreign trainees. Finally, this study attempts to reveal the characteristics and the issues of the system for foreign trainees in Japan. The survey was conducted in Ibaraki prefecture where farmers bring in a lot of trainees for a long time and Yame district, Fukuoka prefecture where there is only short history about foreign trainees on agriculture. The main conclusions of this study are as follows. Firstly, this study came out some conditions for farmers to bring in foreign trainees. Secondly, this study revealed the advantages and disadvantages of the system for foreign trainees.

Economic Performance of Different Planting Density in Oil Palm Plantation

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A detailed farm management study was conducted on oil palm production under a Nucleus Estates Smallholders Scheme (NESS) and Non-NESS in Tembilahan and Sungai Piring Villages in Riau Province, Indonesia, in 2010. The number of farmers studied was 52 and 68 in both villages respectively. This paper presents an examination of financial returns from oil palm trees in relation to the planting density in order to determine the optimal planting density. Using the cases of four year old trees for both types of farmers, we compared the planting density, yield, cost, and income for oil palm production. Average planting density was 143.33 and 125.78 tress per ha for NESS and Non-NESS farmers respectively, which appeared to result in different yields. The NESS farmers obtained 8.53 tons of palm oil and 3,445,678 rupiah of net income per hectare basis, while the corresponding figures for non-NESS farmers were 7.92 tons and 2,589,005 rupiah. Our analysis revealed that the maximum income (3,952,250 rupiah/ha) was obtained from a planting density of 143 tress/ha for NESS farmers, and 2,910,375 rupiah from 124 trees/ha for non-NESS farmers. Therefore, it is clear that the planting density of 142-144 palms/ha should be introduced in order to maximize Net Present Value (NPV). The production cost of FFB (Fresh Fruit Bunches) by non-NESS farmers was higher than NESS farmers. For non-NESS farmers, the production cost was Rp 6,450,821/ha/yr whereas for the NESS farmers, the production cost was Rp 5,028,972/ha/yr for that year. The highest cost component for NESS farmers was fertilizer and its application, which amounted to Rp. 1,607,682/ha/yr. this constituting 32.8% of the total production cost. The second important cost item was transporting 21%, followed by upkeep 20%, harvesting 18% and other expenses 8%. The highest cost component for non-NESS farmers was harvesting and collecting, which consisting 30.9% of total cost. The second was fertilizer 30.2%, followed by upkeep 19%, transporting 18% and other expenses 2.9%. This study indicates that a lower or higher density than 143 trees/ha does not maximize income.

For production cost section, it is clear the farmers must be given extension services to educate them on the proper agronomic practice and extra fund with easy payment to encourage them.

Marketing Efficiency of Mangosteen: Case Study in Bogor, West Java, Indonesia

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Horticulture sector plays an important role in Indonesian economy, especially in agriculture sector. In horticulture sector, tropical fruits are prioritized as the export earning. Among the tropical fruits, mangosteen contributes high export value to tropical fruit export earning of the country. It is exported to some countries such as Taiwan, Japan, Hong Kong, French, Saudi Arabia, China, and Netherlands. As fruits can be categorized in the high growth export, thus, fruits, mangosteen in particular, can be one of the opportunities to increase export earning. Therefore, it is important to analyze current marketing efficiency of mangosteen in order to increase its competitiveness in the global market. The specific objectives of this paper are (1) to clarify the existing marketing channels of mangosteen in Bogor, West Java, Indonesia, and (2) to investigate the actual farmer's share, marketing margin, and profit-cost ratio of mangosteen in Bogor, West Java, Indonesia. Questionnaire survey was conducted to mangosteen farmers in Karacak Village, Leuwiliang Subdistrict, Bogor District, West Java, where it is one of the most mangosteen producing areas in Indonesia, contributing around 37.58% of the total national mangosteen production. In-depth interview was also conducted to mangosteen traders and exporters in Bogor. The survey conducted from August to October 2011. This study has identified the marketing channels and marketing efficiency of mangosteen in terms of farmer's share, marketing margin, and profit-cost ratio in Bogor, West Java, Indonesia.

Socio-economic Determinants and Farmers' Perception on Land Degradation in Northern Laos

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The economy of Lao is based on agriculture. Land use has effected on the livelihood of rural populations through agricultural practices. Land degradation is regularly associated with land use practices and socio-economic factors. Without understanding farmers' perception on land issues, sustainable management of land resources is impossible because they have intimate knowledge on their land. Therefore, the objectives of this study are to find famers' perception on land degradation and to examine the socio-economic determinants of land degradation in the study area. The data was carried out during September 2010. Face to face interviews were conducted from a total of 98 maize farmers that were randomly selected from 8 villages identified as maize growing zones of Bokeo Province, Laos. The logistic regression analysis was used to estimate the socio-economic determinant on land degradation and farmers' perception on the status of land degradation in northern Laos. This study is the first to report to study on determinant of land degradation of maize farmers in Laos. The model predicted eight determinants of land degradation in the study area have positive significant and five determinants are negative significant with land degradation.

Impact of Agricultural Extension Education on Elementary School Level Cocoa Farmers: Acopagro Cooperative-Case Study

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Better education can improve the efficiency of agricultural production. In the Peruvian jungle, there are two main cocoa marketing channels: the cooperative and the intermediaries. The cooperative transfers agricultural technology to the members by means of their agents whilst the intermediaries do not offer any extension service to the farmers. This study analyzes 1) the effect of receiving agricultural extension education on the cocoa production volume and 2) the education level of farmers who are willing to leave the intermediaries as their usual marketing channel and shift to the cooperative. A survey of 140 farmers who commercialize through the intermediaries and 103 Acopagro cooperative members respectively was carried out between December 2009 and January 2010 in Juanjui, San Martin, the main cocoa production area in Peru. Results confirm that being a member of Acopagro cooperative impacts favorably on the cocoa production quantity due to the agricultural extension education they receive. Moreover, non-associated farmers who have elementary school level as the cooperative members are willing to belong to the cooperative in the future. The Acopagro cooperative should continue to support the adequate training and supervision of the communities' agents. Consequently, they can be highly motivated to provide research knowledge and technologies to the cocoa farmers for being competitive in the market.

On Improving the Triple Bottom Line Returns: The SAFEST Way

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The SAFEST project is the CFEM's "ride-on" Community Participatory Action Research project with overall aim to demonstrate the acceptability, viability and adoptability of some ecological farming systems (organic, natural and conservation farming) that can address upland farm households' concern for production of "safe" food and cash under "safe" agroecosystems on a sustainable basis. It is in response to the calls of the following: (1) The Kyoto Protocol: Reduction of Emission from Deforestation in Developing Countries (REDD) and Land-use, Land-use Change and Forestry Activities (LULUCF); (2) United Nations' Millennium Development Goals; (3) The Philippine Strategy for Sustainable Development (PSSD); (4) Order 481 of 2005, entitled "Promotion and Development of Organic Agriculture in the Philippines;" and other environmental laws of the Government of the Philippines. In each of the six 1-hectare mango-based crop-livestock integrated farm in marginal or sub-marginal farm land, the observable triple bottom-line returns include the following: 1) the socio-cultural aspect: transformation from subsistence farmers to business farmers, shift from unsustainable to sustainable practices, individual health being freed from exposure to disease-carrier animal manures, food safe from side effects of inorganic fertilizer, a shift from major to minor construction materials, a variety of nutritious food/feeds, safe potable water/farm irrigation water needs, and access to social services through road construction; 2) the economic aspect: transformation from consumerism and subsistence farming to entrepreneurship, increased income from crop-animal production, lower cost of inputs, income from conversion of agri-wastes and/or lesser-used resources into useful culture media & bio-organic fertilizer (BOF), increased soil productivity, increased effective land area, increased effective rainfall, efficient/effective production system, and, access to business/ finance/ marketing services; and 3) the ecological aspect: transformation from unsustainable/conventional agriculture to sustainable agriculture, reduction of serious nutrient use imbalance, environmental health with agroecosystems *safe* from toxic chemical

residues, solid waste management system, reduced CO₂ from burning, reduced CH₄ from decomposition, reduced emission from deforestation, carbon sequestration, reduced soil erosion/landslide, and biotic balance and/or integrated pest management system.

Environmental Risks and Their Impact on Food Security

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The relationship between ecosystems and livelihoods is changing in fundamental but poorly understood ways as economic systems diversify across rural-mixed economy-urban spectrum. Intensification of industries and rapid processes of urbanization are leading to increasing demands on and decreasing quality of water- and forest-based ecosystems and limiting access of the poor to resources that are critical for them to meet their livelihood needs. The case study in the Silang-Sta.Rosa sub-watershed areas provides some understanding of the interactions between people and institutions within their given natural environment. The major issue confronting the people in the area is how they would be able to improve, protect and expand their current resource base or level of acquirement given the different types of risks facing them. The risks in the upstream areas include soil degradation and the inefficient farm production system that lead to low farm productivity. Given very limited sources of entitlements, the incidence of poverty and food insecurity as well as health risks are also high due to the unsafe or unhealthy environment associated with pollution from farm and household domestic practices. In the downstream areas, households face issues related to poverty such as low income from declining fishery resources, food insecurity, and pollution from upstream as well as downstream areas that threaten their livelihood and increase the incidence of water-borne diseases. To address these concerns, it would be important to engage the different stakeholders in coming up with an integrated development plan that would reflect their common interests and vision for the watershed area.

Understanding and Conserving Indigenous Knowledge on Sustainable Natural Resource Management in the Cordilleras Administrative Region of the Philippines

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The Cordilleras Region of the Philippines has a rich diversity of indigenous knowledge on sustainable resource management. It is the basis for agriculture, food preparation, health care and environmental conservation. This paper aims to integrate the lessons learned from the local people's knowledge on natural resource management. Strategic options on environmental communication and education will be drawn from these findings. Natural resource management strategies practiced by various communities were documented using a variety of Participatory Rural Appraisal (PRA) tools and literature survey. Some of the practices in the Cordilleras like *Muyong* by the Ifugao's and *Batangan* in Mountain Province have sustain the lives of the people by providing steady source of food, construction materials, firewood/fuel and medicine while maintaining forest biodiversity in the region. Shifting cultivation, known as *Uma* system or patch farming, is a traditional crop production system practiced in the Cordilleras to rejuvenate soil fertility. Another indigenous soil fertility management practice in the Mountain Province is *Payew* where sunflower cuttings is incorporated and allowed to decompose in the rice paddy fields during the rice growing season. Natural resource management practices in the Cordilleras have sustained the diversity of forest resources and lives of

the local people. Policy makers, scientists and researchers must recognize and include the role of local people's knowledge in management decisions of the country's fragile environmental resources. Development of information exchange campaign (IEC) materials translated into local dialects is vital so that other communities can learn from these indigenous practices.

Innovation Capacity of Entrepreneurial Farmers: A Case Study in West Java, Indonesia

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Emerging domestic and international markets for horticulture products in Asia provides opportunities for farmers to move from cultivating traditional products to produce high added-value products. This study investigates factors influencing the innovation capacity by vegetable farmers in West Java, Indonesia. We conducted in-depth interviews to focus on the case of the vegetable farmers who are linked to modern markets, such as export markets and local-modern retails. Our study shows that vegetable farmers do either innovation creation or innovation adoption to improve their product quality or to reduce their production costs. Entrepreneurial behavior underlying farmers' decisions on applying innovations are proactiveness and risk-taking behavior. These farmers show their proactiveness in searching new information, learning new knowledge, and being first in markets. Calculative risk-taking behavior is indicated by market diversification and collaboration with fellow farmers. These innovative and entrepreneurial farmers gain growth in farm assets and market sales as their business performance. The empirical case of the vegetable farmers in West Java suggests that working in a group allows farmers to create or adopt more innovations and to reach more markets.

Salt Farm Workers' Well-being as Influenced by the Nature of their Participation in Salt Production Enterprise

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The study was undertaken to determine the effects of participation on the productivity and well-being of salt farm workers in salt-based farming communities in San Jose, Occidental Mindoro, Philippines and its implications to policy formulation. Fifty-three salt farm workers were randomly selected from two barangays consisting of six (6) salt farms with an area of 115 hectares with 87 salt farm workers. Findings showed that the degree of participation of salt farm owners as stakeholders in salt farming was generally high in terms of administrative, technical, livelihood, advisory, extension, and financial support services. The nature of participation of salt farm workers in various management activities in salt farming was observed to be under a pseudo type of participation, particularly in the aspect of problem analysis, goal setting; decision-making and policy formulation with very slight inclination towards assistencialism. The salt farm workers perceived their state of well-being as generally moderate but were high in so far as domains of well-being such as employment and quality of working life, psychological health, information/knowledge, political participation and performance of the government in the maintenance of peace and order. The nature of participation of salt farm workers affected their productivity in terms of income, average yield and their well-being. Socio-demographic and economic factors such as years in farming, employment arrangement, annual income, technological factors such as source of technology, willingness to change technology, characteristics of technology, and skills and institutional factors namely policies, and employment arrangement influenced the degree of participation in the salt-based farming communities studied.

Land Tenurial Situation in Relation to Rice Production in Three Villages in the Red River Delta, Vietnam

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Red River Delta is one of the main rice producing regions in Vietnam. With large variations in natural conditions, the Red River Delta is suitable for development of different types of crops and animals. In recent years, the importance of fisheries, aquaculture and fruit trees have been increasing. With an average farming area per household in Red River Delta being 0.28 ha (2005), land is a limited factor to generate sufficient income. Most farmers resort to diversifying their farm to high quality crops such as vegetables, fruit trees, and livestock for urban markets, or engaging in non-farm activities. The result of this trend is the emergence of tenancy among farmers. This paper focuses on the clarification of the current land tenure systems and the existing tenancy contracts among farm household in agricultural production in relation to rice production of three villages in the Red River Delta, Vietnam. A series of questionnaire survey was conducted in 2010-2011 in village of Hung Yen, Bac Ninh, and Hai Phong Provinces which are located in Red River Delta in the North of Vietnam. Main finding of the research is the flexible of agricultural land tenurial situation. There is increasing area of non rice production with the appearance of difference kinds of tenurial status in difference village. The tenurial status changes as the age of farmers, indicating the life-cycle of farmer economic behavior. There is heavy dependence upon kinship ties in landlord-tenant relation. The production function analysis and marginal productivity analysis reveals that land and fertilizer are being used beyond its optimum level, while more labor and other material factor could profitably be employed in order to increase rice production.

Enhancing the Indigenous People's Capacity in Biodiversity Conservation and Sustainable Livelihood for Food Security in the Uplands

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The paper highlights the experience of Occidental Mindoro State College (OMSC) in working with the indigenous people (Buhid Mangyans) in a collaborative extension program, called the Poverty Alleviation Promotion thru Environmental and Livelihood Program for the Buhid Mangyans (PAPEL Buhid). The program was designed to help rehabilitate and conserve upland resources and generate alternative sustainable livelihoods. The program addressed the most pressing problems identified by the Buhids such as poor health, low farm productivity and income, and environmental degradation. The activities revolved around building the capacity of Mangyans in natural resource management and various livelihood options. These included establishment of a community nursery for forest and fruit-bearing trees and herbal plants; establishment backyard vegetable garden, and planting of mahogany, banana, and coconut trees in the periphery of the village. The Mangyans were also trained on handicraft making, organic fertilizer production, seedling grafting, and practical cooking. Seminars on health and nutrition, parenting, and values orientation were conducted. Jingle making and singing contest with a theme on biodiversity conservation for the Buhid school children was done in cooperation with their teachers. This paper proves that an academe-indigenous people partnership in development program is possible provided that it is people-initiated and urgent need-driven. In addition, cultural sensitivity and transparency help build trust and confidence with partners. Initial accomplishments of the program were the cultivation of idle lands, practice of organic agriculture, adoption of appropriate upland technologies, generation of livelihood, increased awareness on environmental conservation, and building of greener and healthier village.

Assessment on Durian GAP Development Participation in Eastern Cultivated Areas, Thailand

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This investigation aimed to determine 1) the participation of certified growers on durian good agricultural practice (GAP) development, 2) some factors affecting their participation on durian GAP development, and 3) constraints and recommendations on durian GAP development. The studied sample was selected 71 orchards certified durian growers in eastern cultivated areas, Thailand. In depth interview scheduled was obtained to collect data. Descriptive statistics was presented in percentage and arithmetic means. Inferential statistics to test the hypothesis was Pearson product moment correlation coefficient. The reliability discrimination measurements on durian GAP development participation were obtained in three aspects including making decision participation, implementation participation, and assessment participation. Discrimination of farmer capability on durian GAP development participation was determined through Cronbach's alpha with the reliability of 0.95, 0.96, and 0.97, respectively. The findings revealed that most respondents strongly agreed to participate in making decision, implementation and also assessment in all 13 proposed main items. In addition, most respondents moderate agreed in 2 main proposed items including pest management and record keeping. Testing hypothesis pointed out that there were positive statistically significant between cultivated areas, number of marketing channels, number of group belonging, number of household labor force, and farmers' knowledge in durian innovation with their participation on durian GAP development. Most constraints were limitation of their times. Implementation oriented promotion should be concerns in applicable guidelines through appropriate practices.

Promoting Good Management Practices in the Production of Local Banana Cultivars Among Small Scale Growers through Various Information, Education, and Communication Approaches

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There is much room for productivity improvements in local banana production of small hold growers. However, existing traditional practices need to be given up in favor of S&T-based technologies following a "best bet" banana package of technology (POT) developed by PCARRD-DOST and patterned after the plantation-type management of Cavendish cultivars. The project promoted the POT for farmers' adoption through interpersonal and mediated IEC approaches in the provinces of Quirino, Oriental Mindoro and Cavite. Traditional banana growing practices of chronic neglect and undermanagement promote the spread of pests and diseases, thus productivity in these important banana producing areas remain low and below the world average of 15t ha⁻¹ yr⁻¹. A total of 30.5 ha of demonstration farms was established consisting of 15 hectares of Lakatan, 7 hectares of Latundan and 8.5 hectares of Saba involving 23 farmer-cooperators. Interpersonal IECs were provided to selected farmer cooperators (FCs) through training, technical and materials assistance in farm establishment, and regular technical support. The use of tissue-cultured planting materials, high-density, systematic planting system and fertilization were uniformly adopted by FCs. Almost all FCs were able to influence other farmers to practice various POT components. The mediated IEC strategies consist of six printed comics, a printed POT guidebook and its video version. The formats were decided based on the preferences of the respondents in the baseline survey while the contents

answered common problems and concerns experienced by the FCs. The comics were of two genres, a “fantaserye” featuring a superhero named “Super Saging” who helps farmers solve technical problems and “realistic” storylines inspired by the FCs dealing on the POT and on mite control. The banana guidebook in Filipino and its complementary video version contained the topics of interest to growers and would be useful in building local capacities on good management practices in other banana growing areas.

**Capacity Building of the Buhid Mangyan Women in San Jose, Occidental Mindoro
Through Community-Based Livelihood Options**

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Poverty is a phenomenon among the country’s indigenous peoples (IP’s) like the Mangyans of Occidental Mindoro. Many development interventions had been introduced in the past to help alleviate their living but most, if not all, had failed due to dwindling funds, passive community participation and dole-out mentality. With the incessant desire to help uplift the Mangyan’s economic state, the Occidental Mindoro State College (OMSC) in partnership with other government organizations, crafted a project specifically to build the Mangyan women’s capacity to earn income. The paper highlights the strategies employed by the project to ensure smooth and successful implementation. The project recognizes the importance of making women feel they are both owners and managers of the project. A Buhid women organization “*Yame ngayam samahan Pagkasadiyan manga Ina Sayame Sitio Salafay*,” in Tagalog “*Pagkakaisa ng mga Kababaihan sa Sitio Salafay*” was organized. This organization controlled the allocation and distribution of raw materials for the different community-based livelihood options. The initial interventions in “ono” (bead) and “abol” (weaving) making and design, and the quality control strategies had helped in improving the skills and the products of the Buhid women. The average monthly income had increased from PhP 86.80 to PhP 111.00. Aside from women’s full control of their activities, experiences suggest that sustained partnership and implementation of need-driven projects can ensure success of any development endeavour.

**Integrated Farming System Development in Ensuring Food Security and Sustainable
Agriculture in Bali, Indonesia**

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Integrated farming system, usually called as SIMANTRI, is one of food production technologies developed by Local Government of Bali Province since 2009. Until 2011, about 150 SIMANTRIs have established in Bali due to the success of some other ones development, previously. This paper aims to examine that it could be a holistic approach for food security and sustainable agriculture in Bali. An example one is the SIMANTRI operated by farmers group of Purna Gopala in Gianyar Regency, Bali. Based on survey in 2009, 24 farmers who were chosen by census integrated several crops such as paddy in Cropping Season 1 and 3, fodder grasses annually, corn and peanut in Cropping Season 2, and cattle annually into the system. All of these farm enterprises were to produce food and feed commodities. An actual farm income from the average farm size of 0.45 ha was about Rp26,401,297.31/yr. Then, by using BLPX88 as a linear programming package program that accommodated 58 activities and 71 constraints of the system, it was found that the maximum farm income of Rp26,435,430.00/yr. This success indicated the system was optimally operated by local farmers. By defining sustainable agriculture as a holistic farming system which is economically viable, ecologically sound, socially just, and culturally and technically appropriate, so the system that producing food will potentially sustainable.

Food Household Consumption as Labor and Land Institutions in Gunung Kidul Regency

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This research aims to find out the effect of land and labor institution on food household consumptions in Gunung Kidul. This research conducted the survey in Gunung Kidul Regency South Zone, in one hamlet area which is relatively far away from the city or market, and one hamlet areas relatively close to the city or market. Totally, there are 225 farm households, the poor village area in the two hamlets all as respondents. The data was analysed by tabulations and regression. Food household consumptions of the owner-operator farmers are not different with the consumption of farmers in other land institution. Food household consumptions of forestry tenant land are lower than the consumption of farmers in other land institutions. Food consumptions of *LKP* tenant land is lower than the consumption of farmers in other land institutions. Food consumption based on labor institution of farming is not different. Proportion of household income to food consumption for the farmers who are relatively far from the city greater than the proportion of farmers who are relatively close to the city. Similarly, the proportion of carbohydrate intake for farmers who are relatively far from the city greater than the proportion of farmers who are relatively close to the city.

Factors Affecting Empowerment Process among Dairy Cattle Farmers in Semarang Regency, Central Java, Indonesia

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The study aimed to determine the factors affecting empowerment process among dairy cattle farmers in Semarang Regency, Central Java. It analyzed the effect of the socio-demographic factors (age, gender, occupation, family income, educational attainment, and length of membership in cooperatives) on the empowerment process (community organizing, training, and building network). The information gathered from the respondent's interview via questionnaire were coded and processed using the (SPSS) and were analyzed quantitatively to the possible extent by using descriptive statistics such as frequency distribution, mean, and percentage. Spearman Rank Order Correlation test was used to determine the relationship between independent and dependent variables. This study indicates that the is significant relationship between socio-demographic factors and the empowerment process. The indicators of socio-demographic factors could influence an organization and its members to improve the empowerment process. Although the respondents' knowledge on empowerment was still limited, hence, the government should provide empowerment promotion program for all dairy cattle farmers.

Technical Assessment on Commercial Sericulture Production in Northeastern Thailand

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The objectives of the study were to determine 1) commercial sericulture production condition, 2) cost and return in commercial sericulture production, 3) their constraints and recommendations in commercial sericulture production. The studied samples were selected 48 sericulture farmers in Hua Fai Village, PorDang sub district, Chonnabot district, Khon Kaen province through multistage sampling technique. Interview schedule was obtained to collect data. Descriptive

statistics used for analysis were percentage and arithmetic means. The findings revealed that average sericulture production experience was 32 years. Average mulberry cultivated area was 0.80 rai (0.12 ha) per household. The most popular variety is “BURIRUM 60” and irrigated by furrow method. Cultivation techniques were carried out through recommendations by extension officers. The most popular silkworm variety was “DOKBUA”, with 6-8 cycles per year. Rearing period was around 23-25 days. Farmers controlled silkworm disease with lime as regular application. Most of silk yarn product was first grade. Reeling apparatus was granted from The Queen Sirikit Institute of Sericulture. Almost of silk yarn and fabric products sold to sericulture group and middlemen. Average variable cost of sericulture production was 39,510 baht (US\$ 1317; US\$ 1 = 30 baht) per annum. Farmers got various income from sericulture production including cocoon 100 baht (US\$ 3) per kg, silk yarn 1,200 baht (US\$ 40) per kg, and silk fabric 500 baht (US\$ 16.6) per meter. Silkworm disease and high cost were main production constraints. In addition, lack of marketing information and also uncertain marketing channels were serious constraints. A strategic policy for commercial sericulture promotion should focus on marketing channels and marketing information center.

Poster Abstracts

Adapting to Climate Change: Households' Food Security and Adaptive Strategies of Agricultural Communities in Upper Magat River Basin, North Luzon, Philippines

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This study was conducted to determine the adaptive strategies and food security conditions of households in agricultural communities in the Upper Magat River Basin as a consequence of environmental hazards. A structured interview schedule was developed and administered to 189 household-respondents residing within the hazard-prone areas of the Upper Magat River Basin, Philippines. Most of the households in the agricultural communities studied showed that they acquired loans from their cooperative for farm inputs. Correspondingly, the average amount of loan of the respondents in the study sites is about PhP 30,969.75 with the maximum amount of PhP 500,000.00 and minimum amount of PhP 1000.00. Although typhoon provides the higher damage than flood, both of these climatic hazards destroyed the respondents properties like home garden, corn farms, fruit trees, houses, rice farms and animals. The average amount of damage to properties of the respondents in the study sites is about PhP 26,516.45 with the maximum amount of PhP 500,000.00 and minimum amount of PhP 200.00. The most adaptive mechanism of households in the study sites can be viewed as traditional adaptations to annual flood events consisting of construction activities and a delay of the cropping cycle. The specific short-term coping mechanisms of households such as translocation, cleaning, supplementing, borrowing money, and precautionary savings, are performed before and after the occurrence of floods. The observed adaptive strategies influence the agricultural dependency, the level of exposure, land size, and income of the households. Likewise, the damage cost due to floods is positively correlated with income of the households, corn output, price of corn and loan money. However, there is a negative correlation of damage cost with new activities performed by the households after the flood and between current loan and income. The respondents' landownership in the study sites averaged about 1.15 hectare planting various crops such as rice, corn, vegetable and fruit trees and sell directly to the market or their neighbours. This study also shows that households in the Upper Magat River Basin, Philippines with higher damaged cost were inclined to borrow more.

Development of Model System of Sugar Cane Litter Management in Dry Land Sugar Cane Plantation

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The area of sugar cane plantation in Indonesia in 2010 reached 434,257 hectares with sugar production 2,694,227 tons. In sugar industry some by-products are also produced, such as sugar cane tops, sugar cane leaves, *blotong*, drops, and bagasse. Litter weight of cane harvesting area can reach 20-25 tons/ha. The research is being conducted in sugar cane plantations under PG Takalar, South Sulawesi, where there are problems on land preparation which is conventionally conducted so far by burning plant residues (sugar cane dry leaves) in the field. This method causes air pollution to the environment and leads to land degradation in the form of changes in physical properties, soil fertility, killing of soil biota, and global warming. This research aims to design a model system of sugar cane residue management on dry land sugar cane plantations with the purpose to increase the productivity of sugar cane production. The plant residue was used for compost, which is later be as organic

fertilizer. The compost produced here was standard compost according to SNI. The results showed that the application of compost fertilizers give significant influence on of sugar cane plant growth.

Effect of Heavy Metals Concentration in Soil Derived from Application of Raw and Composted Recycled Paper Mill Sludge on *Orthosiphon stamineus*

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Increasing amount of disposed paper mill sludge from industries has recently attracted concern for an alternative environmentally sustainable application. Recycled paper mill sludge (RPMS) is an active organic material and has potential benefits to supply nutrients for crops growth. However, if excessive contaminants are introduced by application of low quality sludge, the practice may have an adverse effect of heavy metals in the contamination of food chain and the environment. Therefore, this study was carried out to investigate the heavy metals concentrations in soil applied with raw and composted recycled paper mill sludge. A study was conducted in the glasshouse unit of Faculty of Agriculture, Universiti Putra Malaysia. The soil used for this study was the Serdang Series and *Orthosiphon stamineus* was used as the test crop in 20 kg pots arranged in a complete randomized design. Application rates of raw and RPMS compost was based on the N content. Treatments were applied during transplanting for 3 weeks *O.stamineus* seedlings. The treatments were control, 100% N equivalent of the recommended rate of inorganic N fertilizer, 100%, 200% and 400% N eq. of raw and RPMS compost, respectively. This study indicates that raw and RPMS compost has potential to be a supplementary nutrient source as well as soil amendment for growing plants. After three months application of raw and RPMS compost, there was no significant difference in the concentrations of heavy metals in soil compared to the control except for Cd. However, foliar concentrations of all heavy metals were below the MPC value of the Malaysian Food Act 1983 and Food regulation 1985. Soil pH affected the total Cd in soil, meanwhile, available P were positively correlated with total Cd and Pb in soil.

Conservation Status and Utilization of Ethnobotanical Resources in Northern Cagayan Valley, Luzon, Philippines

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Throughout the world, people use many plant species for food, medicine, income generation and for the fulfillment of economic needs. In recognition to biological diversity, plants serve significant value to the present and future generations. However, pressure from growing populations and the adoption of modern life styles are threats to the existence of many of these species and the ecosystems that support them. Cagayan Valley, Philippines had an extremely rich diversity of ethnobotanical resources derived mainly from the environment as source of food and medicine. A total of 94 species, representing 92 genera and 60 families of potential wild food and 277 species, 202 genera and 82 families of useful medicinal plants, mostly at the least concerned status of conservation, were identified. Among the new findings are those ethnobotanical resources utilized for food by specific ethnic group, mostly unreported. Gardening and farming, are the major management practices preferred to maintain the existence of these resources. But richness in floral diversity do not exempt the region's resilience to climate change, hence the promotion of indigenous knowledge on the utilization of plant resources for food security and medicine is an effective strategy to minimize the

use of synthetic materials. Validation of pharmacological and nutraceutical efficacy of these plants should be done, for utilization of the growing population, thereby promoting ecological and biological diversity, and stability of IKS as well as in the upliftment of food security.

Sweetpotato (*Ipomoea batatas* L.) Varieties and Its Utilization in the Northern Philippines

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Sweetpotato (*Ipomoea batatas* L.) is locally known as 'dokto', 'lokto', 'ubi', 'bayading', in the cordillera region. It is known to be 'survival crop' 'famine crop', 'poor man's food', 'underutilized crop' and 'neglected crop' but are found nutritious food. It is a versatile crop and all plant parts are utilized as food and animal feed. It is nutritious food and could supplement or substitute rice which is a staple food among the Asean countries. It is also a crop that could resist our changing climate. Interventions has been made by the researchers of the Northern Philippines Root Crops Research and Training Center by selecting high yielding varieties and developing processing techniques in which they were made into candies, wine, yogart, in order to increase its consumption. Likewise, dispersal of planting materials and IEC materials/publications as well as exhibition of products during trade fairs and hands on training is continuously being done in the region in order to promote its importance and utilization.

Yam (*Dioscorea alata* L.) Minituber Seed Production from Vine Cuttings

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This study determined the practicability of vine cuttings as alternative technology for tuber seed increase in yam. Vine cuttings were severed from the 3 months old vine or 2 month old lateral vine disregarding the vine with undeveloped leaves. These were further cut into three different sizes of cuttings which are three-nodal cuttings, two-nodal cuttings and single node cutting. The result showed that the three-nodal cuttings developed an average of two tubers per cutting while the two-nodal cutting yielded 1 to 2 tubers per cutting while the single node cutting yielded one tuber per cutting. The average tuber size produced was of marble size or 7 to 13 g per tuber after four months. These yam minitubers were subsequently planted in the field after sprouting and its tuber yield or size increased from 3 to 7 folds with an average weight of 38 to 76 g per tuber.

Vermicompost Fertilization at Varying Rates of Application: Its Influence on the Growth of Okra (*Abelmoschus esculentus* (L.) Moench) and on the Soil Chemical Properties

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In responding to the call to sustain the efforts towards ensuring food security through environmentally-sound farming approach, this research on okra (*Abelmoschus esculentus* (L.) Moench) was conducted. Okra is a versatile plant and it is known as a powerhouse of valuable nutrients. Varying rates of vermicompost were utilized in the fertilization of the crop aimed at determining their effects on its growth and on soil chemical properties. The study was laid out in a randomized complete block design with five treatments: T1 = control (no fertilizer), T2 = inorganic Fertilizer (IF), T3 = 13 ton ha⁻¹ vermicompost (13tha⁻¹V), T4 = 11 ton ha⁻¹ vermicompost (11tha⁻¹V), T5 = 9 ton ha⁻¹ vermicompost (9tha⁻¹V). Okra plants applied with 13tha⁻¹V increased in fruit weight and number of fruits than those in the control group. The same was observed on the plants treated

with lower rates of vermicompost. The result of application of 13tha⁻¹V was comparable to those plants treated with IF. The chemical properties of the soil had relatively improved as manifested by higher residual amount of nitrogen, phosphorous, potassium and organic matter on soil fertilized with 13tha⁻¹V. The soil pH became more acidic with the application of inorganic fertilizer while soil acidity declined with the use of vermicompost as fertilizer. Utilization of vermicompost is a good option over chemical-based fertilizer.

Bioactivity of Methanolic Seed Extract of *Barringtonia asiatica* L. (Kurz) (Lecythidaceae) on Biological Characters of *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae)

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Plants are known have various chemical compound that have potential to be developed as insecticides. One of the potential plants to be developed as insecticides is *Barringtonia asiatica* (Lecythidaceae). This research was conducted to determine toxicity of methanolic seed extract of *B. asiatica* to mortality and biological character of *Spodoptera litura*. The evaluation of toxicity was carried out using feeding method. Result of this research indicated that methanolic seed extract of *B. asiatica* had insecticidal activity with LC₅₀ at concentration of 0.30% and LC₉₀ at concentration of 0.80% in 13 days after treatment with LT₅₀ at 4.8 days. In addition, Methanolic seed extract of *B. asiatica* caused decrease of larva's weight, time of development, reduced leaf consumption and decrease of egg amount oviposited by female of *S. litura*.

Edible Landscaping: A New Approach in Crop Production

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Edible landscaping (EL) is a new approach that merges science and creativity together to form a revolutionary crop production technology. It gives a twist in the conventional crop production as the basic tenets of landscape designing become its guiding principle. EL combines the basic crop production practices and the conventional landscaping processes which include design conceptualization, implementation and maintenance. Design phase incorporates edible plants like vegetables, fruits, and herbs with other plants and structures while taking into consideration the principles and elements of design to fit on the chosen design or style. Edible softscapes are arranged like ornamental plants to function as hedge, ground cover, accent or screen on the landscape. Trellises and other hardscapes are used to support crops and to provide additional attraction in the landscape. It also features different garden arrangements fit for both urban and rural areas like container gardening, verti-growing and themed gardens of Filipino favourite culinary dishes created through companion planting of crops. Implementation and maintenance phase of EL follow the practices used in the conventional landscaping, however focuses more on seedling and planting material production and modification of the environment to suit for the crops requirements. In general, EL integrates the science of crop production and the art of landscape design to create a more attractive and functional environment that answers the need for safe and nutritious food for the people.

Parasitoids Species of Bagworm *Pteroma pendula* Joannis and Its Abundance in Oil Palm Plantation

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Bagworm is known as one of the most destructive pests in Malaysia's oil palm plantations. There are three major species been recorded and one of them is the *Pteroma pendula* Joannis which was identified as dominant bagworm species in 69 oil palm estates in Peninsular Malaysia. Total of 100 larvae of this bagworm can caused about 133.68cm² of leaves area damaged. Numerous efforts have been considered in order to control the infestations including biological control using fungi, predators and parasitoids). Augmentation of natural enemies particularly parasitoids can be seen through planting of beneficial plants such as *Cassia cobanensis* surrounding the plantation areas. However, in order to ensure the capability of the parasitoids, detail information on species identification and its ecological aspect is still scarce and required to be explored further. Therefore, it is vital to investigate the parasitoids species parasitizing *P. pendula* and its abundance in oil palm area. In this study, the newly emerged parasitoids from collected bagworms larvae and pupae were identified and recorded. There were several species of parasitoids involved and most of them were the same parasitoids species of bagworm *Metisa plana*. The species were *Eupelmus catoxanthae*, *Eurytoma* sp., *Pediobius* sp., *Apanteles metesae*, *Tetrastichus* sp., and two other unknown species that have not been recorded which might be a new recorded species of parasitoids *P. pendula*.

A Study of the Mesofauna Diversity in the Park Land of Kelimutu National Park Ende-Flores, East Nusa Tenggara

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Soil organisms or soil biota as commonly referred to, have a role in the ecosystem as decomposers of organic matter. The process of decomposition in the soil is usually slow if not supported by the activities of decomposers which act as organic catalysts. The parkland of Kelimutu National Park in Flores has a topography, soils and vegetation that is so diverse so that there is need to support the management and development of the area with basic information on biodiversity found in the National Park and in particular soil fauna. This research was conducted in April 2010. Samples of soil were taken using a stratified random sampling technique from four different stations having different vegetations in the National Park. Identification of the mesofauna was performed at the Laboratory of the Faculty of Agriculture, University of Flores and soil analysis performed at the Laboratory of the Faculty of Agriculture, University of Udayana. The Shannon and Simpson index of vegetative analysis was used to analyze the vegetation and mesofauna. The results show that there are 16 kinds of mesofauna scattered in the four observation stations. The highest diversity (1.84) was found on station IV. Station IV had the highest mesofauna because the habitat on this station was made up of vegetation composed of a mixture of forest biomass meaning that the process of decomposition occurs continuously. This was further strengthened with a 23.14 °C temperature, an average soil pH of 6.22, very high organic C (8.42%) and available N being (0.23%) an indication high soil mesofauna activity in this habitat. The lowest diversity of mesofauna was found on the station I (0.35) this was a station with extreme conditions as indicated by the results of soil analysis from the station which showed a low organic C (1.62%), and very low N (0.04%). Since vegetation in an ecosystem are constituent of pioneer plants such as *Vasinium* spp., *Rhododendron* spp., ferns and pines This is an indication of lack of soil mesofauna activity on that ecosystem. Thus, conservation measures need to be done by planting plants that are preceded by typical pioneer plants such as ferns

which are able to provide biomass relatively quickly when compared to other types of plants that will be used as sources of energy for soil mesofauna which are agents organic matter decomposition.

Use of Wild Plants and Animal Droppings as a Source of Manure for the Production of Organic Corn 'Pulut Putih'

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Productive optimal growth of corn "pulut putih" in open space is determined by the condition of soil fertility and organic materials present in the soil. Research results indicate that corn "pulut putih" which was grown with addition of organic materials from wild plants such as *Chromolaena* and *Tithonia* combined with 40% animal droppings showed better production components and growth. The crop grown under these conditions was found to be high in wet and dry weight and had wider leaves.

Toxicity of Plant Extracts from Black Pepper *Piper nigrum* and Physic Nut *Jatropha curcas* Against Rice Weevil *Sitophilus oryzae* (L.) and Rice Moth *Corcyra cephalonica* (Stainton)

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Laboratory studies on toxicity effects extracts of dried plant materials of black pepper and physic nut was made on adults of *S. oryzae* (7-14 days old) and 3rd instar larvae of *C. cephalonica*. On the basis of LC₅₀, results showed that the adults of *S. oryzae* were more susceptible than the 3rd instar larvae of *C. cephalonica* to petroleum ether (LC₅₀=1.6 and 12.5 mg/g) and chloroform extracts (LC₅₀=1.7 and 14.3 mg/g) from fruits of *P. nigrum*, respectively. However, the aqueous extracts from fruits of *P. nigrum* did not show any toxicity effect against both adults of *S. oryzae* and 3rd instar larvae of *C. cephalonica* at the calculated doses during 72 hours exposure. The petroleum ether extract from seeds of *J. curcas* was more toxic to the adult of *S. oryzae* (LC₅₀=6.8 mg/g) than 3rd instar larvae of *C. cephalonica* (LC₅₀=13.2 mg/g). Chloroform and aqueous extracts from seeds of *J. curcas* did not show any toxicity against adults of *S. oryzae* and 3rd instar larvae of *C. cephalonica*.

Preparation and Characterization of Encapsulated *Burkholderia* Strain UPM B3

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The development of cost effective, user friendly and readily available commercial formulations for beneficial microbes has always been a constraint in sustaining the performance of the BCAs. Formulation of biological control agents for commercial use generally involves the mixing of viable BCAs cells with carrier-based materials in liquid or dry form and nutritional supplements such as glucose to develop fine formulations that not only can stabilize and enhance the growth of BCAs but also convenient for storage and user friendly. This study reports on the encapsulation of *Burkholderia* strain UPMB3 in sodium alginate (SA) as the matrix and montmorillonite (MMT) clay

to improve the viability and shelf life of the bioagent (SA-MMT). SA-MMT was characterized using Fourier Transform Infrared Spectroscopy, Thermogravimetric analysis and Scanning Electron Microscopy. FTIR results showed the interaction between the functional groups of SA and MMT in the SA-MMT beads. TGA analysis showed the incorporation of MMT in SA-MMT beads increased the thermal stability of the formulations due to the high thermal stability of the MMT and to the interaction between the MMT particles and the alginate matrix. SEM analysis revealed homogeneous distribution of the MMT particles throughout the SA matrix and the smooth surface of the SA-MMT compare to SA alone. *Burkholderia strain* UPM B3 was successfully encapsulated in the SA-MMT beads. Storage analysis of the encapsulated *Burkholderia strain* UPM B3 showed that lower storage temperature of 10 °C significantly gave better storage properties compared to room temperature (30°C).

Distribution of Root-knot Nematode Species, *Meloidogyne* spp., the Causes of Branched Tuber Disease at Different Altitudes in Indonesia

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Branched tuber disease is a raising problem in carrot cultivation. The disease is caused by infection of root-knot nematode (RKN) species, *Meloidogyne* spp. RKN distribution in Indonesia not clearly known, so needs a comprehensive research. The purpose of this research is to know the distribution of RKN based on altitude places. The identification of the nematodes were conducted at Laboratory of Plant Nematology, Department of plant pest and disease, faculty of Agriculture, Universitas Padjadjaran and Plant Virology, Department of Plant Protection, Faculty of Agriculture, IPB, involving conventional and molecular techniques. The research was conducted from September 2009 until May 2011. Surveillance conducted in plain medium (700-1000 m asl) and highland (1000-1300 m asl; 1300-1600 m asl). The results of conventional and molecular identification is known that at an altitude of 700-1000 m asl there are four species of the NPA, *M. arenaria*, *M. hapla*, *M. incognita* and *M. javanica*. At an altitude of 1000-1300 m asl was found five species, namely *M. arenaria*, *M. falax*, *M. hapla*, *M. incognita* and *M. javanica*, while at an altitude of 1300-1600 m asl were found four species, namely *M. falax*, *M. hapla*, *M. incognita* and *M. javanica*.

Effectiveness of Leaf Extract of Teak (*Tectona grandis* L.f.) against *Arthrrium phaeospermum* (Corda) M.B. Ellis, the Causes of Wood Damage of *Albizia falcataria* (L.) Fosberg

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Arthrrium phaeospermum (Corda) M.B. Ellis is one of the causes of wood damage of *Albizia falcataria* (L.) Fosberg. The objective of this research was to investigate effectiveness of teak (*Tectona grandis* Lf) leaf extract in inhibiting the growth of *A. phaeospermum*. The purpose of this study was to test the potential of teak leaf extracts of teak as a biofungicide. Extraction was done by maceration method using methanol as solvent. Antifungal activity of teak leaf extract was done by a well-diffusion method on potato dextrose agar media. Five concentrations of the leaf extract, i.e. 0% (control), 0.5%, 1%, 2%, and 4% were tested in this study. The result of this study showed that the teak leaf extract significantly suppressed the growth of *A. phaeospermum* with minimum inhibitory concentration 0.1%. The extract inhibited fungal radial growth, total dry weight biomass, and spore formation of *A. phaeospermum*.

Prevalence of *Cucumber mosaic virus* Causing Mosaic Disease on Chilli Pepper in Bali and Collection of Mild Isolates for Cross Protection

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In Bali of Indonesia, chilli peppers (*Capsicum annum* L. and *C. frutescent* L.) are usually affected by two significant viral diseases having typical yellowing and mosaic symptoms, respectively. The yellowing disease had been known to be caused by infection of *Pepper yellow leaf curl virus* (PepYLCV), but the mosaic symptom may be caused by other viruses. In this study, by using enzyme-linked immunosorbent assay (ELISA), the mosaic disease was confirmed to be associated with infection of three viruses, *Tobacco mosaic virus* in the genus *Tobamovirus*, *Chilli vein mottle virus* (ChiVMV) in the genus *Potyvirus*, and *Cucumber mosaic virus* (CMV) in the genus *Cucumovirus*. No chilli pepper plants showing mosaic symptom was associated with infection of PepYLCV. The incidence of mosaic disease was more frequent (50%) than that of yellowing disease (8%) in all chilli pepper growing areas of Bali observed in 2010. Based on ELISA study, it was found that CMV was the main virus induced mosaic symptoms on the chilli pepper in Bali. Among plants showing mosaic symptoms, there were some plants expressed no or very mild symptoms that predicted to be infected by mild isolates of CMV. Double-stranded (ds) RNA analyses of 43 samples of chilli pepper plants naturally showing very mild symptoms suggested that four mild isolates of CMV contained satellite RNA (satRNA) of about 400 bp. Two of the satRNA-contained CMV isolates having significant protective effect against other CMV isolate naturally induced severe mosaic disease. These mild CMV isolates may be useful as biological control agent for mosaic disease management of chilli pepper in Bali or other area of Indonesia.

Forage Yield and Quality of Kenaf (*Hibiscus cannabinus* L.) for Consumption as Ruminant Feed

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Kenaf (*Hibiscus cannabinus* L.) which is usually utilized as a fiber crop can also be used as forage for feed of ruminants. Its early growth stage the plant possesses high protein content, making it a favorable forage for livestock. This study was carried out to evaluate 40 kenaf accessions for forage yield and quality at Universiti Putra Malaysia in 2009. Forage yield and quality traits were measured at the initial flowering stage. The kenaf accessions showed highly significant variation for fresh stem yield, plant dry matter (DM) yield, leaf and stem dry matter yield, leaf/stem ratio, crude protein (CP), acid detergent fiber (ADF) content and days to flowering. Plant dry matter yield ranged from 5286 kg/ha (Evarglade 41) to 16801 kg/ha (1X51). Crude protein content of the leaf ranged from 13.6% (G46) to 22.3% (75-71). Leaf ADF were significantly different among the accessions, where FDW 75-82 gave the highest (24.7%) while C74 gave the lowest (16%). Broad-sense heritability was highest for days to flowering ($h_B^2 = 97.6\%$) and lowest for fresh plant yield ($h_B^2 = 11.1\%$). In conclusion 1X51, Cuba2032 (with high yield), 75-71 and Evarglade 41 (with high CP content), were the most superior among the 40 kenaf accessions evaluated and were found highly potential for forage. These accessions can therefore be utilized in further breeding programs to produce new kenaf varieties with high feed value for ruminant consumption.

Nutrient Digestibility and Growth Performance of Swine Fed Diet Supplemented with NSP-degraded Enzymes

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The effect of dietary non-starch polysaccharide (NSP)-degraded enzymes supplementation on the coefficients of total tract apparent digestibility (CTTAD) of nutrients and growth performance of growing-pigs were studied using completely randomized design. Thirty-six three-way crossbred piglets aging about 4 weeks were divided into three groups with three replicates, which consisted of two castrated-male and two female. The animals were kept in concrete pen where feed and water provided *ad libitum* until 16 week of age. The corn-soy based diet was used as the control diet and the other two experimental diets were control diets supplemented with NSP-degraded enzymes, mainly β -glucanase and β -xylanase from *Penicillium* sp. and NSP-degraded enzymes from *Aspergillus* sp. Body weight and feed intake of each group were collected during three periods of growth (4-7, 8-11 and 12-16 week of age) to evaluate the growth performance. The apparent digestibility assay was taken by using indicator method, which feed and feces sampling were collected at 5 and 12 week of age. Results showed that NSP-enzymes did not significantly improved the nutrient digestibility of young pigs (4-7 week of age) due to the low dietary crude fiber content, but the significantly improvement of nutrient digestibility such as dry matter, crude protein, crude fiber, energy and calcium were found at 12 week of age. The better nutrient digestibility provided the improvement of growth performance in term of body weight gain and feed conversion ratio, especially in period 7-11 week of age. Average improvement of average daily gain and feed conversion ratio were 3.55 and 4.05% by NSP-degraded enzyme supplementation. The different sources of NSP-degraded enzymes did not have the significant effect on the growth performance of growing-pigs.

Effects of Dietary Fenugreek Seed on the Growth Performance, Carcass Composition and Blood Parameters in the African Catfish

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An eight-week feeding experiment was conducted to assess the suitability of fenugreek seed meal (FSM; *Trigonella foenum-graecum*) as a replacement for fish meal (FM) in diets of the African catfish (*Claris gariepinus*). Five isonitrogenous (35% crude protein) and isoenergetic (3480 Kcal/kg) diets were formulated without (control) and with FSM concentrations of 10% (SFM-10), 18% (SFM-18), 26% (FSM-26) and 34% (SFM-34). The FSM replaced FM in the control diet in amounts of 25.3, 35.3, 45.3 and 54.7% in diets FSM-10, FSM-18, SFM-26 and SFM-34, respectively. Each diet was fed to three replicate groups of 30 fish kept in individual 100 l aquaria, organized in a completely randomized design. The fish fed diets FSM-26 and FSM-34 had lower hepatosomatic index, final body weight, body weight gain, feed intake and protein efficiency ratio, but higher feed conversion ratio than the fish in other dietary treatments, while the survival rate was not affected by any diet. The concentration of protein in the whole carcass decreased in fish fed the FSM-26 and FSM-34 diets compared with fish fed the other diets while lipid content of the whole carcass depressed in groups fed FSM-34 diet. The fish treated with the diets FSM-26 and FSM-34 showed lower ash content in the fillet compare to the others. Blood hemoglobin, hematocrit and red blood cells of groups fed up to 18% of FSM were higher than other groups. These results show that up to 18% FSM can be included

in the dietary dry matter to replace up to 35% of FM in the African catfish diet, without any negative effects on the growth performance or survival of the fish.

Making Goats RED

Cathy V. Balicat-Pastor

A development project entitled “Intensification of the Innovative Goat Production System for Sustainable Rural Enterprise Development in Region I, Philippines” was implemented to promote rural-based enterprises that would unlock business opportunities in transforming subsistence type of goat raising into profitable enterprises by employing farmer participatory approach and technology-based enterprise process. It has covered 3 provinces, 14 municipalities and 45 barangays with a total of 190 goat raisers and 271 spill-over farmers served as project partners by adopting innovative production systems on breeding, feeding and health management. A community-based selection and breeding system was established that resulted in significant improvements in the productive and reproductive performance of goats. Goat raisers have been organized into associations and were encouraged to venture into goat enterprises. Farmers obtained a monthly net value of incremental benefit of PhP1,836.33 and PhP5,899.33 for a 10-doe level slaughter and 20-doe level breeder goat enterprise, respectively. Local government units (LGUs) supported the expansion of the project and refocused their priorities towards promotion of the goat industry. Beyond technology adoption thus, building enterprises through marked institutionalization and sustainability efforts of LGUs with organized farmers and empowered communities.