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ABSTRACTS – ORAL PRESENTATION

I. Agricultural Biotechnology to Breed Plants and Animals

**IDENTIFICATION OF A POTYVIRUS ASSOCIATED WITH MOSAIC DISEASE ON
PATCHOULI PLANTS IN INDONESIA**

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Patchouli (*Pogostemon cablin* (Blanco) Benth.) plants, an important source of essential oil, are widely cultivated in Indonesia. The cultivation areas are located mainly in Sumatera (Aceh, North Sumatera, West Sumatera, Bengkulu, and Lampung), Java (West, Central and East Java) and South Kalimantan. Patchouli plants cultivated in some locations were severely affected by mosaic disease in West and Central Java, and West Sumatera. The diseased plants showed typical symptoms of pale green mosaic, malformation of the leaves and severe retardation of plant growth. This study was carried out to identify the virus associated with mosaic disease on patchouli. By enzyme-linked immunosorbent assay, the diseased plant samples collected from Garut, Ciamis, Bogor (West Java) and West Pasaman (West Sumatera) strongly reacted with Potyvirus antiserum, but did not show any signal with antisera to *Cucumber mosaic virus*, *Tobacco mosaic virus*, *Broad Bean Wilt Virus 1* and *Broad Bean Wilt Virus 2*; except the samples collected from Brebes (Central Java) which reacted strongly with *Broad Bean Wilt Virus 2* only. The potyvirus was then isolated. The virus isolate could be mechanically transmitted to *Nicotiana benthamiana*, *N. tabacum*, *Chenopodium amaranticolor*, *C. quinoa*, *Gomphrena globosa*, and *Solanum melongena*. Positive results were also obtained using a reverse transcriptase-polymerase chain reaction (RT-PCR) method to detect and identify Potyvirus from nucleic acid extracts of the symptomatic patchouli plants, using a pair of degenerate primers specific for potyvirus CP gene. The sequence of this RT-PCR fragment, consisted of 327 bp, confirmed that a potyvirus associated with mosaic disease on patchouli plants in Indonesia. Based on our experiment with Tapak Tuan variety, the mosaic disease would affect the yield of patchouli plant up to 26,52%, reduced the essential oil content up to 2,37 % and patchouli alcohol up to 5,06%.

THE EFFECTS OF NUMBER OF SCIONS GRAFTED AND CUT-DOWN PRODUCTIVE BRANCHES ON THE GROWTH OF NEW SHOOTS IN SIDE GRAFTING TECHNIQUE OF CASHEW TREES

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The productivity of cashew trees usually decline with age, and side grafting on the old trees are seen as a model of simple and inexpensive technique of rejuvenation to quickly improve the productivity. Series of experiments of the present main research entitled "Side grafting technique as cashew rejuvenation model" will be conducted to study this problem. The first experiment was conducted in the field at cashew centre areas in Lewobele Village, Larantuka East Flores Regency, NTT Province, Indonesia from May to July 2010. Two treatment factors (number of scions grafted and number of cut down productive branches per tree) were factorially arranged in a randomized complete block design (RCBD) experiment. One (S1) and two scions (S2) were grafted per tree, and all productive branches were cut down (P1), two (P2) and three (P3) productive branches were left on the tree. Fifty four cashew trees of 18 months old were used as root stocks and eighty one healthy scions originated from the centre nursery were used in the grafting. The results of the first experiment showed that 100% scions were grown well, indicated that side grafting was a simple and inexpensive technique to rejuvenate cashew trees due to fully compatible scions and rootstock. The interaction treatment between two scions grafted per tree and two productive branches left on the tree (S2P2) resulted in the highest (50%) percentage of new-growth branches that have been flowering at 7 weeks after grafted, which was significantly different ($p < 0.05$) from the other combination treatments. The result of this first experiment is being used to support the main research, which will be completed in December 2010.

THE ELIMINATION OF *Cymbidium mosaic virus* FROM *Dendrobium* ORCHID PLBs BY CHEMOTHERAPY

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Orchid is one of the major export crops of Southeast Asian countries. However, orchid production both for cut flower and potted plant is threatened by viral diseases which not only causes a decrease in yield and damage to produce but is also the serious problem for export due to the international trade barriers. Since viral diseases cannot be cured, farm management is the vital part of production wherein the first step is planting of virus-free orchid plants. The elimination of virus from elite orchid clone will offer the means to the orchid production business. In this report, we demonstrate the successful elimination of *Cymbidium mosaic virus* (CymMV) from the infected protocorm-like-bodies (plbs) of *Dendrobium* orchid. The CymMV-infected plbs were cultured in Vacin&Went liquid medium supplemented with dithiouracil (DTU) at the concentration of 0-0.3 mM or ribavirin at the concentration of 0-0.1 mM for 2, 4 and 6 weeks with weekly subculture to fresh medium. The results demonstrated that all DTU treatments could not eliminate the virus while ribavirin, at the concentration of 0.05mM for 6 weeks could successfully eliminate CymMV from plbs up to 54.5% as confirmed by ELISA and RT-PCR. However, we found that ribavirin had higher toxicity to the orchid cells compared to DTU. This was clearly observed in the DTU treatment at 0.3 mM which caused the decrease in survival rate of plbs to only 80% compared to less than 20% survival rate when 0.1 mM ribavirin was applied.

APPLICATION OF NEW MICROBIAL FORMULATION FOR INCREASED GLUCOSINOLATE CONTENT AGAINST HEAVY RAIN AND DISEASES OF KALE CROP

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Resistance effects of seed bacterization and 3-foliar sprays (at 14, 21 and 28-day-old plants) with new *Pseudomonas fluorescens* SP007s kaolin-based formulation developed in this study (the KUwin/Gap SP007s) on diseases and heavy rain in correlation with glucosinolate accumulation in treated plants were evaluated in conventional system of kale (*Brassica oleracea* var. *alboglabra*) production during 23 January to 27 March 2010 at Banpan, Angthong with RCBD arrangement. The 15-day-old seedlings of seeds treated with the new SP007s product had the highest reduction in 3-naturally endemic diseases of black rot (caused by *Xanthomonas campestris* pv. *campestris*), Alternaria leaf spot (*Alternaria brassicicola*), and downy mildew (*Peronospora parasitica*) compared to another bioproduct (ISR-P/SP007s[®]), chemical (Funguran[®]), conventional practices, and nontreated control (P=0.05). Maximal glucosinolate accumulation (sinigrin and glucoiberin) detected by HPLC was observed with 22.6 µmol/g when 35-day-old treated plants were exposed to 7-day-heavy rain (91.8 mm). Evaluation of the 3 diseases (black rot, *Alternaria* leaf spot, and downy mildew) of this same growth stage of KUwin/Gap SP007s-treated plants was also reduced with 96, 88, and 82% respectively compared to nontreated control. Seedling vigor and yield were positively correlated with disease reduction and increased glucosinolate accumulation. This study suggests that the new microbial product reduces three diseases by 82-100% at harvest and induces plant tolerance to heavy rain which could be explained by total glucosinolate content (P=0.05).

DEVELOPMENT OF BIO-PCR TECHNIQUE FOR DETECTION OF *Xanthomonas campestris* pv. *vesicatoria*

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The seed-borne bacterium *Xanthomonas campestris* pv. *vesicatoria* (Xcv) causes bacterial spot of tomato worldwide including Thailand. The disease causes a significant reduction of yield and seed quality. A rapid, sensitive and specific detection technique is necessary required for supporting the phytosanitary certification system and seed quality control of international trade. A novel Bio-PCR technique was developed by using a combination of semi-selective medium NCT and specific primers Amy-F (5'- GCG CGC CGT GCG GGG GTA- 3') and Amy-R (5'- ATG CCC CGC CCA ACG CCA GT- 3') which designed to amplify a 574 bp fragment of alpha-amylase gene of Xcv. These primers were highly specific to Xcv which were no cross reaction with species and pathogens of *Xanthomonas* and other bacteria. Whereas plating efficiency of the NCT medium was 87.0% as compared with nutrient agar and was good inhibition of other bacteria. The developed Bio-PCR technique could detect Xcv from artificial inoculation of tomato seeds and leaves at the minimum of 1.3x10¹cfu/ml and 6.6x10³cfu/ml, respectively whereas Direct-PCR could only detect Xcv from seeds at 5.5x10³cfu/ml but could not detect from leaves. The results indicated that the developed Bio-PCR technique is highly specific, sensitive and detected rapidly Xcv from both tomato seeds and leaves which will be a useful technique for tomato phytosanitary certification especially seed-health quality control and disease management.

ESTABLISHMENT OF CRITICAL PEST LEVEL AND PHENOLOGICAL FORECAST OF THE LEAF HOPPER, *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, Philippines 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 eggmass hatchability and emergence of larval/nymphal instars of insect pests of the crop. Three major insect pests; *Amrasca sp.* and *Dysdercus cingulatus* were found with high population density during the dry seasons of 2009-2010. *Heliothis armigera* and *Dysdercus cingulatus* registered a low and comparable population for the whole assessment period in all test sites with mean population ranging from 3.55-5.89, except for *Spodoptera litura* which ranged from 16.0-22.0, regardless of observation sites. Population of *H. armigera* leveled-off 30 days after crop emergence and increased abruptly at 45 days with a registered mean population ranged from 0.86 to 2.56 respectively, indicating that feeding of the pest starts as the crop reaches fruit bearing stage. High population of *Amrasca sp.* was evident for January planting which exceeded the 10% critical yield reduction level which confirmed that plantings made during dry seasons would entail significant damage to the crop. With a series of feeding interaction tests conducted for *Amrasca biguttula*, its critical threshold level was established with a population-standing crop ratio of 45.53 per 50 plants with an allowable yield reduction threshold of 10%. Moreover, phenological forecast on the eggmass hatchability of *A. biguttula* and *D. cingulatus* were found correlated with temperature. The mean temperature of 36°C caused simultaneous hatchability of eggmass and biological emergence of the first stadium of the two major pests, taking only 3 days to emerge. As the temperature increases, hatchability and rate of development of the insect pest decreases.

IMPROVING THE YIELD PERFORMANCE OF CABBAGE IN CLUBROOT INFESTED SOIL IN NORTHERN PHILIPPINES USING BENEFICIAL MICROORGANISM

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Clubroot (*Plasmodiophora brassicae*) is an obligate parasite. This soilborne fungi thrives in the soil as resting spore for eight years even in the absence of its host. It is the number one disease causing yield reduction of crucifers in Northern Philippines. The study aimed to improve the performance of cabbage in a heavily clubroot infested field using *Trichoderma sp.* in combination with calcium oxide (CaO). The experiment consisted of nine treatments with plot size of 1x10 m² replicated four times following the Randomized Complete Block Design. *Trichoderma* at 10, 15, and 20g rates were inoculated and mixed in the soil before transplanting. Calcium oxide and flusulfamide, at 8 tons and 200 kg ha⁻¹, respectively and farmers' practice were included as treatments for comparison. The effectiveness of *Trichoderma* was based on the fresh and dry root weights, top weight, head circumference, yield, disease severity and % control. Under field conditions, cabbage applied with 20 g *Trichoderma sp.* had the highest fresh root and oven dry weights of 131.25g and 10.95g.; highest fresh and top dry weights of 700g and 200g, respectively after 82 days. The same treatment produced the widest polar head circumference of 47.91 cm and highest marketable yield of 33 t/ha at harvest. Similarly, the 20g rate resulted in slight clubroot infection and high control of 80%. *Trichoderma* is as effective as Flusulfamide in reducing clubroot severity.

**INCORPORATING CLIMATE CHANGE ADAPTATION INTO SUSTAINABLE
DEVELOPMENT: A CASE STUDY OF SALT WATER INTRUSION IN
SOUTHERN VIETNAM**

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Southeast Asia is among the highly vulnerable regions to climate change. Temperature increase, changes in rainfall, sea level rise, and changes in extreme weather events are unfolding, and further changes are inevitable. Adaptation measures are therefore critically important. Although theoretical understanding on adaptation has developed in the international community, empirical evidence on adaptation has been rather limited in Southeast Asia despite the high vulnerability therein. Taking salt water intrusion in Southern Vietnam as an example, this study examines the dynamic process of adaptation. First, vulnerability was directly caused by an environmental stressor: the increasing salinity had seriously impaired rice farming in the region. The adaptation measure was implemented to change from rice farming to shrimp farming. Initially, the shrimp culture went well. After several years, however, the secondary vulnerability emerged since the shrimp culture inherently had risks due to bacterial and viral diseases. Furthermore, high capital intensive nature of the shrimp culture worsened livelihoods of marginalized farmers, undermining food security in some areas. Subsequently, the farmers in the region developed several shrimp culture practices depending on their adaptive capacity and geographical location: some practices are more stable than the others. Climate change adaptation measures have high resilience to specific stressors. However, the adaptation measures may incur other risks, which might adversely affect livelihoods of farmers and hamper sustainable development. To realize “no-regret adaptation”, it is essential to take secondary vulnerability into consideration and incorporate strengthening adaptive capacity into sustainable development scenario.

**MOLECULAR CHARACTERIZATION OF *CYMBIDIUM MOSAIC VIRUS*
(CymMV) INFECTING ORCHIDS IN JAVA, INDONESIA**

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Cymbidium mosaic virus (CymMV) is an economically important virus infecting orchids in the world. The typical symptoms such mosaic and necrotic on the leaves were found infecting *Cymbidium*, *Phalaenopsis*, *Dendrobium* and *Oncidium* in Indonesia. The disease is distributed in several areas in Java and were suspected spread via vegetative materials. The objective of the research was identify the causal of mosaic disease infecting orchids. Symptomatic samples were collected from several areas such as from Surabaya and Malang (East Java), Magelang (Central Java), Jakarta, and Bandung and Bogor (West Java). Serological test of all samples were positive against CymMV antisera. The virus could infect several indicator plants such *Datura stramonium*, *Chenopodium amaranticolor*, *C. quinoa*, *Nicotiana benthamiana*, *N. glutinosa* and *Cassia occidentalis*. Further, reverse transcription polymerase chain reaction (RT-PCR) of total RNA extracted from symptomatic orchids were carried out by using a pair of primer specific to the coat protein of CymMV. The 650 bp DNA fragment was successfully amplified, confirming the present of CymMV in those samples. Direct sequencing of the CP gene showed that the homology among those isolates ranged from 90,1 – 97,7%, while to those of isolates from other countries range from 92.8 to 98.3%. Phylogenetic analysis of the CP amino acid and sequences revealed that those six Indonesian isolates were clustered in the same group with those isolated from Japan, India, China and South Korea. This is the first report of CymMV infecting orchids in Java, Indonesia.

DEVELOPMENT OF WATER MANAGEMENT IN PADDY FIELDS TO REDUCE METHANE EMISSION

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Paddy field is recognized as another source of methane (CH₄) emission which is one of the important greenhouse gases causing global warming. In addition, continuous flooding in paddy field increases methane gas emission into atmosphere. In 2006, the authors conducted the research focused on water management in paddy fields to reduce environmental impacts by varying water depths in paddy field located in Mae Klong River Basin, Thailand. It was found that higher and longer flooding period of paddy field increased methane emission. The traditional irrigation induced the highest impacts on methane emission, while the combination of shallow water depth with drying period showed the lowest impacts. In 2009, the authors conducted the research focused on effect of flood conditions to methane emission in paddy fields. A flood period of 5 and 10 days released methane less than traditional irrigation, by about 33 %. This paper focused on utilization of water management in irrigated farm at the farmers' field condition such that paddy fields were irrigated only when they were dry to reduce methane emission. The result showed that this measure of water management condition reduced methane emission by approximately 85 % when compared with traditional paddy irrigation. This approach can be an alternative for farmers in irrigated paddy field since it can maintain the same yield while methane emission is reduced.

GEOGRAPHICAL DISTRIBUTION OF EGGPLANT (*Solanum melongena* Linn.) VARIETIES IN THE LANDSCAPE OF ALBAY PROVINCE: PHENOLOGY AND STOCHASTICITY OF GERMPLOSM

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Eggplant is a widely cultivated crop in the province of Albay, Philippines. This paper assesses the varietal preference of farmers for the crop and the dynamics of genetic resources distribution in the agricultural landscape of the area. For reference during the field surveys done in 2008-2009 cropping, the province was divided into Eastern and Western grids. A total of 60 sampling sites with varied topography across gradient of soil texture were identified based on predetermined selection criteria. The total land area of all sampling sites was approximated at 83.21 hectares, 35.90% of which was planted with *S. melongena*. The Eastern grid shared 9.63% while Western grid had 26.27%. This insures both grids as continuum of productive agricultural lands. In terms of seed types planted, landrace variety occupied only 5.66% of the total land area. The large proportion of land planted to hybrids (94.64%) indicates (1) shift in preference of farmers from traditional to modern, and (2) prelude to consequential gradual displacement of landraces by hybrids. Overall, the geographical distribution of *S. melongena* in Albay has both ecological and socio-economic roots. Farmers' preference and availability of planting materials (e.g. seeds) appears as primary determinants of continuity of variety in time and space. Further, the extensive occurrence of eggplant fruit and shoot borer (*Leucinodes orbonalis*) offers a deterministic threat and limiting factor to production since farmers have become reliant on chemicals for pest control. Stochastic threats experienced in the province included "force majeure" such as eruptions of Mayon Volcano and frequent typhoons. The implications of these factors in eggplant production will be discussed.

YELLOWING DISEASE OUTBREAKS IN TOMATO IN INDONESIA ASSOCIATED WITH INFECTION OF *TOMATO CHLOROSIS VIRUS* AND *TOMATO INFECTIOUS CHLOROSIS*

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Since 2004, outbreaks of yellowing disease in tomato (*Lycopersicon esculentum*) crops have occurred in several regions of Indonesia, especially in upland of Garut and Cipanas [West Java], Magelang [Central Java], Bedugul [Bali] and Sembalun [Lombok]. The disease was characterized by interveinal yellowing that developed initially on lower leaves and then progressed to the upper part of the plant. Interveinal yellow areas on leaves develop red or brown necrotic flecks. No obvious symptoms are produced on fruit but significant yield reduction occurs. The yellowing disease symptoms resembled to those described in USA, Spain and others countries for the infections caused by *Tomato infectious chlorosis virus* (TICV) and *Tomato chlorosis virus* (ToCV). Symptomatic tomato plants, collected during 2008 and 2009 in Garut, were positive in RT-PCR assays using ToCV- and TICV-specific primers. Computer-assisted sequence analyses of CP genes of the virus isolates showed about 98 to 99% homologies with those of ToCV and TICV sequences in the GenBank database. Whitefly-transmission experiments from symptomatic tomato samples showed TICV isolate was transmitted only by the greenhouse whitefly (*Trialeurodes vaporariorum*), whereas ToCV isolate was transmitted not only by the greenhouse whitefly but also by the banded-wing whitefly (*Bemisia tabaci*).

PERFORMANCE OF GRAFTED TOMATO UNDER DIFFERENT PROTECTIVE STRUCTURES IN TARLAC PROVINCE

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Tomato production in the province of Tarlac is characterized by extreme seasonality. In the dry months, there is abundant supply for tomatoes but during wet season, yield is low, hence, there is limited supply in the market coupled with poor quality of produce that contributes to severe price fluctuations. New technologies for off-season tomato production had been developed by the Asian Vegetable Research and Development Center (AVRDC) which included the use of protective structures. High initial cost of protective structures restricts the farmers from adopting off-season production. However, nylon net structure can be used as alternative structures thus minimizing cost of shelter compared to AVRDC. Different treatment combinations that give the highest net income and benefit: cost ratio is Sherry variety grown under AVRDC- protective structures had the highest cost of production. However; it is more durable and, hence lasts longer which will eventually offset cost of production in subsequent off-season production times. Off-season tomato is now adopted by some farmers in the province of Tarlac using a plantlet grafted tomato with an EG 203 eggplant rootstock, a variety adaptable under Philippines condition that tolerates flooding and shows considerable resistance to bacterial wilt. However, improvised materials such as bamboos, combined with round bars and covered with nets produced significant yield of 2.5-3.0 kilograms per plant. Moreover, the quality in terms of sizes and color are acceptable to consumers especially in the province of Tarlac. Other alternatives should be looked into, hence, making it available, suitable, environment-friendly and cost efficient to tomato growers.

**BACTERIAL LEAF BLIGHT ON *Acacia crassicarpa* CAUSED BY
Xanthomonas campestris IN INDONESIA**

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Acacia crassicarpa Cunn. ex Benth. is one of the fast-growing species being planted for reforestation in large areas in Indonesia. The government has set a policy of developing plantation forests, both industrial and community-based plantation forests. Plantation forests can contribute to mitigating climate change. One challenge has been to produce high quality seedlings required for the reforestation effort. Bacterial leaf blight (BLB) is the most frequently observed disease on *A. crassicarpa* in nurseries. As an emerging disease, its occurrence on *A. crassicarpa* has never been reported previously. Disease symptoms become apparent on 5 – 6-week-old seedlings and blight develops within 1 – 2 weeks. Early symptoms appear as small red streaks on tip, middle, or basal parts of the phyllodes. The strikes expand in length and width along the veins and later turn into brownish red color. They may then unite and dry, forming a blight syndrome. BLB symptoms have not been observed to develop on other acacia species such as *A. auriculiformis* and *A. mangium*. The bacterium is rod-shaped, yellow colony and mucoid on YDCA with the cell sizes of 0.5 – 0.7 x 0.8 – 1.7 µm. Identified as a Gram negative entity with aerobic growth, it also hydrolyzes starch and esculin, digests protein and litmus milk, and utilizes arabinose, glycerol, and melibiose. These morphological and physiological characteristics, together with molecular properties of the 16S rRNA gene, indicate that the pathogen belongs to *Xanthomonas campestris*. Laboratory tests indicate that the pathogen is seed-borne.

OCCURRENCE OF BACTERIAL WILT ON ACACIAS AND EUCALYPTS IN INDONESIA

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Acacia and eucalypt plantations are being established on a large scale basis in Indonesia. These tree plantations are very important for climate change mitigation and adaptation. Disease infection is considered as a limiting factor in the establishment of acacia and eucalypt plantations. A number of pathogens have been identified to be associated with the trees in Indonesia. One of them is *Ralstonia solanacearum*, the causal agent of bacterial wilt (BW) disease. This is thought to be the first report on the occurrence of BW on fast-growing acacias and eucalypts in Indonesia. Incidence of BW disease on eucalypts in nursery and plantation has become apparent in recent years. In contrast, on acacias the disease is observed very rarely in plantations. Symptoms start as leaf drooping followed by wilting and yellowing of infected plants within a few days or weeks. Vascular discoloration in the stem is evident. Bacterial streaming is also observed from cut stems. White and irregular colonies with red coloration in the centre are consistently isolated from diseased plant tissues plated onto TZC medium. Successful completion of Koch's Postulate confirms compatible interaction in this host-pathogen system. Root related problems leading to stress condition of the plants have been identified as important pre-disposing factors for disease development. Root coiling or strangulation resulted from unmatched planting sites, the use of over grown planting materials, or improper planting practices are closely related to pathogen infection. Therefore, proper planting practices of high quality seedlings suitable to the planting sites are recommended to minimize disease incidence in plantations.

THE USE OF H₂O₂ FOR THE STUDY OF SOIL ORGANIC MATTER STABILIZATION

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The stabilization of organic matter in soils depends on the chemical structure of organic compounds and on the surface properties of the mineral matrix. Studies on organo-mineral interactions involving removal of organic matter, consequently require that the oxidation procedure chosen to destroy it does not alter the properties of the minerals. By using peroxidation, it would reflect the degree of stability of soil organic carbon in organo-mineral fraction. I investigated illite clay mineral without addition (I) and its mixture with wheat residues (St +I) and farmyard manure (M + I). The organic C contents of I, St + I, and M + I were 6.8, 30.4 and 23.4 g kg⁻¹, respectively. After treatment with 10% H₂O₂ (soil:solution ratio of 1:30, 80°C, 20 hours, 6 additions), the amount of residual organic carbon was similar (0.7 g kg⁻¹) in the unmixed illite and its mixture with organic materials. Approximately 3-5% of the metal oxides in the illite and in the mixtures with straw and manure were dissolved into the H₂O₂ solution and were detected in the supernatant. However, the X-ray diffractogram (XRD) showed that the structure of illite (alone or in mixtures) was unaltered after oxidation. The specific surface area of illite also remained the same after oxidation. It is concluded that the attack of H₂O₂ on the illite was minimal.

DEVELOPMENT AND VALIDATION OF THE RAPID IMMUNOCHROMATOGRAPHIC STRIP FOR *Cucumber Green Mottle Mosaic Virus*

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Cucumber green mottle mosaic virus (CGMMV) is a member in the genus *Tobamovirus*. It infects many species in Cucurbitaceae causing mosaic symptoms, yellowish leaf, and finally fruit distortion. The virus have been reported in Europe, Israel, Saudi Arabia, India, Pakistan, Korea and Japan which severely damaged and marked great loss of the total yield. Since chemical control is not available for plant viruses therefore virus-free materials is recommended for the control measure where the necessity of a rapid, sensitive and reliable mean of detection is required. In this research, an immunochromatographic strip (ICS) was developed for the detection of this virus. The system employed devices including sample application pad (SAP, 33 glass fiber), conjugate release pad (CRP, 33 glass fiber), nitrocellulose membrane (NCM, Prima 40) and absorbent pad (AP, 470 cotton linter). Anti-CGMMV polyclonal antibody (PAb-CGMMV) was conjugated with 40 nm colloidal gold particles for antigen capture at the CRP. PAb-CGMMV and anti-rabbit IgG were immobilized at a test line and a control line, respectively. Thirteen sample buffers were tested and Na₂BO₃ showed good promising line. Validation of the ICS was carried to provide the reliability of the assay. The investigation on specificity revealed highly specific reaction in agreement with ELISA. No cross reaction was observed either with healthy cucumber sap or other plant viruses and the assay could be visualized within 3 minutes. The sensitivity of the developed ICS examined by testing with diseased sap and CGMMV contaminated soil solution were 1:10,000 and 24 µg/ml, respectively.

ADDITIONAL SULPHONATED HYDROXYMETHYLATED PHENOLIZED SULFURIC ACID LIGNIN (SHP-SAL) INTO MORTAR OF LIGNIN MODIFICATION

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Building material to make mortar as control was carried out with two kinds of cement-sand comparison i.e. 1:2 and 1:3. Water was put into a stirring basin followed by 520 gram of cement with water cement comparison at 1:0.45 and 1:0.65. The engine was turned on at 140 ± 5 rpm speed for 30 seconds. After that, sand weighted according to the cement-water total comparison, was added slowly into the basin while the engine was running at similar speed for 30 seconds. The sample was then put into the paste, 0.4% of the cement weight; the speed was changed to 285 ± 10 rpm for 30 seconds. The stirring engine was stopped for 15 second and immediately cleaned off the mortar that was stuck in the inside wall, the engine then was covered for 1 minute. The mixture was let for 90 seconds and then turned on at 285 ± 10 rpm speed for 15 seconds. The mortar was put into a 16 x 4 x 4 cm casting cube 30 seconds after mixing. The casting was filled up with two layers where each layer was firmed and pounded for 32 times in ± 10 seconds. The entire molding time was not more than two minutes. The mortar surface was flattened and put in a damp place until the for testing, i.e. 3, 7, and 28 days. Mortar making as control was carried out with similar procedure without addition of sample. Each of mortar making was repeated twice.

ANTICLASTOGENIC EFFECTS OF BANABA (*Lagerstroemia speciosa*) AND VIRGIN COCONUT OIL (*Cocos nucifera*) ON THE CHROMOSOME BREAKING POTENTIAL OF TETRACYCLINE-INDUCED IN SPRAGUE DAWLEY RATS

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Numerous studies had been done on banaba (*Lagerstroemia speciosa*) and its active ingredient, corosolic acid, a potent compound that has insulin-like effect to lower glucose in the body. Virgin Coconut Oil (VCO) is rich in lauric acid. This study was undertaken to determine the anticlastogenic effects of banaba decoction and VCO using the micronucleus test which determines the chromosomal breaking activity of the known mutagen, tetracycline (TCN). The effects of banaba and VCO on the gain in weight, heart rate, respiratory rate, and temperature, feed and water intake in clastogen-induced rats were determined. Treatments 1 and 2 were assigned as the negative and positive controls, respectively; while treatments 3, 4 and 5 were clastogen-induced using TCN at the rate of 0.5 ml/20 grams body weight and were treated orally with banaba decoction, VCO and combination of banaba and VCO at the rate of 10 ml per animal per day, respectively. Treatment period was for a period of four weeks after which the experimental rats were sacrificed and were subjected to Micronucleus test. Both banaba and VCO reduced significantly ($P < 0.01$) the number of MPCEs in clastogen induced rats which indicates their 'anticlastogenic activity'. VCO (T4) was the most effective followed by banaba (T3), and combination of banaba + VCO (T5) with mean MPCEs of 1.33, 2.0 and 2.22, respectively. The positive control had more than thrice the number of MPCEs with 11.67 compared with rats given VCO, banaba, and combination including the negative control ($P < 0.01$) which was not clastogen induced. Further studies on the chemical substance found in Banaba and VCO that can shield the interaction of TCN with base pairs in DNA need to be

investigated. Moreover, the mechanisms of actions of the substances as anticlastogens need to be elucidated.

PRODUCTION OF POLYCLONAL ANTIBODY AGAINST AN INDONESIAN ISOLATE OF CHRYSANTHEMUM VIRUS B (CVB)

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Chrysanthemum Virus B (CVB) is a carlavirus that has been reported as one of the major viruses infecting chrysanthemum world-wide. Leaf mottling or mild vein-clearing is associated with CVB infection, although most of the cultivars are symptomless. The infection may also result in reduced flower quality. In order to produce healthy plants of chrysanthemum demands the screening of chrysanthemum materials for CVB before they can be transported from one country to another. Guidelines for CVB in a certification scheme recommended that CVB infection checked by serology. The success and accuracy of serological techniques to detect and identify viruses is dependent on the availability of diagnostic reagents such as antibody with good quality. The aims of this research is to produce polyclonal antibody of the CVB by guinea-pig immunization using purified CVB of Indonesian isolate. The antiserum was used further for the serological test. Serological methods for detection of CVB were I-ELISA and TBIA. The result showed that guinea-pig immunization using 150 µg of purified virus was able to produce 10.75 ml of antibody. The antibody produced had high sensitivity for detection of CVB when examined by I-ELISA and TBIA.

DEFENSE RESPONSE ELICITOR ACTIVITIES OF COMPOUNDS FROM *Ganoderma* CELL WALLS: A COMPARISON

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Basal stem rot (BSR) is the most important disease currently threatening the palm oil industry. The molecular signaling process between the pathogen, *Ganoderma boninense*, and its host, oil palm, during the infection process is still unclear. This study focused on the elicitation effects in oil palm roots of an aqueous extract of *G. boninense* compared to the effects of four compounds known to elicit defense responses. These four compounds included laminarin, chitin, fungal cell wall proteins (CWPs; extracted from *G. boninense* cell walls) and polygalacturonic acids (PGAs). The treated oil palm roots were assayed for five defense related activities: β -1,3-glucanase, chitinase, phenylalanine ammonium lyase (PAL), peroxidase (PO) and nitric oxide synthase (NOS). Results revealed that enhanced β -1,3-glucanase and chitinase were detected 3 h after treatment and reached their peaks 8 to 12 h after treatment for all the elicitors tested. Both activities were found to decrease significantly after peak activity was reached. However, laminarin and chitin were able to elicit the highest activities for β -1,3-glucanase and chitinase activities, respectively, and were significantly higher than those of *Ganoderma* extract-treated roots. For all five treatments, PAL and PO activities accumulation began 24 h after treatment and peaked at 48 h after treatment, with chitin being the most effective elicitor. NOS activity was detected 4 h after treatment. Peak activity was achieved at 20 to 24 h for all treatments except for chitin which showed no significant difference compared to those of the control. Laminarin was found to elicit the highest peak activity for NOS, followed by *Ganoderma* extract. The results showed that laminarin and chitin were the most effective compounds to elicit defense related responses in oil palm and have the potential to be used for developing a defense boosting strategy against BSR.

SENSITIVITY OF SOYBEAN [*Glycine max* (L) Merrill] POLLEN QUALITY TO HIGH TEMPERATURE STRESS DURING REPRODUCTIVE DEVELOPMENT

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Plant reproduction is highly vulnerable to global climate change such as high and low temperatures especially during reproductive growth stage. Future increases in greenhouse gases which will raise earth's surface temperature that would severely affect soybean production. The objective of this study was to quantify the response of pollen quality of soybean genotypes grown at different temperatures. The experiment was conducted in the field from July-October, 2009 at Experimental Field 2, Faculty of Agriculture, Universiti Putra Malaysia. To create variations in temperatures Degree Days, plants were covered with transparent plastic sheets. Normal condition without cover plastic cages (25°C) and single layer plastic cages (30°C) or double layer plastic cages (35°C) with transparent plastic walls were placed above the plant canopy at R1 to R2, Early Flowering (EF) or at R1toR5 EF to Pod Development (PD) plant developmental stages. Three varieties, AGS190, Dieng, and Willis were used in this study. Pollen numbers, viability, germination percentage and tube length, and pollen load were measured. The experiment showed that anthers derived from plants exposed to high temperature produced less pollen numbers per anther together with lower pollen germination, shorter pollen tube length and less pollen load for all three varieties, ($P < 0.0001$). These results suggest that AGS190 variety have a better ability to tolerate high temperature stress than the Dieng and Willis genotype. The clear effect of high temperature on pollen production and pollen grain germination have major implications on the fertilization process and seed set in sensitive crops such as soybean.

POPULATION GENETIC STUDIES ON *Oryctes rhinoceros* (L.) (Coleoptera: Scarabaeidae) USING RANDOM AMPLIFIED MICROSATELLITE (RAMS) MARKERS

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Oryctes rhinoceros or commonly known as rhinoceros beetles is an important pest of oil palm. The nocturnal habit of adults and its destructive feeding habit further heighten the difficulties in eliminating this pest. In Malaysia, incidences of beetle attacks became severe with the enforcement of the Zero Burning Concept. Currently, pheromone trapping is conducted at replanting sites. However, not all the population of *O. rhinoceros* in the field was attracted. This increased the possibilities for the presence of a cryptic species complex. To further clarify these possibilities, the genetic variations in *O. rhinoceros* population in oil palm plantations were investigated using randomly amplified microsatellites (RAMs) markers. Light and pheromone traps were used to collect a total of six populations of beetles for this study. DNA was extracted from the thorax and head tissues and seven RAMs primers were screened through all the populations. Seventy eight reproducible loci were generated and all the loci were polymorphic. Distances calculated based on similarity coefficient of Nei and Li (1979) ranged between 0.422 and 0.736. Based on the dendrogram, the clustering was observed to be influenced by preference to trapping system as well as geographical distance. The dendrogram constructed produced two major clusters. The separation of clustering between the Perak Pheromone (PP) and the Perak Light (PL) is important as it gives rise to the possibility for the presence of two groups of *O. rhinoceros* based on their preference toward light trap and pheromone trap. However, further studies using codominant markers especially single locus DNA microsatellite

markers will be carried out to understand the population genetic structure in *O. rhinoceros* and to further validate the presence of any cryptic species complex.

EFFECT OF ORYZALIN ON MUTANT INDUCTION OF *Spathoglottis plicata* Blume var. alba *IN VITRO*

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Oryzalin (4-(dipropylamino)-3, 5-dinitrobenzenesulfonamide, an herbicide) has been used for mutant induction in *Spathoglottis plicata* Blume var. alba in this study. Three-month old seedlings were exposed to 0.001, 0.005 and 0.01% oryzalin for 24 and 48 hr. It was found that the treated seedlings grew slower than the seedlings of control. After transferring the three-month old plantlets to the greenhouse for 6 months, the concentrations of oryzalin and exposure time significantly affected viability and morphology of the treated plants. Oryzalin at a concentration of 0.01% for 48 hr gave the lowest survival rate. Bush size, plant height and leaf size were decreased significantly compared to the control plants. On the contrary, seedlings treated with oryzalin at 0.005 % for 48 h gave the larger bush size, greater plant height and leaf length than that of control. Ploidy numbers, chromosome counts and flow cytometry are to be determined.

SEED QUALITY OF SOYBEAN IN RELATION TO PHOMOPSIS SEED DECAY FOR TWO SEASONS IN MALAYSIA

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Phomopsis seed decay (PSD) is detrimental for seed quality in soybean. In this study, three varieties of soybean planted at two plant densities for two seasons were evaluated for their sensitivity to PSD in Universiti Putra Malaysia. The incidence of infection to *Phomopsis* was determined by culture plate method in harvested seeds. Seed quality was tested using standard germination test, tetrazolium test and electrical conductivity. The most colonies of pathogen in infected seeds showed similarity with *Phomopsis longicolla*. There were significant differences between varieties and plant densities for infection to *Phomopsis* in the first season. The AGS 190 variety had 40% *Phomopsis* infection with 68% viability based on standard germination test and 60% based on tetrazolium test. The electrical conductivity was 98 $\mu\text{S cm}^{-1} \text{g}^{-1}$. In the second season the percentage of rainfall was higher than first season, so seeds were harvested with delay and the incidence of *Phomopsis* infection was higher in all varieties. Percentage infection of *Phomopsis* was 42, 32 and 25 % in AGS190, Deing and Pershing, respectively. Lower percentage viability based on standard germination and tetrazolium test and higher electrical conductivity were observed in second season. Higher plant density caused higher infection in PSD, lower percentage of seed viability and higher electrical conductivity. There was significant negative correlation between seed germination and *Phomopsis* incidence, and also it showed positive correlation with electrical conductivity. This study indicates that the incidence of PSD usually depends on field environments and planting densities while the severity of infection is dependent on the variety.

**CRYOPRESERVATION OF PROTOCOLM-LIKE BODIES (PLBs) OF *BRASSIDIUM*
SHOOTING STAR ORCHID BY VITRIFICATION AND ENCAPSULATION
DEHYDRATION**

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Protocorm-like bodies (PLBs) of *Brassidium* Shooting Star, hybrid orchid which is a new commercial ornamental plant was cryopreserved by vitrification and encapsulation-dehydration techniques. The effects of PLB sizes, sucrose concentrations in preculture media and exposure to PVS2 duration were the main parameters assessed in vitrification technique. The viability of the cryopreserved PLBs were determined by 2,3,5-triphenyltetrazolium chloride (TTC) assay after two weeks post cryopreservation. In vitrification technique, PLBs with the size of 3-4mm, precultured in half strength semi-solid MS media supplemented with 0.8M sucrose and dehydrated in PVS2 for 20 minutes at 0°C showed the best viability rate. In encapsulation dehydration technique, PLBs with the size of 3-4mm precultured in half strength semi-solid MS media supplemented with 0.8M sucrose and encapsulated in 3.5% of sodium alginate showed the best viability rate. The best parameters were chosen for positive and negative storage in LN and further biochemical content analysis (chlorophyll, total soluble protein and peroxidases activities) were conducted to investigate the physiological responses of the PLBs after cryopreservation.

MANNANASE PRODUCTION AND ITS POTENT APPLICATION IN FEED

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The supplementation of enzymes in the animal feed industry is currently very popular in Thailand. Enzymes promote the digestibility of non-starch polysaccharide which increases the energy and amino acid digestibility. However the commercial enzyme production is very few and the cost of enzyme and feed ingredients has continued to rise due to the increase in demand and cost of raw materials. This research aimed to investigate the optimal conditions and effectiveness of *Aspergillus wentii* in producing mannanase using Palm Kernel Meal (PKM) as a substrate in Solid State Fermentation (SSF). Without any supplementation, PKM is a good source of substrate for *A. wentii* to produce mannanase. It secreted mannanase when grown on PKM as an impure inducer. The highest mannanase activity was obtained at 37 U/g koji and 40-60 % initial moisture level was suitable for mannanase production. Decreasing the inoculum level prolonged the time for mannanase production in contrast to the medium depth. At higher temperature (35-45 °C), there is little influence on fungal growth but an obvious decrease in mannanase production was observed. The maximum increase in reducing sugar and crude protein contents of fermented PKM was achieved at 4.5 and 31.6 % gDW, respectively. During mannanase production, low concomitant cellulase and xylanase were also found. These results indicate the efficient induction of an impure PKM for mannanase production by *A. wentii*. This work revealed the potential of fermented PKM as source of feed additive.

VIRUSES ASSOCIATED WITH MOSAIC DISEASE ON CHILI PEPPER IN BALI, INDONESIA

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There are, so far, two kinds of viral diseases known affecting chili pepper in Indonesia, namely yellowing and mosaic. Yellowing disease has been reported associated with one virus that is *Pepper leaf curl geminivirus* (PepLCV), but mosaic disease of the plant may associate with infection of several different species of viruses. These viruses may be *Cucumber mosaic cucumovirus* (CMV), *Tobacco mosaic tobamovirus* (TMV) and *Chili veinal mottle potyvirus* (ChiVMV). Surveys conducted in the most of the chili pepper production areas of Bali reveal that mosaic diseases occurred in high incidence and caused a significant yield loss in some areas. Virus identification by using enzyme linked immunosorbent assays revealed the domination of CMV infection in all field surveyed (28.5%). These results suggested that mosaic disease of chili pepper in Bali was mostly associated with infection of CMV.

II. Rural Development and Agribusiness

ENVIRONMENTAL PERFORMANCE EVALUATION CHICKEN FARM CASE STUDY MO2 TAYTALAD MUENG LOPBURI

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This study is a research survey aimed to identify the environmental performance indicators (EPIs) for evaporative cooling system broiler farms which located on the fish pond. The study was conducted on 4 evaporation broiler farms in Lopburi province. Five operational performance indicators (OPIs) were set – unpleasant odors, discharge water, broiler litter, resources utilization, and mosquitoes and flies and five management performance indicators (MPIs) were set – environmental policy, environmental problems, legal and regulatory matters, training, and complaints. Environmental risk assessment was used to identify the significant environmental aspects and to evaluate environmental performance. The environmental performance evaluation found that all 4 farms' performances were fair. Management performance evaluation found that 2 farms had fair performance and 2 farms had needed to improve performance. A comparison between Thai and overseas performance was made on the following parameters: pH, BOD, COD, PO₄, SS, TKN and electrical utilization. Thai standard performance was 7.38, 18 mg/l, 120.75 mg/l, 1.57 mg/l, 68.25 mg/l, 7.35 mg/l, 458.2 kW/thousand birds respectively. The comparison between the case study performances and the overseas guidelines (Trade Effluent and industrial Sludge Regulations of Nation Environmental Policy Act) found t4 parameters (BOD, PO₄, TKN and electricity utilization) that were different significantly. The result of study showed in general that effluent quality did not meet the value-building effluent standards. Nevertheless, there was one house washing per broiler cycle and broiler farmers used a very small water volume to control humidity Therefore, there should be specific effluent standards to be used as the environmental management standard for broiler farm

because the broiler business is continuously growing and may cause serious environmental problems in the future.

ECONOMIC ANALYSIS OF THE CONVERSION TO A MORE FRIENDLY FARM MANAGEMENT: A STUDY IN CIANJUR DISTRICT, WEST JAVA, INDONESIA

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In the early 19th century, the total area of natural forest in Java was around 10 million ha. However, in the last decades the deforestation in the island has decreased it sharply to 1 million ha in 1989 and 0.4 million ha in 2005. The standard forest cover of 30 % of the total island area became the target to be achieved. This paper aims to clarify the current condition of farm management of farmers in Cianjur district, West Java, and to conduct the economic analysis for converting to an environmental friendlier farm management by planting the trees and raising livestock in order to increase the green and lessen the dependence on forest in the district. A field survey was conducted from July to September 2009. Cost and return analysis and NPV were employed in this study. The result shows that by converting to the new farm management the farmers will earn higher income and positive NPV over 25 years.

**PANGASINAN STATE UNIVERSITY ORGANIC FERTILIZER PROJECT
EXTENSION STRATEGIES AND INITIATIVES**

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The paper showcases the extension strategies and initiatives of Organic Fertilizer Production Technology which has been generated for the last 9 years. It discusses the package of technology on organic fertilizer production, the different components to effect desired development outcomes for the rural communities and people. The approaches used include (1) capability building/training of farmer-clienteles; (2) establishment of organic fertilizer production plants and assistance to LGUs Material Recovery Facility; (3) techno-demo to showcase PSU organic fertilizer (4) distribution of IEC materials in collaboration with cooperating agencies; and (5) monitoring and evaluation on trained farmer cooperatives, The dissemination, promotion and utilization of the PSU organic fertilizer production technology (1) equipped farmers and other clientele with the skills and knowledge on low-cost and adaptable organic fertilizer production technology; (2) established organic fertilizer production plants and assisted LGUs in the production of organic fertilizer using their acquired state-of-the-art equipments; (3) promoted the utilization and adoption of the OFPT thru techno-demo and IEC materials; (4) increased number of farmers adopting the technology; and (5) strengthened linkages with other agencies. It is therefore recommended to closely monitor and evaluate the performance of trained farmers; intensify the conduct techno-demo at farmers' farms; and, license the product.

**MUSHROOM FOR PROFIT: A LIVELIHOOD ASSISTANCE PROJECT FOR
THE MARGINALIZED SECTORS IN REGION I**

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The R&D project generally aimed to create/open innovative/alternative livelihood assistance for the marginalized sectors in Region I. The project was coordinated with the local government

units, POs and non-governmental organizations in the province of Pangasinan and SUCs and PHEIs within and outside the region. Beneficiaries included LGUs and SUCs and PHEIs. Consultation and planning with the potential partners and stakeholders as well as formulation of implementing rules and regulations was undertaken to identify perceived problems and solutions on the issues related to mushroom production. Training of screened beneficiaries on mushroom package of technologies and management was conducted and IECM were distributed. Design of ideal mushroom fruiting house was given to the potential mushroom growers, ranging from concrete to semi-concrete to high-tech fruiting house. On-site/field monitoring and evaluation of the beneficiaries' project were conducted to validate whether accomplishments are consistent with the actual output in the field.

COMPETITIVENESS ANALYSIS OF SMALL AND MEDIUM-SIZED ENTERPRISES IN THE NORTHERN RURAL AREAS OF VIETNAM

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This paper attempts to analyze the competitiveness of small and medium-sized enterprises in the domestic market as well as international market where globalization process recently has resulted in rapid increase of product movement, capital and labor. Analysis is conducted at enterprises level by using "Resource Cost Ratio" (RCR coefficient) to identify evidence implying competitive advantage. In order to question which has most influenced the enterprise's competitiveness, we use ECM model (error correction model) to quantify relationship between RCR and its factors contributed. Finally, we offer some practical policy recommendations to strengthen the competitiveness of enterprises. The results of the study revealed that most of agricultural small and medium enterprises are competitive, so as service enterprises. There is no case of competitive industrial enterprises. Enterprises from Hanoi are more competitive than those from other provinces in the North. In terms of legal form, more competitive are private, joint-stock, and foreign-invested companies, and less are state-owned and limited liability companies. Results from ECM estimation showed the direct influence of volume of sale, selling price, own capital and land on the change of RCR coefficient. Technical capacity and scale economies pose problems, particularly for small firms. The recommendations to enhance competitiveness are the government should ban unnecessary formalities in land hiring procedure and cut down interest rate to invest and upgrade production facilities in order to comply with more stringent standards.

ACCESSIBILITY TO RURAL PUBLIC SERVICES IN VIETNAM: AN OUTLOOK FROM THE RED RIVER DELTA

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In the transition to a market oriented economy, rural public services in Vietnam have changes towards decentralization and public service users have to pay for the service fees, instead of an existed free provision. This paper attempts to answer the questions of how people in rural area in Vietnam receive from public services provided by the government institutions and how they contribute to the government budget. Moreover, how equitability in benefiting rural public services in different groups of people is explored by closer looking at the major public services (*i.e.*, education, health, infrastructure and economic development) in the Red River Delta, which is considered as an area of the well-equipped public services as compared with other rural areas in Vietnam, since this is a dynamic and prioritized economic region in Northern Vietnam, and will be a strongly affected region by sea level rise in the future. We also provide some insights into appropriate institutional setting for

bringing equitable and accessible public services in the Red River Delta. The empirical findings from the public services in the Red River Delta are good suggestions and policy implications for those in other rural areas in Vietnam.

VERTICAL INTEGRATION IN PRODUCTION AND DISTRIBUTION OF EXPORTED VEGETABLES: PERSPECTIVES OF FARMERS AND FIRMS IN LUC NAM DISTRICT, BAC GIANG PROVINCE, VIETNAM

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This paper aims to identify the coordination models between farmers and firms in term of production and distribution of exported vegetables in Luc Nam district, Bac Giang province, Vietnam. Contract farming was enacted a few years ago in Luc Nam district, Bac Giang province. However, the coordination between producers and firms was not improved so much because of increasing in input prices, fluctuation of prices of vegetables, weather conditions, small-scale production, poor quality of vegetables, lacking of market information and support of the Government. On the other hand, the coordination between farmers and firms is successful or not depending so much on the ability of the firms in terms of looking for customers, especially exported vegetables such as baby cucumber, Japanese cucumber and baby tomato. Research methods used in this study including selection of the study area and Participatory Rural Appraisal (PRA) in Dong Phu and Dong Hung communes, Luc Nam district. In addition, SWOT analysis was applied to point out strengths, weaknesses, opportunities and threats of each partner in production and distribution of exported vegetables. This study also indicates economic performances and social impacts of coordination models on farmers and firms. Factors affecting the coordination models between producers and firms were mentioned, consisting of demands in distribution of vegetables of producers, demands in processing materials of companies, policies offered by companies for producers, ability in looking for markets of processing companies, demands in consumption of vegetables in the world, requirements in vegetables of importers, and roles of local authorities.

SUSTAINABILITY OF THE INDIGENOUS WOMEN'S UPLAND FARMING SYSTEM: LESSONS FOR CLIMATE CHANGE ADAPTATION IN THE HIGHLANDS OF OCCIDENTAL MINDORO, PHILIPPINES

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This paper describes the sustainability of the Hanunuo Mangyan women's upland farming system in Occidental Mindoro, Philippines. This also determined their socio-economic and psychological characteristics, and perspectives of the environment. This employed participatory rapid appraisal techniques. The triangulation method consisting of household survey, field observation, key informant interview and focused group discussion were used in generating and validating data. The Hanunuo women were young with basic education and actively involved in community organizations. They had high aspirations for an improved life and had good perspectives of the environment. These showed women are potential in helping initiate sustainable upland development in the community. The upland farming system was traditional and subsistence. Cropping system was multistorey with high biodiversity but with low productivity. Some farm practices were detrimental to humans and environment like slash-and-burn cultivation and use of toxic chemicals for native plant varieties. Hence, the farming system can be considered as "moderately sustainable." Research results suggest a need to educate the Hanunuo women on responsible stewardship of the environment. Culturally

acceptable farm practices and new crops with economic potentials that could adapt to poor soil conditions must be introduced. Adaptation measures appropriate for uplands must be instituted to address the threats of climate change.

**SUSTAINABLE AGRICULTURAL DEVELOPMENT EXTENSION PROGRAM (SADEP):
THE OMSC's PARADIGM IN EDUCATING COMMUNITIES ON CLIMATE CHANGE
ADAPTATION IN OCCIDENTAL MINDORO, PHILIPPINES**

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Occidental Mindoro State College, San Jose, Occidental Mindoro, Philippines**

The Sustainable Agricultural Development Extension Program (SADEP) is the Occidental Mindoro State College's (OMSC) strategy to educate rural communities of Occidental Mindoro, Philippines on health, sustainable agriculture, natural resource management, livelihood and climate change. This program launched in 2001 aims to improve farmers' productivity and income; promote safe community living, build people's awareness and capacities to address emerging threats of climate change, and mobilize community participation in environmental protection projects. The OMSC forged partnerships with various development organizations to finance the projects. The program is instrumental in bringing development to the countryside. It enabled generation of sustainable livelihood among farming households hence, an improvement in their productivity and income. It facilitated adoption of ecologically sound farming practices. It raised people's consciousness on impact of climate change. It rekindled their aspirations to secure the future through responsible stewardship of the environment. It is recommended that partnership with other development organizations must be institutionalized to sustain projects and improve delivery of services. Continuous capability building of communities in natural resource management and climate change adaptation and mitigation are very important. Impact study should be conducted to determine how much SADEP has contributed in attaining good quality of life in rural communities.

USE OF BEEF SKIN FOR MAKING CRACKLINGS IN THAILAND

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Cracklings are a crisp, deep fried food that may be made from skin of pork and poultry. Pork rind cracklings are popular in the Thailand. If beef skin can be made into cracklings like pork or poultry skin, it will be very useful for consumers. This research aims to study acceptance of beef skin cracklings by assessing the satisfaction of consumers in terms of appearance, flavor, texture, color and overall satisfaction of pork cracklings compared with beef skin cracklings. The skin of native cattle aged 2-3 years through incubation (aging) at temperatures below 4 °C for 7 days were used. Five experimental formulae were prepared: Formula1. pork cracklings (control formula), Formula 2 beef skin from back part, Formula 3 beef skin from plate part, Formula 4 beef skin from legs part, and Formula 5 beef skin from neck and head part. The experimental design was Repeated Measurement in CRD. The skin samples were cut into small pieces and put in deep-fried (palm oil formula at 200 °C for 45 seconds per formula) until golden brown. The sample was collected in a plastic bag to prevent air penetration with oxygen absorber. The results showed that Formula 2 beef skin from back and Formula1 had the highest scores in overall satisfaction. There were not significant difference in satisfaction ($p < 0.05$) when compared with the control group (pork cracklings). So beef skin cracklings can be used to replace pork cracklings or to add value.

ASSESSMENT OF THE EFFECTS OF REGULATING THE USE OF PLASTIC BAGS AS PACKAGING MATERIAL IN COMMERCIAL ESTABLISHMENTS IN LOS BANOS, LAGUNA PHILIPPINES

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The paper assessed the perceptions and level of compliance of the residents and owners of commercial establishments in Los Banos, Laguna, Philippines on the implementation of Municipal Ordinance 2008-752 that prohibits the use of plastic bags on dry goods and restricts its use on wet goods. It also determined the ordinance's effect on the profits of the commercial sector and the buying habits of the residents. It was found out that all of the household respondents and the commercial establishments were aware of the ordinance however only 86% of the commercial establishments and less than half of the household respondents were fully compliant. Further, it was revealed that compliance is affected by gender, educational attainment, level of income, and age of the household respondents. Firm's compliance on the other hand is affected by the type of goods sold. Household respondents' buying habits were also altered as they shifted their preference to buy from wet markets to supermarkets, changed product preference and the number of visits to the markets. In addition, 24% of the firms reported to have experienced an increase in their profit due mainly to the reduction in packaging costs. The reduction in the municipality's solid wastes generation cannot however be solely attributed to the implementation of the ordinance as it was concurrently implemented with segregation and recycling program.

COMPARATIVE STUDY OF AGRICULTURAL LAND USE SYSTEM IN THREE PROVINCES 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 (from lowlands to midlands and highlands and season temperature variations), 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 is 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, livestock and aquaculture for urban markets, or engaging in non-farm activities. The main focus of this paper is to analyze and compare the recent changes in land use system, and to determine the pattern of land holding of the farm respondents for agricultural production of three provinces. A series of questionnaire survey was conducted in March and June 2010 in Hai Phong, Hung Yen, and Bac Ninh Provinces which are located in Red River Delta in the North of Vietnam. Comparative analysis have led to the preliminary findings that agricultural land use was very flexible, encourage agricultural diversification, use resources more efficiently and reduce risk to farmers. Economic returns from different land uses vary considerably and vegetable production plays a key role in generating household cash income.

**THE PHILIPPINE COMPREHENSIVE AGRARIAN REFORM PROGRAM:
ITS PERCEIVED IMPACT TO ECONOMIC DEVELOPMENT OF FARMERS**

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Poverty in the Philippines is a rural phenomenon. The greater percentage of the poor is dependent on agriculture. Most of them are tenants; they do not own the land they till. The Comprehensive Agrarian Reform Program (CARP) was envisioned to alleviate if not to eliminate poverty through its three components of: Land Tenure Improvement (LTI) Agrarian Justice Delivery (AJD) and Program Beneficiaries Development (PBD). This study evaluated the implementation of CARP and its perceived impact to the economic development of farmer-beneficiaries in two Agrarian Reform Communities. Findings revealed that the implementation of Land Tenure Improvement (LTI) and the Agrarian Justice Delivery (AJD) was *very satisfactory*. The Program Beneficiaries Development (PBD) component was rated as simply *satisfactory*. CARP implementation was perceived to have improved *much* farm productivity while *moderate* improvement to farmers' income and their basic needs satisfaction. The marked improvement in farm productivity was not followed on the same degree by improvement in income due to other intervening factors such as high production cost, high interest rate and short term payment period of agricultural loans and unforeseen natural calamities and climate change. It is concluded, that CARP achieved improvement in the economic development of farmer-beneficiaries but there are a lot more to do for poverty alleviation and improvement of the quality of life of farmers. It is recommended to conduct a deeper study and together with the farmers come up with a more effective strategy to achieve its objective of improving the life of the rural poor.

**INITIATIVES TO PROMOTE ORGANIC AGRICULTURE IN THE PROVINCE OF
PAMPANGA, PHILIPPINES**

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The continued used of chemicals create an imbalance in the nutrient composition of the soil, making it acidic and hence reduces soil productivity. Recognizing this situation Pres. Gloria Macapagal Arroyo issued Executive Order 481 "Promotion and Development of Organic Agriculture in the Philippines" to address worsening problems which every farmer is facing. The project focused on the identification of efficient propagation techniques for selected indigenous vegetables; and documented the promotion of organic-based production practices in Pampanga, Philippines. Selected indigenous vegetables were grouped according to the mode of propagation (seeds and cuttings). For seed vegetables, the following were used as treatment: method of drying: air, sun and oven drying at 50°C. For cuttings, the age and length of cutting were considered. In terms of seed propagation, the three methods of drying did not differ significantly. Significant differences were observed in the age and length of cuttings. Cuttings planted within 1 to 2 days obtained highest percent survival. Moreover, most of the organic farmers in Pampanga, Philippines are above 50 years old with 1-2 hectares size of farm. In the absence of organically-grown vegetable seeds, they rely on the use of hybrid seeds. Basal application of organic fertilizer is the most commonly practiced and farmers use botanical spray and insect repellent plants. Conventional practice is adopted relative to harvesting and postharvest technology. Their knowledge in organic agriculture was obtained mainly from training, seminars and monographs. Marketing was usually done in whole sale and retail systems. Majority (75%) relied on credit assistance from private with 3-5% interest rate, while 25% of the farmers availed from government banks with relatively lower interest rate.

**ADAPTATION OF FARMING COMMUNITIES TO CLIMATE CHANGE
AND CLIMATE RELATED HAZARDS**

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Upland and lowland farming communities are most vulnerable to climate change and climate-related hazards. The type of hazard and the severity of losses due to these hazards and the resulting adaptation measures taken by farm households vary depending on the risks associated with these hazards. Very often, human activities which are exploitative of natural resources aggravate the adverse effects of natural hazards. The nature of these exploitative activities by farming households as well as their adaptation measures are influenced by the existing social, economic and institutional conditions. The solution requires the joint effort of the local community and local government that should consider the specific local conditions to reduce the vulnerability of farming communities thru proper management of natural and environmental resources. On the whole, the study points to the need for an integrated approach to promote community resiliency and reduce the vulnerability of communities to these climate related hazards.

SUPPLY CHAIN ANALYSIS OF HIGH VALUE VEGETABLES IN THE PHILIPPINES

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The paper is designed primarily to analyze the supply chain of selected high value vegetables in the country and suggest policy directions and strategies to address the key binding constraints that affect the productivity and competitiveness of these crops. The supply chain of selected high value vegetables is composed of five major components: input supply, production, postproduction, marketing and trade and consumption. Key participants involved in the supply chain at the micro level are input suppliers, growers, brokers/agent, assembler-wholesalers, wholesalers/distributors, wholesaler-retailers, retailers and consumers. Cabbage, carrot, bell pepper and broccoli benchmark farms in Benguet which adopted improved production technologies incurred lower production costs than typical farms. The practice of using more of organic than inorganic fertilizers and adoption of IPM significantly reduced the production costs of the benchmark farms compared to typical farms. Assembler-wholesalers who transported cabbage from production areas in Benguet to Metro Manila received the highest share of net income in the supply chain followed by retailers and wholesaler-retailers. Farmers obtained the lowest share of net income. For carrots, assembler-wholesalers in the Benguet-Divisoria distribution channel generated the highest share of net income while in the Benguet-Balintawak distribution channel, it was the retailers. The difference in net income distribution is due to the difference in buying prices of the assembler-wholesalers between the two trade channels and the difference in the value of postharvest losses at the retail level. Given the major findings of the study, the following policy directions and strategies are recommended: (1) promotion of IPM, production programming and organic/green farming in major production areas; (2) conduct of massive information campaign on the best practices of benchmark farms; (3) conduct of hands-on training on proper postharvest handling practices/technologies; (4) strengthen the marketing assistance program of the government; (5) provision of adequate market infrastructure; and (6) provision of effective and timely market information system.

STRENGTHENING CAPACITIES FOR CLIMATE RISK MANAGEMENT AND DISASTER PREPAREDNESS: A GOP-FAO INITIATIVE IN THE BICOL REGION

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The Bicol Region, due to its geographic location and physical environment, is highly vulnerable to typhoons, floods, and droughts. It experiences an average of 20 typhoons and tropical storms annually. They usually result to landslides, flash floods, widespread flooding and together with strong winds, cause the destruction and damage to homes, public infrastructures, and agriculture. The region also experiences seasonal variations in weather, especially of rainfall, resulting to variations in production and seasonal price fluctuations that significantly affect the income of the farmers. Climate change is expected to further exacerbate the poverty condition in Bicol given its vulnerability to climate-related hazards. The Government of the Philippines (GOP) and the Food and Agriculture Organization (FAO) saw the need to strengthen the capacity of local communities to respond to climate change. This concern is being addressed by (a) improving capacity of local government units to use early warning system; (b) strengthening capacity of PAGASA to provide site-specific short- and long-term forecasts; (c) strengthening capacity of the DA-RFU and concerned LGUs undertake timely and accurate post-disaster damage assessment; (d) developing and implementing community-based natural disaster risk management plans; and (e) identifying, pilot testing and disseminating good practice options for climate change adaptation and disaster risk reduction for vulnerable livelihood groups.

ASSESSMENT OF CURRENT FARMING PRACTICES AND PRODUCTIVITY OF THE RAIN-FED RICE FARMERS IN REGION III, PHILIPPINES

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The study attempted to assess the current farming practices and productivity, identify the area and the farmers under rain-fed rice farming, identify the coping mechanism to mitigate the effect of climate change and problems relative to low productivity of the rain-fed rice farmers in Pampanga. Survey data and secondary sources were utilized to assess how they are coping with different factors concerning rain-fed farming. The findings indicate that there are still many rain-fed rice farmers in Pampanga using traditional practices. Their land area was not fully utilized for rice production due to insufficient source of water and lack of farm implements. They are not involved in cooperatives, are aware of climate change but do not really know what climate change means. The high cost of inputs, low price for products, irrigation facilities and lack of capital are the major reasons for low productivity. It is recommended that the government must extend more efforts in providing services for the rain-fed rice farmers by taking the cultural and management practices into consideration. Strategies are needed to remove management related inefficiencies in rice production either through a better market price information system or effective farmer-oriented technical training programs. It is further recommended that government assist farmers acquire new high yielding varieties. With these new technologies and their adaption, there is a big possibility that yield will be increased.

PHOSPHORUS USE EFFICIENCY IN MALAYSIAN UPLAND RICE

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Phosphorus deficiency is the major constraint to crop production in Malaysia and this has resulted in upland rice production showing low yields $\approx 1 \text{Mg ha}^{-1}$. Conventional amelioration of P deficiency by application of fertilizer is becoming increasingly uneconomical and ecologically unsound as the efficiency of added fertilizer is low $\approx 10\%$ (Werft and Dekkers, 1996). Consequently, improvement of P uptake and P use efficiency (PUE) by crops is critical as an economic, environmental-friendly and sustainable strategy. The key to increase P recovery from less accessible forms is using crop cultivars that are more efficient in P use. High PUE is achieved through efficient internal P utilization and/or increased acquisition of more P from soil. This study was carried out with the aim of (1) To assess the variability of PUE in upland rice landraces grown in field conditions, and (2) To study the root morphology and phosphatase traits of the different upland rice landraces. Ten upland rice landraces were planted in polybags without application of any P sources to determine their P acquisition ability. Another study was made in the field where these landraces were planted at zero and 100 kg P ha⁻¹. Total P uptake was measured from plants grown in glasshouse at 30 days old and their root characteristics measured using a WINRHIZO scanner. Phosphatase exudates in roots of plants grown in the field were measured at harvest following the method of Tabatabai and Bremner, 1969. Shoot weight (SWT), root weight (RWT), root length (RL). Root surface area (RSA) and PUE exhibited significant differences among landraces. PUE was highest in G10 which also exhibited the highest phosphatase activity determined from field grown plants.

ECOLOGICAL FARMING FOR ECOLOGICAL RECOVERY

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The world faces problems which range from inequitable income, resource distribution and environmental degradation to social deformities or maladjustments. Indiscriminate collection and consumption caused many species of plants and animals to slowly disappear. Agricultural ecosystems suffer most due to ecological backlash caused by loss of some important components found therein. Rural communities are the most adversely affected because they depend much on ecosystems that are supposed to provide food and other needs but are now heavily damaged. The introduction of foreign plant and animal species caused exploitation and imbalances of local habitats and disappearance of some important flora and fauna. This study envisioned to reproduce local breeds of plants and animals and bring back agricultural ecosystems to a more stable condition where they can provide maximum productivity and benefits. The project specifically aimed to retrieve and perpetuate native species of edible freshwater mollusks and fishes that are already disappearing. A fishpond was constructed inside a 500 m² area where native species of fishes that were commonly found in the rice fields were cultured. Vacant spaces were planted with indigenous vegetables. A garden for herbal medicines was also put up to provide source of planting materials. Native chicken production was also established inside the farm. Once the farm becomes fully established, it would be able to provide stocks that could be distributed to local communities for mass production to satisfy their table requirements. It would also provide necessary genetic material for sustainable breeding programs.

A SITUATION OF MATRITIS – MASTITIS – AGALACTIA (MMA) SYNDROME IN EXOTIC SOWS RAISED IN FARMS IN THAI BINH PROVINCE, VIETNAM AND PRESCRIPTIONS FOR TREATMENT

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A study of Mastitis – Metritis – Agalactia (MMA) on reproduction exotic sow was conducted at 4 farms (raising 500 sows) in Thai Binh province, Vietnam. The results revealed that the MMA percentage was high (50.93%) leading to reduction in the post weaning conception rate of MMA sows compare to non MMA sows (90.92% and 96.11%, respectively), to increase diarrhea percentage of piglets (83.19% and 50.26%, resp.), to reduce the 21-day old piglet body weight (5.45 and 5.91 kg). The prescription No.3 was better in treatment of MMA sows

III. Food Security and Development of Bioenergy

SUSTAINABLE BIOENERGY DEVELOPMENT AND FOOD SECURITY UNDER CLIMATE CHANGE CONDITIONS

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Climate change and agriculture are interrelated, indicated by agriculture is significant contributors to greenhouse gases (GHGs) emission and agriculture is one of the first sectors to be affected by climate change. Because of the major of GHGs emission come from fossil energy utilization and the rising costs of fossil fuels due to increasing in the global fuel demand compromise the ability of many developing countries to search for new sources of bioenergy. This paper aims to discuss how to develop bioenergy under the climate change condition without weighing heavily in food security. Secondary data from appropriate sources were used to prepare this paper. Descriptive analysis was used to discuss the problem. Bioenergy is energy produced from biomass that is burned directly or further processed into solid, liquid, or gaseous fuels. A number of agricultural crops can serve as feedstocks for bioenergy production. Bioenergy development could revitalize the agriculture sector, foster rural development, generate employment and provide a source of income to support rural livelihoods, improve rural access to sustainable energy, increase harvests for both food and fuel crops, and make a significant positive contribution to the climate problem. But, if not managed sustainably, it could seriously threaten food security. Given the opportunities and risks, criteria for the sustainable development of the bioenergy industry should be clearly established.

THE EFFECT OF LENGTH OF DELAYED PROCESSING AND CONDITIONING ON THE QUALITY OF CURED VANILLA BEANS

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The experiment intended to find out the optimum effect of conditioning on the quality of cured vanilla beans. At Randomized Block Design with two factors namely length of delayed processing (0, 5 and 10 days) and conditioning temperature (ambient temperature, 30, 35 and 45°C). Results showed that conditioning at temperature 30°C and 5 days length of delayed processing yielded highest quality of cured vanilla beans with the highest rendement (19,24 percent). Water content of 35,

78 percent (wb), vanillin content 2,89 percent (db). Conditioning at 30°C and 5 days length of delayed processing produced sharp aromatic, black color and best texture of cured vanilla beans

OPTIMIZATION OF THE SPRAY DRYING PERFORMANCE OF BANABA [*Lagerstroemia Speciosa* (L.) PERS.] LEAF EXTRACT FOR INSTANT TEA

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The study was conducted to establish the optimum spray drying performance of banaba leaf extract for instant tea and develop a drying model for it using the Regression Surface Methodology. The effect of the process parameters such as air inlet temperature (100, 120 and 140°C), pump speed (7,000, 10,000 and 13,000 rpm) and decoction ratio (1:3, 1:5 and 1:7, banaba leaf to water) on the response variables, namely: drying capacity, product moisture content and recovery rate, were evaluated. The experimental test consisted of fifteen (15) runs using the Box-Behnken design. Response surface analysis showed that models for drying capacity and moisture content were statistically adequate. The optimal processing condition is 122°C, 10,000 rpm and 17.5 (1:5.7, banaba to water) decoction ratio yielding to a drying capacity of 15.16 g/min and 6.84 % moisture content, dry basis. Upon validation, it was found that the predictive model for the drying capacity is accurate and precise and better product moisture content was obtained. Moreover, the spray dried banaba powder has shown significant anti-diabetic activity when tested on alloxan-induced diabetic mice at the dosage rate of 250 mg/100 g body weight. Hence, spray drying can be used in the production of banaba powder at specified optimum processing condition.

PERFORMANCE EVALUATION OF SWEET SORGHUM LINES FOR BIO-ETHANOL AND GRAINS UNDER PANGASINAN CONDITIONS

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The general objective of the study is to conduct evaluation trial of five (5) sweet sorghum lines under Pangasinan condition. Specifically, it aims to determine their agronomic characteristics and identify and recommend varieties that are suitable for ethanol production. This paper highlighted the results of the three (3) trials conducted from October 2007 to February 2009. Analysis of variance in the 1st and 2nd trials showed that there were significant differences among varieties observed for plant height, stalk yield, stripped stalk yield, stalk juice volume, stalk juice yield, Brix, stillage yield, grain yield and seed size. In the 3rd trial, however, stalk yield and stripped stalk yield parameters showed that there were no significant differences among the varieties tested. The mean agronomic characteristics of the 5 varieties evaluated showed that ICSV 700 performed better in terms of plant height. Consequently, ICSV 700 and ICSV 93046 were the top performers in terms of stalk yield, stripped stalk yield, stalk juice volume, stalk juice yield, and *Brix. The varieties SPV422 and NTJ2 performed better in terms of stillage yield in the 1st trial while SPV 422 obtained the best performance in the 2nd trial. However, for the 3rd trial, ICSV 93046 performed better as compared to the other varieties. On grain yield parameter for 1st and third trials, SPV422, ICSR93034 and NTJ2 were among the top yielders. Data on grain yield was not taken in the second trial due since it was attacked by the birds. Whereas, in terms of seed weight, ICSR 93034, performed better in the 1st and 2nd trials, while SPV 422 performed better in the 3rd trial.

GROWING RICE ON AN AMENDED ACID SULFATE SOIL UNDER RAIN-FED CONDITIONS

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Climate change has, to a certain extent, altered the life of farming communities in the main granary area of Malaysia, especially in the rain-fed regions of Kedah. Unfortunately, subsidized irrigation water for crop production is not provided in these areas. A study was conducted in the Merbok, Kedah, Malaysia, so as to ameliorate the infertility of an acid sulfate soil for rice cultivation. In Malaysia, converting marginal land to productive rice fields is part and parcel of the ongoing exercise to boost up self-sufficiency in rice, which currently stands at 73%. The soil under study was stressed by the low pH and the presence of high amount of Al, which is toxic rice plant. In this study, rice (variety MR 219) was planted on a non-irrigated field where the soil was treated with various amendments that included ground magnesium limestone (GML), liquid lime and hydrated lime. Treating the soil with GML and other amendments at the appropriate rates had increased soil pH significantly with concomitant decrease in exchangeable Al that result in better growth of rice plants as compared to that of the control treatment. The rice yield on amended soils was higher than the national average of 3.8 t/ha. The yield of rice grown on the soil using farmer's practice is about 2 t/ha. The ameliorative effects of the amendments are expected to last for more than four seasons, two years. The rainfall that came later than usual had created havoc to the production of rice in the area.

DROUGHT TOLERANCE EVALUATION OF RICE WITH DIFFERENT WATER SUPPLY AND CULTIVATED UNDER VINYL HOUSE

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Global warming may lead to climate change that causes deficit or excess water in rice cultivation. Drought tolerant varieties may have good opportunity as a reasonable option to overcome water stress condition. The objective of this study was to evaluate the effect of limited water supply toward growth and production of eight rice genotypes, namely IR64, IPB97-F-15, Ciherang, Menthik Wangi, and Rokan hybrid (low land type), Jati Luhur, Silugonggo (up land type), and Way Apo Buru (amphibian type, that could be planted both as lowland and up land). Rice seedlings at 14 days old were transplanted in pond with massive walls (4 m length, 3 m width and 0.8 m depth), 1 plant per hole and 2 raw per variety, with spacing 20 cm to 20 cm. The experiment was conducted in a vinyl house, with four replications. Water was supplied by irrigation pipe with inlet and outlet per pond as treatment: W₃ (watering till 3 weeks after transplanting, WAT), W₆ (watering till 6 WAT), W₉ (watering till 9 WAT), and control (watering during rice growing). Plant height, leaves number, tiller number, leaves chlorophyll content, stomata number, and photosynthetic activity were observed periodically. Yield and yield component were observed at harvest time. Drought sensitivity was observed by scoring index, and drought tolerant index were calculated as productivity achieved ratio to control in each rice variety. The results showed that rice variety having different level in drought sensitivity and drought tolerant index. IR 64 variety showed the most sensitive to drought, whereas Jatiluhur variety showed the most tolerant one. From this research, we propose a bioassay method for screening of rice tolerance to water stress in naturally growing conditions.

THE POTENTIAL OF GREENHOUSE GAS REDUCTION FROM CLEAN DEVELOPMENT MECHANISM IMPLEMENTATION IN SWINE FARMS IN THAILAND

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The objective of this study was to estimate the potential for greenhouse gas reduction from the implementation of “Clean Development Mechanism” in the swine farms in Thailand. The “Clean Development Mechanism” is compatible with anaerobic system. Thus, the farms that treated wastewater by anaerobic systems were evaluated for the potential and value of greenhouse gas reduction. In addition, biogas production and electricity generation were assessed. The swine farms treated wastewater by an anaerobic system have the annual potential in methane reduction was 7.8 million tons or the equivalent of 164.8 million tons of carbon dioxide. This was worth about 84,838.2 million baht. For biogas production, 577,733 livestock units were able to produce 179.2 million m³. The estimated annual potential electricity generation was 215.1 million units and valued about 494.7 million baht.

WATER CONSUMPTION VARIATION AMONG RICE VARIETIES SHOWING POSSIBILITY TO EXPLORE BENEFIT OF WATER USE EFFICIENCY

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Economic value of water should be considered in relation with water scarcity and expansion of water consumption for other sectors outside of agriculture. Water use efficient varieties may have good opportunity as a reasonable option that could produce rice grain efficiently. This study was conducted to determine water consumption among rice genotypes that conventionally cultivated as low land (IR64, IPB97-F-15, Ciherang, Menthik Wangi, and Rokan hybrid), up land (Jati Luhur, Silugonggo), and amphibian type (Way Apo Buru, that could be planted both as lowland and up land). Rice seedlings at 14 days old were transplanted in a plastic container (67 cm length, 47 cm width and 37 cm depth, containing 83 kg of air dried soil), 1 plant per hole and 6 plants per container. The experiment was conducted in a vinyl house, using Randomized Complete Block Design with three replications. During rice growing, water table was maintained at 2 cm above soil surface, and water was added and recorded weekly. Plant height, leaves number, tiller number, leaves chlorophyll content, leaves thickness, stomata number, and photosynthetic activity were also observed. The results showed that water consumption among varieties were significantly different. IR 64 variety showed the smallest consumption of water, whereas Jatiluhur variety showed the highest one. The amount of water consumption among rice varieties were recorded in range of 15.93 to 24.13 liter per plant, or equal with 3,639 to 4,827 m³ per ha. The finding may guide us to explore benefit of water use efficient variety as sustainable option in water management of rice cultivation.

ANTIMICROBIAL ACTIVITY OF KEFIR AND LACTIC ACID BACTERIA ISOLATED FROM KEFIR

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Kefir is a refreshing, self-carbonated fermented milk product that is well known as a functional food product and regarded as healthy food. Health benefits of kefir was believed due to metabolic activities of lactic acid bacteria occur in this product. Lactic acid bacteria (LAB) commonly used as starter cultures in foods are known to produce antimicrobial substances such as organic acids, hydrogen peroxide, bacteriocins, have a great potency as biocontrol of pathogens and spoilage organisms as well. The present study was aimed at evaluating *in vitro* antimicrobial activity of one Indonesian kefir and LAB isolated from this kefir against pathogens. These lactic acid bacteria was identified as *Lactobacillus brevis*, *Lactobacillus acidophilus* and *Lactobacillus kefiranofaciens*. These three species as well as kefir filtrate showed antagonistic activity against pathogen *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhi* except *Lactobacillus kefiranofaciens* showed no inhibition to *Salmonella typhi*.

DIFFERENTIAL CARBOHYDRATE METABOLISM OCCURS DURING SUBMERGED GERMINATION AND EARLY GROWTH IN BARNYARDGRASS (*Echinochloa* spp.) AND CONTRASTING RICE (*Oryza sativa* L.) GENOTYPES

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With the looming water crisis due to climate change, more rice farmers are likely to shift from transplanted to direct-seeded rice (DSR). An important aspect of DSR which is flooding to suppress weed growth, however, could also adversely affect growth of rice. This study was conducted to determine the morphological and biochemical responses of two rice genotypes, IR42 and *Khao Hlan On* (*KHO*), and two grasses, *E. crus-galli* and *E. colona* to various times and depths of flooding. *KHO* and IR42 had less reductions in germination, shoot and root growth and tolerated early and deep flooding better than did *E. crus-galli* and *E. colona*. However, both weeds recovered fast, which allowed them to catch up with both rice genotypes after initial flooding injury. In all four species, flooding enhanced anaerobic fermentation through increased activities of alcohol dehydrogenase (ADH) and pyruvate decarboxylase (PDC). The ability of *E. crus-galli* and *E. colona* to shut off ADH and PDC after aerobic germination, which was not observed in both rice genotypes, could contribute to the faster growth and competitiveness of the two grasses. Activity of aldehyde dehydrogenase (ALDH), which detoxifies acetaldehyde, was higher in *KHO* and *E. crus-galli* than in *E. colona* and IR42 under flooded conditions. Regulation of ALDH activity appeared to be implicated in the mechanisms of tolerance to flooding of *E. crus-galli* and *KHO* and may serve as basis in developing flood-tolerant rice cultivars and other crops.

AFLATOXIN- PRODUCING POTENTIAL OF *Aspergillus* AND *EUROTIUM* ISOLATED OF RICE

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Aflatoxins are among the five most important naturally occurring mycotoxins in food and produced by several species of *Aspergillus*. They are of the most important concern as they are mutagenic, teratogenic and carcinogenic. Considering the economic and nutritional importance of rice in Malaysia, this research was conducted to determine *Aspergillus* and *Eurotium* species that produce aflatoxins in rice under natural conditions. Characterization of the species was based on PCR amplification and nucleotide sequencing of the internal transcribed spacer (ITS) 1 and 2 regions of 16S rDNA. Milled rice samples were collected from retailers in four states (Selangor, Perak, Penang and Kedah) in Malaysia. The samples were evaluated for *Aspergillus* and *Eurotium* contamination and holomorphs were isolated and identified. Aflatoxin production capability of all isolates on yeast extract sucrose (YES) agar was determined and analysis performed with thin-layer chromatography (TLC) and fluorescence spectroscopy. Only *A. flavus* isolate A2 (Accession number: GU076485; UNiCC code: UPMC 89) was found to produce aflatoxin B in medium culture (367 µg/ml). The identified isolates were deposited in the Microbial Culture Collection Unit (UNiCC) in Universiti Putra Malaysia and sequences in the GenBank sequence database at the National Center for Biotechnology Information (NCBI) with accession numbers allocated.

LONGEVITY OF SAFED MUSLI (*Chlorophytum borivillianum*) UNDER DIFFERENT STORAGE CONDITIONS

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Safed musli is an herbaceous crop which is popularly used in aphrodisiac medicines. Safed musli tubers can be stored for limited period as the tubers start to sprout in the storage, and result in decreasing tuber quality. Temperature and inhibitors have been widely used to inhibit sprouting among tuberous crop. Therefore, the purpose of this study is to prolong the storage life by inhibiting tuber sprouting, while maintaining the tuber quality as planting material. The experiment was conducted at Universiti Putra Malaysia on 2009. Tubers were stored in two temperatures namely 28±2°C and 10±2°C. In each temperature, Paclobutrazol (PBZ, gibberellic acid synthesis inhibitor) were sprayed weekly in three concentrations namely 0, 100, 200 and 300 mg/L. Data on sprouting percentage and respiration rate were collected at two and four months respectively. Results showed that temperature and concentration of PBZ affected the storability of tubers. Tubers stored under control condition at 28°C had the highest sprouting percentage of 40 and 70 at two and four months respectively. All other treatments stored at 28°C irrespective of the concentration of PBZ used, were only slightly better than control. There was no sprouting recorded from all treatments in 10°C. As the tubers were sprouting in control, it significantly has the highest respiration rate in comparison with other treatments. There was no significant difference among all treatments in 10°C. In conclusion, longevity of safed musli tubers can be prolonged under cold room temperature.

DIRECTION IN UTILISATION OF CROPS FOR BIO-ENERGY IN MALAYSIA IN RESPONSE TO CLIMATE CHANGE

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Climate change has prompted countries to intensify efforts to utilize crops for renewable bio-energy, where Malaysia is not an exception. The government's seriousness in embarking on production and use of this alternative energy is seen from the establishment of the new Ministry of Energy, Green Technology and Water in April 2009, specifically devoted to focus on efforts to enhance the development of bio-energy from alternative sources. The National Bio-fuel Policy was formulated in March 2006 which envisages research and development, production, use and export of bio-fuel to ensure a cleaner environment, reduce reliance on fossil fuels, and to enhance and stabilize the price of palm oil. Being the most efficient oil crop, oil palm is by far the most highly utilized crop for bio-fuel in Malaysia, although some basic work are also currently being conducted on *Jatropha*, cassava, and sago and nipah palms. Through development of indigenous technologies developed by the Malaysian Palm Oil Board, a desirable level of success has been achieved in production, utilization and export of bio-fuel from palm oil. Advancements have been made in the production of bio-diesel from palm oil, energy for burning and production of bio-ethanol using oil palm biomass from the mills, and methane trapping from palm oil mill effluent (POME) for industrial use. An even more sustainable approach is the utilization of the total oil palm biomass milling by-product for bio-energy. Research and development on the use of *Jatropha*, a newly introduced crop, as a bio-energy crop is still at its infant stage, with focus on introduction and evaluation for suitable varieties. Although *Jatropha* has the ability to thrive well on marginal soils, research efforts need to be intensified on breeding for suitable varieties, pest and disease control, cultural practices and mechanization, particularly for the harvesting operations. Bio-energy industry in Malaysia faces challenges, which include competition in the price offered by bio-fuel from other oil plant sources, quality of bio-fuel produced and sustainability requirements imposed. This requires even more intensive research and development efforts, including those towards genetic improvement and development of new varieties to meet these specific needs.

RESPONSE OF TWO SOYBEAN VARIETIES TO THE APPLICATION OF ORGANIC FERTILIZERS IN SATURATED SOIL CULTURE SYSTEM

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Saturated Soil Culture (SSC) is a technology that gives water permanently, maintains, and keeps its depth constantly (± 5 cm under soil surface), and makes soil layer in saturated condition cultivation. This technique has been successfully used to increase soybean productivity. SSC can be used in the area where the water is available but it can also be used in the marginal land such as tidal swamp. Tidal swamp is one of the potential ecosystems for future soybean production but it is hampered by low soil pH caused by pyrite content. Organic matter and SSC may be used to overcome the problem. Farmers can use on-farm inputs that are normally available at the production site. An organic farming system may be able to ensure food security at the local level because continuity of plant production is possible. This study was conducted to investigate the response of two soybean varieties to different types of organic manure in Saturated Soil Culture. The experiment was carried out at IPB experimental station, Bogor, Indonesia, in December 2009-July 2010. Split plot design was used with types of organic fertilizer as the main plot (poultry manure, *Centrosema pubescens*, and *Tithonia diversifolia*) and soybean varieties as the sub plot (Anjasmoro and Wilis). The results

showed that the application of the type of organic matter gave similar soybean production (1.71, 1.63 and 1.73 t/ha respectively for poultry manure, *Centrosema pubescens*, and *Tithonia diversifolia*). Wilis had a significantly higher vegetative characteristics and production (1.78 t/ha) than Anjasmoro (1.61 t/ha).

RESPONSE OF TWO SOYBEAN VARIETIES TO THE APPLICATION OF ORGANIC FERTILIZERS IN AN ORGANIC FARMING SYSTEM

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The national demand for soybeans is increasing in response to increasing population. Consequently, the cultivation of soybeans should be extended to new areas, including those of marginal fertility, and under various farming systems. Because farmers may have limited access to supplies of inorganic fertilizer and pesticides, and limited funds with which to buy them, organic farming can be a viable option. Farmers can use on-farm inputs that are normally available at the production site. An organic farming system may be able to ensure food security at the local level because continuity of plant production is possible. This study was conducted to investigate the response of two soybean varieties to different types of organic manure in an organic farming system. The experiment was carried out at IPB experimental station, Bogor, Indonesia, in December 2009-July 2010. Split plot design was used with types of organic fertilizer as the main plot (poultry manure, *Centrosema pubescens*, and *Tithonia diversifolia*) and soybean varieties as the sub plot (Anjasmoro and Wilis). The results showed that the application of *Centrosema* sp. and *Tithonia* sp. increased plant height and productivity, and reduced plant pest and disease intensity compared to poultry manure. Production of soybean applied with poultry, *Centrosema* sp., and *Tithonia* sp. manures was 1.16, 1.33, and 1.48 t/ha, respectively. On upland, Anjasmoro was higher in vegetative characteristics and productivity compared to Wilis. The production of Anjasmoro and Wilis was 1.57 and 1.07 t/ha, respectively.

THE EFFECT OF WATER DEPTH AND BED WIDTH ON THE PRODUCTION OF SOYBEAN (*Glycine max* L. Merr) UNDER SATURATED SOIL CULTURE ON TIDAL SWAMPS

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Saturated soil culture (SSC) is a cultivation technology that gives continuous irrigation, maintains water depth constant and makes soil layer in saturated condition. By keeping the water-table constant, soybean can avoid the negative effect of inundation on soybean growth because soybean will be acclimatize and improve its growth. This technology is appropriate to prevent pyrite oxidation on tidal swamp and has proved to increase the productivity of soybean on non tidal swamp. The experiment was done to study the effect of the level of water depths and bed width to determine the optimal bed width on the yield of soybean. The research was conducted at Banyu Urip, Tanjung Lago, Banyuasin, South Sumatera, Indonesia from April to August 2010. The experiment was arranged in a split plot design with three replications. The main plot of the experiment was water depth in the furrow irrigation consisted of 10 and 20 cm under soil surface (USS) watering. The sub plot of the experiment was bed widths consisting of 2, 4, 6 and 8 m. The result of the experiment showed that the seed production was obtained with the level of water depth 20 cm USS and bed width 2 m (4.15 ton/ha) and it was significantly different from those at bed width 4 m (2.59 ton/ha), bed width 6 m (1.84 ton/ha) and bed width 8 m (1.74 ton/ha). The seed production was obtained with

the level water depth 10 cm USS and bed width 2 m (3.43 ton/ha) and it was significantly different from those at bed width 4 m (2.46 ton/ha), bed width 6 m (1.75 ton/ha) and bed width 8 m (1.68 ton/ha). The highest seed production was obtained with water depth of 20 cm USS and bed width 2 m, so this treatment was the most appropriate combination for soybean production on tidal swamps.

IV. Bioresource Management and Revitalization of Local Wisdom

HYPOGLYCEMIC EFFECT OF *Lagerstroemia Speciosa* (L.) PERS. ON ALLOXAN-INDUCED DIABETIC MICE

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Lagerstroemia speciosa (L.) Pers. known as “banaba” is traditionally used as a herbal medicine in the Philippines. Although *Lagerstroemia speciosa* has been shown to produce hypoglycemic effects in some mice models of diabetes, there are no reports of the effects of this substance in alloxan-induced diabetic mice. Thus, the present study aimed to elucidate the hypoglycemic effects of *L. speciosa* in ICR strain of mice. Diabetes was induced by the intraperitoneal injection of alloxan. Spray dried *L. speciosa* powder (1000 mg/kg) or decoction (20 ml/kg) was administered on alloxan-induced diabetic male ICR mice for 28 days by gavage. The effects of *L. speciosa* on blood and urinary glucose levels and body weight, feed intake and water intake were measured. Spray dried *L. speciosa* powder and decoction significantly reduced blood and urinary glucose levels of diabetic mice from day 8 to 28 compared with the diabetic control. These mice also had lower body weight compared with the diabetic control from day 15 to day 28. The feed intake of diabetic mice was higher compared with non-diabetic control and *L. speciosa*-treated diabetic mice from day 22 to 28. A comparable fluid intake was evident among non-diabetic mice and *L. speciosa*-treated diabetic mice from day 8 to day 28 which was significantly lower compared with the diabetic mice. These results suggest that *L. speciosa* possesses beneficial antihyperglycemic activity in controlling the elevated glucose level in alloxan-induced diabetic mice.

ASSOCIATION OF ROOT-KNOT NEMATODE SPECIES, *Meloidogyne* spp. WITH BRANCHED TUBER DISEASE ON CARROT IN INDONESIA

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In Indonesia, branched tuber disease is a problem in carrot cultivation. Until now the cause of the disease is not clearly known, so it needs a comprehensive research. The purpose of this research is to determine the primary cause of branched tuber disease with Koch's Postulates test. Further identification of the pathogen was conducted at the laboratory of Plant Nematology 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 2010. Koch's Postulates showed that the incidence of branched tuber was significantly lower, 1.7-7.3% on nematode-free land and 48.3-64.8% on infested land. Therefore it can specify that the nematode is the primary cause of the disease. Five species of RKN, namely *M. arenaria*, *M. falax*, *M. hapla*, *M. incognita*, and *M. javanica* can be associated with branched tuber disease incidence.

GLOBAL-OVER FISHING: UNDER THE CONDITION OF CLIMATE CHANGE

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Within the last 30 years, the global natural resources of fisheries under the condition of global climate change has been utilized especially the areas called Exclusive Economic Zone (EEZ), 200 nautical miles away from coast. Because of the common properties of global fishery resources, everyone can take advantage of these fishery resources, leading to global-over fishing. In this day and age, the world is faced with global overfishing accounting for 28 percent of the total fishery stock. More crucially, the global fishing went beyond the maximum sustainable yield (MSY), continuously spread out all over the world. This study aims to measure the global status of bio-resources of fishery to determine the manner of their protection by applying the bio-resources econometric model. The methods of econometrics as the tools gave meaningful results for the sources of global overfishing. According to the bio-natural resource econometric model, the technological index, increasing in the over-all price of fishery products as well as the growth rate of global population are the major key factors that forced the world fishery industry to get involved in global over-fishing. Global fishing resource is one of the important bio-resources; also belongs to people all over the world. We have to make the sustainable utilization for the global fishery that would lead to the sustainable development through bio-resources management. By doing that, Food and Agriculture Organization (FAO) has endeavored to encourage all nation members to reduce the global overfishing through policies such as the old vessel buy back program, fishery industry's subsidization to get out from the industry in order to reduce the numbers of the vessels in the world. The nations such as Australia and New Zealand along with China are successful in the implementation of policies.

CO₂ AND N₂ FUMIGATION FOR ORCHID SNAIL CONTROL

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Plant sanitation is highly strict for cut flower orchids exported to US and Japan. Since methyl bromide fumigation, a common procedure is not allowed due to ecological considerations, environment friendly methods are necessary for orchid flower exportation. Nitrogen and carbon dioxide have a potential to inhibit respiration. This research aimed to investigate an influence of those gases on orchid amber snail (*Succinea chrysis*) extermination and orchid flower performance. The snails were collected from an orchid farm in the central of Thailand in the early morning during raining season, then subjected to fumigation for 6 hours at room temperature (~27C) with 1) normal air, 2) 100% CO₂, 3) 100% N₂ or 4) 20% CO₂+80% N₂. Snail mortality was observed within 6 hours. Inflorescences of *Dendrobium* 'Khao Sanan' were collected from the farm, then subjected to similar conditions above and the vase life duration was monitored. The results showed that the longer fumigation period, the higher the snail mortality. The snails completely died (100% mortality) within four hours of 100% CO₂. At six hours after treatment, the snail mortality of 100% N₂ and 20% CO₂+80% N₂ treatments were 97 and 93%, respectively. The vase life of the inflorescences subjected to all treatments was not different, approximately 12-13 days. The results indicated that fumigation with CO₂ or N₂ gas, for at least 4-6 hours, could potentially exterminate orchid snails with no harm to the flower quality.

**POTENTIALS OF AGROFORESTRY IN CLIMATE CHANGE ADAPTATION:
EXPERIENCES OF THE SELECTED AGROFORESTRY FARMERS IN THE PHILIPPINES**

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This paper argues that agroforestry offers great potentials to agroforestry practitioners in adapting to the impacts of climate change in their farming systems. Agroforestry is a land use management system that combines the production of woody perennials and agricultural crops, together with livestock and/or aquatic resources for the twin purpose of ecological stability and socioeconomic productivity. Drawing from the actual experiences and insights of the agroforestry farmers, this paper also validates the claims of various researchers and scientists about the multiple benefits from agroforestry, that would in turn, help the farmers become more resilient in their farming systems and livelihood strategies and be able to adapt with the impacts of climate change. This paper further argues that the diversity of crop components in an agroforestry farm help maintain farm production despite the changing seasonal phenomena to wit, rainfall distribution and temperature pattern. The economic loss in one crop may be compensated by the other crops. In addition, this paper highlights the specific coping strategies of the agroforestry farmers. These include: a) modification in the cultural and silvicultural management practices, b) modification in the cropping pattern, c) maintaining crop diversity, d) proper combination of both the annual and perennial components, and, e) site species matching. Recognizing the potentials of agroforestry and other farmer-initiated mechanisms in climate change adaptation, this paper urges not only the farming communities, but also the concerned institutions to intensify advocacy on agroforestry technology adoption in the agriculture and forestry sectors in order to cope with the long-term impacts of climate variability.

**RICE STRAW DEGRADATION BY THERMOPHILIC FUNGI UNDER LIQUID AND
SOLID STATE FERMENTATION**

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Out of 28 fungi isolated from organic and chemical soil from Surin rice fields, Thailand. Only ten showed highest cellobiase carboxymethyl cellulase, xylanase, and FPase activities by qualitative screening method for enzyme assay. They identified to the genus level as: *Aspergillus* (7 isolates), *Paecilomyces* (5 isolates), *Penicillium* (4 isolates), *Mucor* (4 isolates), *Chaetomium* (2 isolates), *Acremonium* (2 isolates), *Pyrenochaeta* (1 isolates), *Pythium* (1 isolates), *Humicola* (1 isolates), *Sporotrichum* (1 isolates). These fungi were grown on rice straw pieces-based liquid and solid media under thermophilic conditions (50°C). The degradation of rice straw was analyzed for dry matter loss, cellulose, hemicellulose and lignin contents. In addition, the production of enzymes involved in the degradation of rice straw was estimated in international unit of cellulose, cellobiase, xylanase and FPase. The result clearly showed that *Aspergillus niger* was able to efficiently degrade rice straw with weight loss between 50-70%. Cellulose, hemicellulose and lignin contents decreased more 80% after three weeks under thermophilic condition. Application of this knowledge may improve the management of waste rice straw under climate change.

EFFECT OF STORAGE CONDITION ON SKIN BROWNING AND QUALITY OF LITCHI FRUITS

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Litchi cv. “Thieu” (*Litchi chinensis* Sonn) is a famous fruit of high commercial value in Vietnam. Nevertheless, fruit pericarp has rapidly turn from bright red to brown colour soon after harvest. It has been found that postharvest changes in the fruit was affected by the storage temperature and the humidity. Fruits held at 30°C and 75% RH (room condition) had greater water loss and changed skin colour faster than the fruits held at 4 °C and 90% RH within 4 days. High loss of total phenolic content and an sharp increase of PPO activity has also found in fruits held at room condition. Temperatures of 4°C and 90%RH was satisfactory for the maintaining of fruit skin colour and fruit quality.

CHARACTERISTICS OF ROADSIDE PUMMELO STALLS IN NAKHON PATHOM PROVINCE, THAILAND

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Nakhon Pathom province is well known as the pummelo city. Pummelo fruits produced from this area have received “Geographical Indication” under the name of ‘Nakhonchaisri Pummelo’ since the year 2005. Numbers of pummelo stalls operate all year round along the two major roads, Petchkasem (PK) and Pinklao-Nakhonchaisri (PNS), connecting Nakhon Pathom to the capital Bangkok. In this study, we interviewed stall owners to gain information about fruit sources, buying and selling system, sale promotion, fruit quality, stall characteristics and limitation. There were 32 stalls on PK road and 67 stalls on PNS road. The stalls along both roads were grouped in clusters and most of them were placed on Bangkok inbound side. The stalls on PK road were on the concrete pavement of residential area and fee was charged while the stalls on PNS road were set up over the ditch next to the unpaved roadside without any charge. The representative stall owners were mainly female, 25-50 years old with 2-20 years of experiences in this business. The main pummelo cultivars were ‘Khao Nam Phueng’, ‘Thong Dee’, and ‘Khao Yai’ from Nakhon Pathom and other provinces. Between December and September, stall owners purchased pummelo fruits mainly from Nakhon Pathom (‘Khao Nam Phueng’ and ‘Thong Dee’ cultivars) and Samutsongkhram (‘Khao Yai’ cultivar) either via contracted orchards or middlemen. Between October and November when pummelo fruits in Nakhon Pathom were scarce, fruits from other sources such as Chumphon, Kanchanaburi, Prachinburi, Talad Tai wholesale market in Pathum Thani and Srimuang wholesale market in Ratchaburi were obtained via middlemen. Fruits were ordered on a weekly basis, 400 – 600 fruits for a stall on PK road and 300 – 500 fruits for a stall on PNS road. Fruit quality is highest in summer and poorest in cool season. Prices were different among cultivars and fruit sizes where ‘Khao Nam Phueng’ was the most expensive one. Pummelo fruits were sold as a whole fruit or only pulp in a Styrofoam tray and fruits sold on PK road were more expensive than those sold on PNS road. Total sale per month was between 25,000–40,000 Baht for a stall on PK road and between 12,000–30,000 Baht on PNS road. To promote, stall owners hung the sign ‘Authentic Nakhonchaisri Pummelo’ and offered peeling service, discounts and helped customers select fruits. Operational limitation includes

a decline of customers, an increase in price of pummelo fruits and the request to move out due to the PNS road expansion project.

EFFECT OF DIFFERENT TEMPERATURE REGIMES ON SEED GERMINATION IN BLACK CUMIN (*Bunium persicum*) ECOTYPES

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Black cumin (*Bunium persicum*) is an important medicinal plant species which grows wildly in cold and temperate desert region from southeastern Europe to southern Asia. This study examined the effects of constant and fluctuating temperatures on seed dormancy and germination behavior of five ecotypes of *Bunium persicum*. Seeds of the five ecotypes were collected from different locations in Iran. Seeds were imbibed at constant temperatures (5°C-20°C), and at fluctuating (5°C/15°C) temperatures. The seeds of ecotypes collected from dry areas had the lowest percentage germination. Fluctuating temperature regimes during imbibition improved germination in all ecotypes. Temperature at 20°C during imbibition inhibits germination. As in natural environments, germination occurs beginning of March and temperature at this time is 10-15°C. Alternating temperature is the best germination condition under natural adaptation.

DISTRIBUTION OF DRY MASS, NITROGEN, PHOSPHORUS AND POTASSIUM IN THAI PUMMELO FRUITS

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'Thong Dee' (TD), 'Khao Nam Phueng' (KNP) and 'Khao Yai' (KY) are major commercial cultivars of Thai pummelo. Mature fruits of each cultivars from well managed orchards in Nakhon Pathom and Samutsongkhram provinces were separated into outer peel (flavedo), inner peel (albedo), segment membrane, pulp and seed to determine fresh and dry weight and primary nutrient (nitrogen; N, phosphorus; P and potassium; K) concentration in different fruit parts. N, P and K losses through crop removal were also calculated. Means of fruit weight were 1,290 g, 1,740 g and 1,687 g for TD, KNP and KY and edible portion of TD, KNP and KY was 60.6 %, 55.7 % and 53.3 %, respectively. Dry mass partitioning was 18.7 – 20.4 % in flavedo, 30.5 – 37.9 % in albedo, 7.6 – 9.7 % in segment membrane and 28.7 – 35.5 % in pulp of the three cultivars. Only TD and KNP had seeds which accounted for 5.9 % of fruit dry mass. KNP and KY fruits were generally larger than TD and had greater dry mass proportion of albedo. Nutrient concentrations on a dry mass basis were 1.65 – 1.84 % N, 0.18 – 0.26 % P and 2.21 – 2.42 % K in flavedo, 0.67 – 0.87 % N, 0.06 – 0.11% P and 0.97 – 1.51 % K in albedo, 0.79 – 0.96 % N, 0.07 – 0.12 % P and 0.68 – 1.03 % K in segment membrane, 1.11 – 1.66 % N, 0.20 – 0.30 % P and 1.72 – 2.71 % K in pulp of these three cultivars and 2.0 % N, 0.25% P and 0.61 % K in seeds for Td and KNP cultivars. Calculation of N, P and K contents in the whole fruits reveals that N, P and K losses through crop removal were 187 g N, 28 g P and 268 g K in TD, 182 g N, 20 g P and 220 g K in KNP and 187 g N, 26 g P and 269 g K in KY for every 100 kg of fresh fruits harvested.

POPULATION DENSITY AND SOIL MICROBIAL DIVERSITY IN BANANA PLANT HABITAT WITH AND WITHOUT FUSARIUM WILT SYMPTOM

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The fungus of *Fusarium oxysporum* f.sp. *cubense* (Foc), which is responsible for the *Fusarium* wilt disease on banana plant, is one of the important soil borne pathogens which may lead to a significant loss in Indonesia's banana yield. This study was conducted to identify the population density and soil microbial diversity on banana plant with and without symptom of *Fusarium* wilt in Bali. The sample of soil was taken from three regencies in Bali such as Karangasem, Klungkung and Jembrana, which are the centers of banana cultivation in Bali. It was taken from two sites for each regency representing the banana plant habitat with and without *Fusarium* wilt symptom. It was taken around the banana stem base with a depth of 20 cm. The density of the soil microbial population is more numerous and highly significant ($P < 0.01$) in the banana plant habitat without *Fusarium* wilt symptom (1.4×10^7 cfu/g of soil) compared to that in the banana plant habitat with *Fusarium* wilt symptom (10^6 cfu/g of soil). The population density of bacteria, actinomycetes and fungi in the banana plant habitat without *Fusarium* wilt symptom is 7.8×10^6 , 6×10^4 and 5.3×10^4 cfu/g of soil respectively, more numerous and highly significant ($P < 0.01$) compared to the banana plant habitat with *Fusarium* wilt symptom, which is 5.9×10^5 , 4.1×10^5 and 2.3×10^4 cfu/g of soil respectively. The index of the soil microbial diversity in the banana habitat without *Fusarium* wilt symptom is 2.0966, greater than that in the banana plant habitat with *Fusarium* wilt symptom, which is 2.0499. The *Bacillus* spp. and *Pseudomonas* spp. dominate both the banana plant habitat without *Fusarium* wilt symptom and that with *Fusarium* wilt symptom, whose respective domination index is 0.8843 and 0.8434.

GEOGRAPHICAL INFORMATION SYSTEM OF ENDANGERED TREES OF BALI ISLAND

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Plant has an important value in human life and also for Hindu people in Bali, which are reasonably familiar with some varieties of useful plants. Plants other than for consumption are also broadly used for some activities which are related to medication, aesthetic, social, culture and Hindu ceremony. Some of these plants ultimately in urban areas are categorized endangered. Even though these plants exist, it is difficult to identify and monitor its existence. An alternative way to overcome this problem is by making use of GIS. The purpose of this research was to make a particular information system of endangered ceremonial trees in Bali Island. There were 94 species of trees that were categorized socially valuable religious in Bali and as many as 39 species of trees were categorized as endangered trees. The location of trees in the field was known by creating distribution maps of trees that have coordinate positions using MapServer GIS software. Those tree species were able to be classified by level of family and completed by codification of trees physical classification and trees morphology by using the MySQL Server. The mapping of digital trees by GIS can quickly provide the spatial information in the form of trees distribution maps that are integrated with related information.

MAIN DISEASES OF *Aloe Barbadensis* MILLER IN BALI

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Aloe (Aloe barbadensis Miller) has been planted in Bali since 2006 with the total area of 170 hectares. The leaves of this plant is processed into gel for further use such as pharmaceutical, food and baverage, cosmetic etc. During the plant growth in the plant field, there are several diseases have been found to be associated with aloe plants, however, there is no information available on the main disease and the cause of the disease. This research was conducted in order to know the main diseases associated with the aloe plant and the causal agents that responsible for the diseases. This study was done from January to June, 2010 in five regencies in Bali, namely Buleleng, Karangasem, Bangli, Gianyar and Badung. Three observations point were determined in each regency, except for Buleleng Regency, whereas only one observations point was determined. Observation of the disease was done by evaluating 20% of the total plant population in each observation point to determine the disease occurrences. For identification of the causal agent of the disease, plant samples were collected from diseased-plants. Koch's Postulate procedure was applied to determine the causal agent of the disease. The first main disease found in aloe plantation was the leaf rot disease with the occurrence by 7.04% and the second one is black spot disease with the occurrence by 4.64%. There are four species of fungi isolated and identified from the diseased-plants, namely *Fusarium* sp., *Cladosporium* sp., *Colletotrichum* sp., and *Helminthosporium* sp. Among these fungi, only two fungi i.e. *Fusarium* sp. and *Cladosporium* sp. can infect aloe plant on artificial inoculation and produced the same symptom as found in the field, while two fungi i.e. *Colletotrichum* sp., and *Helminthosporium* sp. could not infect aloe plant. *Fusarium* sp. was confirmed as the cause the leaf rot disease while *Cladosporium* sp. was the cause of black spot disease.

ANALYSIS OF DISTRBUTION OF TEMPERATURE and AIR FLOW IN THE INNER ROOM ECO-HOUSE USING CFD

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Ventilation concept is a design to calculate the accumulation of air movement into the building construction as a whole. Using the effect of a fold external air stream enter into the building passing through the window and door, hence happened moving heat and mass, the humid and air pressure with a purpose to make cool the room. At external side the sun radiation be assumed there are not yet influenced of concerning to the process that happened in the building, non as burden. The calculation of heat transfer of air and energy expressed is distributed as the temperature changing in dwelling building, be analyzed by the numerical method and CFD (Flovent 7.2). Computer as tolls to help and assist approaching to predicted the process. Passing the temperature, mass and speed of velocity of air which distributed in this dwelling building be presented as a chromatic picture illustration of the air stream. The purpose of this research is the analysis of the environmental natural energy to create the system of air refreshing, temperature and ventilate to operate the air supply from outside building to be enough environment air in the building, serving supply of requirement of air stream so to be dweller feel balmy and convenient in the situating ventilate. Only one hole of the twenty-hole at the west side of the wall is using to enter the air. This discussion is enable to the existence of the nocturnal cooling system and be using in the rural area to gets environmental refreshment of the building to be standardization of eco-housing system.

**AGRICULTURAL ADAPTATION IN A PROTECTED TROPICAL HABITAT:
IMPACT OF CHAIN REACTION**

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Changing of agricultural system in a protected tropical habitat was investigated. The seven sites of study area covered three provinces in the south of Thailand. The aim was to study the impact of agricultural practices on climate change by using birds as an indirect indicator. The data collected including field survey, focus group and monthly bird counting between 2004 and 2007 were analyzed. The graphical method : mosaic plot illustrated that bird species distribution varied by site and period of time. This was related to agricultural system in each site. Agricultural system has been changed to monoculture such as oil palm and rubber plantation which planted in swamp forest, paddy field and abandoned area. The current of agricultural approach was influenced by the awareness of climate change. On the other hand, the climate change was influenced by agricultural change as a chain reaction.

**BIOLOGICAL STRATEGIES OF PARASITOIDS ASSOCIATED WITH PEA LEAFMINER
FLY, *Liriomyza huidobrensis* (Blanchard)(Diptera: Agromyzidae)
TO COMPETE AND PERFORM PARASITIZATION OF THEIR HOST**

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The pea leafminer fly, *Liriomyza huidobrensis* (Blanchard) (Diptera: Agromyzidae), is an important pest of vegetable crops worldwide. *Hemiptarsenus varicornis* Girault (Eulophidae), *Opius liriomyzae* (Braconidae) and *Gronotoma micromorpha* (Eucoilidae) are parasitoids associated with the pest. These parasitoids are biological control agents for the pest in the field. This study determined the biological strategy of parasitoids in the competition and parasitization their host. Among the three parasitoid species, the *H. varicornis* is the most quickly recognized habitat and insect host and also in parasitizing the host. In addition, *H. varicornis* can also parasitize the host by paralysis and host-feeding. *H. varicornis* has very short pre-oviposition period and produces offspring faster than *G. micromorpha* and *O. liriomyzae*. The fecundity pattern generated by the three parasitoid species changed due to the competition. *H. varicornis* fecundity increased two times more than in normal circumstances. While *O. liriomyzae* offset the increase in fecundity of *H. varicornis* by increased egg laying when the capability of *H. varicornis* decreased. While *G. micromorpha* is not able to maintain the rate of egg laying comparable to the two other parasitoid species, however, to stay afloat and maintain the viability of offspring, the competitive strategy used by *G. micromorpha* is by ovipositing for a lifetime. The ability of fecundity, parasitization rate and proportion of females was highest in *H. varicornis*. High mortality occurred in *G. micromorpha* and *O. liriomyzae* because of the paralysis and host-feeding by *H. varicornis*. Mortality that occurs in *G. micromorpha* and *O. liriomyzae* affect the total proportion of females produced by the two parasitoid because of death of the female individual candidates. The highest fecundity, parasitization rate and proportion of females can be produced by *G. micromorpha* and *O. liriomyzae* when both parasitoid species were released after the release of *H. varicornis*.

REVITALIZATION OF LOCAL WISDOM TO RESPOND TO CLIMATE CHANGE IN SMALL ISLANDS: A CASE OF MALUKU PROVINCE

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Small islands are characterized by vulnerability in term of water shortage, soil erosion, land degradation, natural disaster, subsistence economic scale and social cultural conflict. For a long time, rural community in small islands in Maluku province has capability to adapt with climate change. Now days, these norms have changed considerably due to rural monetization and commercialization and therefore local community capability to response climate change is questioning. The aims of this research were to identify local wisdom in small islands and to found out problems, changes and strategies to develop and revitalize local wisdom to response climate change. Based on field work and observation, there were some findings of local wisdom in small islands Maluku: (1) *dusung* systems; (2) *sasi* and *kewang* systems; (3) *pela* relationship, *mata rumah* and *gandong* kinship; (4) *lutur* systems; (5) *arin* and *nyafar* system; and (6) shifting cultivation agriculture practices. These local wisdoms were used as the main local norms and values to influence and determine individual and group behavior in dealing with social culture and natural resource exploitation, however some of them need revitalization particularly to preserve staple food during the extreme dry seasons, to conserve agricultural seeds, and to create norms to protect and maintain local natural resource sustainability.

COMPOSITION AND ECO-BIOLOGICAL CHARACTERISTICS OF PARASITOIDS OF SOYBEAN MAJOR PESTS AT GIALAM, HANOI.

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Soybean is infested by many insect pests, such as stem miner, leaffolder, armyworm, bollworm, stink bug but there are also many kinds of insect natural enemies. Each creature, has at least 2 natural enemies (Paul DeBack, 1964). Since chemical insecticides have many disadvantages like loss in natural enemies and bio-balance, as well as environmental pollution, research on insect parasitoids diversity and their biological characteristics to protect agricultural production as well as our environment is very important. In the soybean producing areas in Gialam, Hanoi, 14 insect parasitoid species were identified in summer-autumn 2009. The predominant species were *Microplitis manilae* Ashmead, *Trathala flavo-orbitalis* Cameron and *Telenomus subitus* Le. The life cycle of the pupal endoparasitoid, *Xanthopimpla punctata* F. is about 11.9 ± 0.76 days, under an average temperature of $27.9^{\circ}\text{C} \pm 2.4$ and average humidity of $72.5 \pm 4.6\%$. The adult longevity depends on food quality, those fed with pure honey live longer than those fed with honey solution 50%, 8.5 and 5.6 days, respectively; while those fed pure water live only 2.6 days. Female *X. punctata* prefer laying egg in one day old host pupae and do not lay eggs in 4 day old host pupa. The functional response of the female was represented. When the host density is high, females parasitized more hosts.

THE EFFECTIVENESS OF *Metharizium* sp. AND *Beauveria basiana* TO SUPPRESS POPULATION OF WHITE GRUB ON *Ipomea batatans* RHIZOSPHERE

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White grub was known as agricultural pests of most horticultural crops such as cassava, banana, peanut, soybean, watermelon and cacao in Bali Province. Biological control (biocontrol) using living organisms as agents is one of alternative approaches for managing white grub. Two isolates of fungi namely *Metharizium* sp. and *Beauveria basiana* were identified as highly pathogenic against white grub in a concentration of 10^7 spores/ml. Based on infection rates, *Metharizium* sp. were found more aggressive as compared to *Beauveria basiana*. *M. anisopliae* and *B. basiana* were could formulate on the solid substrates contains sawdust, cornstarch and sugarcane juice. Application of those formulas into the *Ipomea batatans* soils in pots experiments caused the mortality of white grubs were 80% and 70% by *Metharizium* sp. and *B. basiana*, respectively. Those biocontrol agents formulations could protect *Ipomea batatans* to 60% and 50% by formulation of *Metharizium* sp. and *B. basiana*, respectively.

MODIFIED FRUIT BAGGING TECHNIQUES FOR MANGO

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Mango (*Mangifera indica*, L.) is one of the commercially important fruit crops in the Philippines. There are several mango varieties grown in the country but Carabao mango known in the international market as the "Philippine Super Mango" is the most popular. Mango is prone to attacks of insect pests and diseases in all stages of development. One management practice which can help address these problems is fruit bagging because it is another way of preventing contact between the host and insects/diseases as well as minimize mechanical injuries. The proper selection and use of suitable pest management practices to reduce pest injury at levels below those causing significant loss aims to increase profit through the improvement of fruit yield and quality by reducing pest damages and the reduction of the cost of pest management. Bagging of mango fruits is a well-known practice, information on the bagging material and bag form are very important on how they affect quality and income. The project aimed to determine which of the bagging materials and forms gave the best quality of fruits; determine the effect of the bagging materials and forms on pest incidence, yield and net income. The project was conducted at the Integrated Sustainable Agri Techno Demo Farm (ISATDF) of the Pangasinan State University. Results revealed that brown paper bag, White plastic bag and glossy paper bag; and all the bagging forms were effective against skin injury, thus improving the physical appearance of the fruits. The use of brown paper bag, white plastic bag and glossy paper bag as bagging materials; and triangular/Marsman style, flat/Cebu technology and modified square as bag forms securely protected the mango fruits against pest incidence, thus enhancing the fruit quality. Fruit bagging with brown paper bag and triangular bag/Marsman style exhibited the highest ROI, thus increasing the income. However, a verification study be conducted along this line for a more conclusive result.

DIFFERENT MORPHOLOGICAL CHARACTERS OF *SPATHOGLOTTIS PLICATA* INDUCED BY GAMMA IRRADIATION

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The *Spathoglottis plicata* of purple color available as pot plant in the market was used in this study. The *in vitro* seedlings of 3-month olds were radiated with gamma rays (Cs-137 source) at the doses of 0, 2, 4, 6, 8 and 10 krad. Only seedlings treated with 2 krad survived and showed morphological variations of 5 different clones namely clone 13, 19, 22, 23 and 25, whereas the control plants were divided into 3 groups. Clone 19, 22, 23 and 25 showed flower structures that were significantly different from those of the control groups. Clone 25 gave flowers of different size from the control, more intense fragrance with incomplete blooming petals. Clone 23 showed long spots on sepals and petals, undulate petal margin, malformation of petal and malformation of essential organs. Clone 19 gave flowers of brighter color with no petal and essential organs clinging to sepals. Clone 22 gave flower of darker color with no essential organs. All clones were found significantly different from the control plants in terms of plant height, leaf length, leaf width and inflorescence length excepted clone 13. As to the morphological characters, mutant clone 23 is potentially to be released as a new variety of pot plant in the market.

NITRIC OXIDE SYNTHASE (NOS) ASSOCIATED PROTEIN IN PEA (*Pisum sativum* L.)

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Nitric oxide synthase (NOS) activity was detected in pea (*Pisum sativum* L.) leaf extracts using a citrulline formation assay that is used in mammalian system. Total protein extraction method was modified from that used in mammalian system based on biochemical activities such as the use of protease inhibitors, pH and precipitation with salts and organic solvents. Physiological aspects such as the effects of various chemicals that induce systemic resistance in plants on NOS activity and immunodetection of a NOS associated protein were also studied. The NOS associated protein was partially isolated using liquid chromatography and characterized based on mammalian NOS inhibitor and co-factor requirement. Co-relation of NOS activity and NOS associated gene expression during incompatible and compatible pea-bacterial interactions were investigated using interactions of *Ralstonia solanacearum* and *Pseudomonas syringae* pv *pisii*, respectively, with pea. NOS activity was detected using citrulline formation assay. NOS associated gene expression was measured using real-time reverse transcription-polymerase chain reactions (RT-PCR) and a probe designed from a cloned cDNA fragment of pea that was homologous to NOS of snail and AtNOS1/AtNOA1 of Arabidopsis.

INTERCROPPING OF *Anthurium* sp IN RUBBER TREE (*Hevea brasiliensis*) PLANTATION IN SOUTHERN THAILAND

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Land used for rubber plantation are plenty in southern part of Thailand. It takes many years before these lands are profitable. During this time, the plantation grounds are potentially used to grow non perennial plants that are economically important and require growing conditions similar to the rubber plants. Anthuriums are popular cut-flower plants that grow in the shady and humid conditions of the immature rubber plantations. The aims of this study were to find out the suitable planting materials for *Anthurium* sp. cultured in 3 years old rubber tree (*Hevea brasiliensis*) and to evaluation the benefit of this intercropping system. The experiment was done in the rubber plantation in Nakhon Si Thammarat province, Thailand. Six supporting materials; coconut-husk, chopped coconut-husk, rubber tree charcoal chips, sand, chopped coconut-husk mixed with charcoal chips (1:1), and chopped coconut-husk mixed with sand (1:1) were used. It was found that the chopped coconut-husk gave the highest numbers of leave and flower. Farmers may start earning at the benefit of proximately 9,127 US dollar/year/10,000 plants when growing the plants with chopped coconut-husk in an area of 1,600 square meters within 3 years of cultivation.

THE ABILITY OF HYPOVIRULENT MICROBES TO CONTROL PATHOGENS OF BANANA WILT DISEASE

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Hypovirulent microbes was obtained by mutation banana wilt disease pathogens into nonpatogenic, using mutagenic compounds for *Fusarium oxysporum* f.sp. *cubense* and use Tn5 genes for *Ralstonia solanacearum*. Mutagenic compounds used is N-methyl-N-nitro-N-nitrosoguanidine (NTG); 8-Quinololinol; 2,6-Dichloronicotinic acid and N, N, N', N'-tetramethyl-1,4-phenylendiammoniumdichloride, was obtained 10 hypovirulent microbes. Hypovirulent bacteria was cultured in liquid nutrient medium, and fungus was cultured in potato peptone glucose medium, followed by inoculated 150 ml of bacterial or fungal each on the roots of banana plants. Three days after inoculation, the banana plant was dual inoculated by pathogens *F. oxysporum* f. sp. *cubense* and the *R. solanacearum*. Hypovirulent microbe production through mutations of *R. solanacearum* by using Tn5 mutagen, is able to control banana wilt disease with smallest banana wilt leaf percentage 28.09% (lightness damage), followed by hypovirulent of *F. oxysporum* f.sp. *cubense* using the mutagen 2,6-Dichloronicotinic acid, with wilt leaf percentage 49.46% (moderately damaged) and in the non application of hypovirulent microbe, the percentage of banana wilt leaf reached 100% (heavily damaged).

INVESTIGATION ON THE INFLUENCE OF *BIO-URINE*, FERMENTED WITH LOCAL MICROORGANISMS (MOL) FROM GAMAL (*Gliricidia sepium*) LEAVES ON THE GROWTH AND YIELD OF GREEN MUSTARD (*Brassica juncea L.*)

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Cow urine is a bio-fertilizer, however without fermentation it is just waste and could not be effectively utilized by plants. Therefore, this study sought to convert cow urine (waste) to bio-urine and use as a fertilizer. Our strategy is to use local microorganisms (MOL) from Gamal leaves as a starter for fermentation and determine the biodiversity of microorganisms, the nutrients of bio-urine particularly plant hormones, as well as the influence of bio-urine on green mustard (*Brassica juncea L.*). In our investigation, the microorganisms found in bio-urine are fungi, *Aspergillus* sp., *Rhizopus* sp., *Phoma* sp., *Candida* sp., *Penicillium* sp and *Fusarium* sp., as well as bacteria, *Pseudomonas* sp., *Burkholderia* sp., and *Serratia* sp. In bio-urine, plant hormones were detected, 1197,6mg/L. The treatment by bio-urine had significant effect on plant growth with the concentration with 200ml/L water resulting in number of leaves, 11.27; plant height 27.28cm, average weight of fresh plant, 75.37g and average weight of oven dry plants 7.56g. These phenomena clearly indicate bio-urine has the potential as a fertilizer consistent with our goal to utilize waste for organic farming.

THE PRELIMINARY SPATIAL STUDY OF ENDOMYCORRHIZAL FUNGI IN ROOT-PLANTS OF DRIED AREAS IN BULELENG, BALI

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Plants growing in poor soil areas are commonly associated with endomycorrhizal fungi as a mutualism symbiotic. The fungus takes a role on enhancement of the uptake of soil mineral nutrients particularly phosphorus, thereby enhancing host plant vigor. Some Bali areas, particularly Buleleng area have poor soil conditions and few studies on the endomycorrhizal fungi have been undertaken. This study sought to observe the occurrence and percentage of indigenous endomycorrhizal fungi associated with plants commonly planted in two villages, West Tianyar and Penjarakan. The study was undertaken during August 2010. The root infection in 14 plants categorized as crop and associated-shaded plants were observed by means of Grid-line Intersect method. The number of spores was counted by wet sieving and decanting method. The results showed 12 root plants species had endomycorrhizal infection. The colonization is presented as vesicle, external hyphae and spore forms. The vesicle forms were not found during the examination. The percentage of infected roots varied from 24.7 % to 64.3% of samples taken from Penjarakan and 21% - 45.67% from Tianyar. The number of spores also varied from 12–35 spores/100 g of soil. The number of spores found in Tianyar was higher than those at Penjarakan. Such variation could be attributed to soil texture, where Tianyar soil is sandy silt and Penjarakan is dried-clay loam.

**EFFICACY OF ENTOMOPATHOGENIC FUNGI AGAINST COCOA POD BORER,
Conopomorpha cramerella (Snellen) (Lepidoptera: Gracillaridae)**

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An experiment on the efficacy of the entomopathogenic fungi against cocoa pod borer (CPB) *Conopomorpha cramerella* (Snellen)(Lepidoptera: Gracillaridae) was conducted from June up to November 2009 in Laboratory of Integrated Pest Management, Faculty of Agriculture Udayana University. The objective of experiment was to know the efficacy of entomopathogenic fungi *Beauveria bassiana* and *Metharizium anisopliae* against CPB larvae. The experiment was arranged into randomized block design consisted of seven treatments and four replicates. The results indicated that both entomopathogenic fungi, *B. bassiana* and *M. anisopliae* were effective in controlling the CPB larvae. *B. bassiana* with 10^5 and 10^7 spores/ml was more effective to control CPB larvae than *M. anisopliae*.

**IMPACTS OF FLOWERING TREES ON CLIMATE CHANGE
IN METROPOLITAN AREAS**

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The warming of our metropolitan areas is influenced by the urban heat island effect caused by removal of trees and replacing these with roads, parking lots, buildings and other aspects of a human-dominated landscape (Primack and Higuchi, 2008). Therefore, there is a rising interest in understanding how plants, communities, and ecosystems respond to global climate change and urban climate modifications (Neil, et al., 2010). One of the most practical solutions is to plant flowering trees and trees in general which are important for aesthetic functions, reduction of solar radiation and regulation of air temperature, wind and humidity. The high demand for planting materials of flowering trees is beset by the unavailability of easy and fast methods of vegetative propagation for mass production. Eight flowering trees suitable for urban landscapes were tested: African tulip (*Spathodea campanulata* P. Beauv.), Dwarf Banaba (*Lagerstroemia floribunda* Linn.), Golden shower (*Cassia fistula* Linn.), Native Banaba (*Lagerstroemia speciosa* [L.] Pers.), Palawan cherry (*Cassia* x 'Palawan cherry'), Palosanto (*Triplaris cumingiana*), and Yellow Antsoan. Seven pre-sowing treatments were tested: Control (T₁), soaked in distilled water, 24 hr (T₂), soaked in hot water, 40°C, 1 hr (T₃), refrigerated, 15°C without water, 1 wk. (T₄), refrigerate, 15°C with water (T₅); soaked in acid, 1 min. (T₆); soaked in water, 24 hr. + 24 hr. air drying (T₇); hard coated seeds, scarified/clipped (T₈); hard coated seeds, scarified/clipped + GA₃, 30 min. (T₉); and GA₃, 24 hr. (T₁₀). Palawan cherry and Palosanto had high percentage germination in all the treatments. Germination was high for yellow Antsoan and Palawan cherry when seeds were scarified/clipped. Germination was good for golden shower seeds in T₈, T₉, T₆ and T₇. Poor germination was observed in African tulip, Native Banaba and Dwarf Banaba in all pre-sowing treatments. The best seedling growth in terms of root and shoot growth was obtained in two growing media namely, garden soil and equal parts of garden soil and sand. African tulip showed good rooting response and growth performance in both mature cuttings and young shoot tip treated with indole butyric acid (IBA) and naphthalene acetic acid (NAA) and grown in sterilized garden soil + coconut coir dust (1:1) and floral foam. Yellow Antsoan and Palosanto showed slight positive response to IBA and NAA but with low rooting percentage. The study revealed that propagation of flowering trees is highly dependent on pod maturity, seed moisture content and dormancy, pre-sowing treatments, post-harvest handling of seeds and type of sowing

medium. For vegetative method of propagation, sources of planting material, age and size of cuttings, planting position, growing media and use of growth regulators for rooting of cuttings are important considerations. Furthermore, seed germination and rooting of cuttings differed among the species of flowering trees. Finally, nursery management of the flowering trees is an important aspect that should be thoroughly studied.