

# **MSPPC 2003**

**14th Malaysian Society of  
Plant Physiology Conference**

# **Challenges in Plant Productivity and Food Security in a Changing Environment**

**23-25 September 2003**

**Awana Golf & Country Resort, Genting Highlands**

Organized by:

**MALAYSIAN SOCIETY OF PLANT PHYSIOLOGY (MSPP)**

*<http://www.mspp.org.my>*



Co-organized by:

**Malaysian Agricultural Research and Development Institute (MARDI)  
Ministry of Science, Technology and Environment Malaysia (MOSTE)  
Ministry of Agriculture Malaysia (MOA)**





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## MSPP IN BRIEF

PERSATUAN FISILOGI TUMBUHAN MALAYSIA (MSPP)  
(The Malaysian Society of Plant Physiology)

MSPP is a professional scientific body dedicated towards promoting research and development in tropical plant biology. Inaugurated on 29th April 1989 (Registration No. 889 Wilayah Persekutuan) the Society was formalized with the purpose to encourage and promote the development of plant physiology as a pure and applied phase of botanical science. This may be accomplished by:

- The organization of meetings, lectures, symposia, seminars, workshops, conferences and related activities
- The publication of matters pertaining to plant physiology and related topics

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# FORWARD BY THE DEPUTY SECRETARY GENERAL (POLICY)



**DATO' DR HASHIM HASSAN**

## **MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT, MALAYSIA (MOSTE)**

It gives me great pleasure to welcome all participants of the 14<sup>th</sup> Malaysian Society of Plant Physiology Annual Conference to Genting Highlands, Pahang. I believe that the cool air and verdant surroundings is a conducive environment for the exchange of information and ideas among participants. Hopefully, at the end of the day, the society will come out with viable solutions to address the theme of the conference "*Challenges in Plant Productivity and Food Security in a Changing Environment*".

As one of the 12 megabiodiversity countries in the world, Malaysia is endowed with vast biological resources which includes genetic resources readily available to be utilised in the agricultural sector in particular for food production. In fact, one of the six objectives of the National Policy on Biological Diversity is to ensure long- term food security for the nation. In this regard, Malaysia is thought to harbour about 12,500 species of flowering plants but only a handful of the species have been utilised for food production. However, food production is intricately linked with plant productivity especially when land is the limiting factor.

The country as a whole is facing problems of land shortage for arable farming with the competing demands from industry, housing and tourism. Therefore, given the constraints of limited land available for agricultural activities, plant productivity must be enhanced if we are to ensure that food production is not compromised. In this regard, there are many factors that influence plant productivity. I recognise that the Conference is giving attention to a whole spectrum of factors from environmental stress to water, temperature and haze issue. I hope ideas germinated from the 2 days meeting will enable us to increase our crop production and ultimately help in ensuring food security without the need for further exploitation of land.

I am happy to note that the Malaysian Society of Plant Physiology is taking proactive steps to dwell in these productivity-environment issues for sustainable development and food production of the nation. I am also happy to note that other significant agencies such as the Malaysian Agricultural Research and Development Institute (MARDI), the Ministry of Agriculture Malaysia (MOA) and the Ministry of Science, Technology and the Environment Malaysia (MOSTE) are teaming up efforts with the Society to ensure successful deliberations. Lastly, I wish you all a pleasant stay and hope you will benefit from the meeting.



# FORWARD BY THE DEPUTY DIRECTOR GENERAL

## **MALAYSIAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE (MARDI)**



**DATO' EMBI YUSOFF**

Assalamualaikum wm wb and Salam Sejahtera,

It gives me great pleasure to welcome participants to the 14th. National Conference of the Malaysian Society of Plant Physiology (MSPP). May I offer my congratulations to the MSPP for taking the lead to organize this important meeting together with the Ministry of Science and the Ministry of Agriculture Malaysia (MoA). The Malaysian Agricultural Research and Development Institute (MARDI) takes pride and honour to be a partner in promoting science and technology, addressing the important issues related to national crop production and food security. It is heartening to note that MSPP has taken initiative to provide series of such forum.

I would like to thank the organizing committee for inviting MARDI to co host this important conference. The theme of the conference complements MARDI's long term objectives for improving productivity through physiological and managerial intervention in the crop production systems.

The transformation of agriculture from low productivity semi-commercial enterprises to vibrant and economically sustained commercial enterprise calls for a combined improvement in crop productivity and the entrepreneurial skills of farmers. Constraints to productivity caused by environmental degradation, climatic changes and escalating cost of inputs and management require crops to be biologically more efficient in the near future.

The roles of physiologists, criminologists, agronomists and other related fields of specialization become more crucial to push forward the crop sector to compete in a liberalized economic scenario in the near future.

I am convinced our Scientists can turn around these constraints into opportunities through their creativity and dedication in fulfilling their noble tasks.

# MSPPC 2003



**DR HAWA ZE JAAFAR**

## FORWARD BY THE PRESIDENT

- **MALAYSIAN SOCIETY OF PLANT PHYSIOLOGY (MSPP)**
- **CHAIRMAN OF THE MSPPC 2003 ORGANIZING COMMITTEE**

Assalamualaikum wm wb and salam sejahtera.

Alhamdulillah, it gives me yet another great pleasure to welcome all the participants to the 14<sup>th</sup> Malaysian Society of Plant Physiology Conference 2003, shortly the *MSPPC2003*. The Society is very grateful to the Malaysian Agricultural Research and Development Institute (MARDI), the Ministry of Science, Technology and Environment (MOSTE) and the Ministry of Agriculture (MOA) for their support in organizing the conference.

In this Annual Conference, the Society draws another attention on serious issues pertaining to crop production and food productivity, i.e. the changing environment that dictates limitation to food productivity. The issues become more challenging with the dire need to increase food production to support the escalating world population. Efforts to produce enough food will drive intensive cropping on to marginal environments that are less favorable for growing crops, imposing more stress on the environment. Coupled with deforestation for arable farming, these endeavors exert adverse impacts on the physical, biological and human components of the environment. In addition, alterations in the atmospheric compositions have also changed the climatic patterns. These unfavorable environments and climatic variations will inflict stress on growth and development, limit crop yields and cause significant year-to-year variations. Thus, challenges to continuously improve and increase productivity and quality of crop plants under these adverse and varied environments become more demanding in an endeavor to increase productivity and stabilize the nation's food security. Knowledge in both plant stress and physiological responses to adverse environments and climate variability, and genetics will play a significant role in this quest, especially in efforts to develop crop plants with improved environmental resiliency.

Therefore, the theme, '*Challenges in Plant Productivity and Food Security in the Changing Environment*', is very timely to bring together those working in this field of specialization to review current status and provide directions for organized future research in the areas of plant biology relating to productivity, production system and the environment. It is also hoped that the meeting will enable us to disseminate past and current research findings and to provide basis for inter-agency networking and collaboration in our future research, in this respect towards sustainable food production systems in a changing environment.

With that I warmly wish you delegates Happy Conferencing! Wassalamualaikum wm wb.



# CONFERENCE ORGANIZING COMMITTEE

- 
- CHAIRMAN** • Dr Hawa ZE Jaafar
- SECRETARY** • Assoc. Prof. Dr Mohd Ridzwan Abd Halim
- FINANCE** • Dr Umi Kalsom Md. Shah
- 

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  - Mr Maurad Ahmad
-



# MSPP EXECUTIVE COMMITTEE 2002 / 2003

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• Dr Elizabeth Philip (*Philip@frim.gov.my*)  
(from 1<sup>st</sup> Nov. 2002)  
• Dr Ismanizan Ismail (*ismanizan@pkrisc.cc.ukm.my*)  
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• Ms Emmyrafedziawati Aida Kamal Rafedzi  
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• Ms Normah Abd. Majid (*amnornah@mardi.my*)  
• Mr Mohd. Shukri Mat Ali (until 18<sup>th</sup> May 2003)

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**Auditors** • Dr Othman Hashim  
• Dr Masri Muhamad



# MSPPC 2003

## PROGRAMME

14<sup>th</sup> Malaysian Society of Plant Physiology Conference

### MONDAY 22 September 2003

2000 – 2200 **PRE-REGISTRATION (SECRETARIAT ROOM)**  
**POSTER PLACEMENT (BILEK TANAU)**

### TUESDAY 23 September 2003

0800 – 0900 **REGISTRATION**

0900 – 0915 **WELCOME BY THE CHAIRMAN OF THE ORGANIZING COMMITTEE**

0915 – 0935 **OPENING ADDRESS BY Y. BHG. DATO' HASHIM HASSAN, DEPUTY SECRETARY GENERAL, MOSTE**

0935 – 1000 **PHOTOGRAPHY SESSION**

1000 – 1100 **EXHIBITION, POSTER SESSION AND REFRESHMENT**

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#### **KEYNOTE ADDRESS**

**Chairperson: Dr Hawa ZE Jaafar, President of MSPP**

1100 – 1145 **Keynote Address (I):** Increased crop productivity in a changing environment  
*Y. Bhg. Dato' Dr Hashim Hassan, Deputy Secretary General, MOSTE*

1145 – 1220 **Keynote Address (II):** Challenges in plant productivity and food security in a changing environment  
*Dr Mohd. Hashim bin Tajudin, Golden Hope Research Sdn Bhd*

1220 – 12.50 **POSTER SESSION**

1250 - 1400 **LUNCH**

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## **SESSION I: ECO-PHYSIOLOGICAL PROCESS**

**Chairperson: Dr Mohd Haniff Harun, MPOB**

- 1400 – 1420 Fluorescence Measurement - a Diagnostic tool for environmental stress in plants  
*Dr Elizabeth Philips, FRIM*
- 1420 - 1440 Interactive effect of soil water potential and temperature on wood decomposition  
by *Resinicium bicolor*  
*Dr Abd Jamil Zakaria, MARDI*
- 1440 - 1500 Physiological performance of urban tree (*Mesua ferrea L. Clusiaceae*) to  
atmospheric pollutant SO<sub>2</sub> and NO<sub>2</sub>  
*Nurul Azzura binte Shahadan, UPM*
- 1500 - 1520 Selection and characterization of maize genotypes for water stress (drought)  
tolerance  
*Aini Waznati Lasuan, UPM*
- 1520 - 1630 **MSPP 15th ANNUAL GENERAL MEETING**
- 1630 – 1700 **POSTER SESSION, EXHIBITION AND REFRESHMENT**
- 2000 - 2230 **POOLSIDE DINNER, POSTER PRESENTATION AWARDS AND  
MOMENTOS PRESENTATION**

**WEDNESDAY 24 September 2003**

## **SESSION II: ASSIMILATE PRODUCTION**

**Chairperson: Assoc. Prof. Dr Ridzwan Abd. Halim, UPM**

- 0900 - 0930 **Keynote Address (III):** Impact of environmental and climatic changes on crop  
production  
*Y. Bhg. Dato' Embi Yusoff, Deputy Director General, MARDI*
- 0930 – 0950 Environmental stress on rice with special reference to O<sub>3</sub> and stimulated haze  
*Dr Ahmad Maksom Abdullah, UPM*
- 0950 - 1010 Effects of changing levels of potassium nutrition on photosynthetic efficiency and  
growth of banana  
*Mohammad Naveed Khan, UPM*

1010 - 1100 **REFRESHMENT AND POSTER SESSION**

## **SESSION III: GROWTH AND DEVELOPMENT**

**Chairperson: Dr Daniel Baskaran Krishnapillay, FRIM**

- 1100 - 1120 The effect of jasmonic acid on development of oil palm cultures  
*Dr Ahmad Tarmizi Hashim, MPOB*

- 1120 - 1140 Effect of partial rootzone drying (PRD) on growth, yield and water use efficiency (WUE) of tomatoes on soilless culture  
*Hassan Ibrahim Ali, UPM*
- 1140 - 1200 Heat tolerance and improvement of flowering and fruit set of tomatoes under high temperature growing conditions  
*Ismail Iberahim, UPM*
- 1200 – 1220 SEM of the mangosteen leaf: a probable explanation to the slow plant development  
*Dr Zakaria Wahab, UPM*
- 1220 1240 **POSTER SESSION**
- 1240 – 1400 **LUNCH**

#### **SESSION IV: WEATHER AND CROP PRODUCTION**

**Chairperson: Dr Zamri Ishak, MARDI**

- 1400 - 1420 Light interception and leaf area index measurements under three oil palm planting systems  
*Dr Mohd. Haniff Harun, MPOB*
- 1420 – 1440 Effects of pineapple green wastes compost on growth and yield of *Capsicum annum*  
*Siti Zaharah binti Sakimin, UPM*
- 1440 – 1500 BAC-based physical mapping of the yield related QTL in *Oryza rufipogon*  
*Song Beng Kah, UKM*
- 1500 – 1520 Versatility of low vacuum scanning electron microscope in the study of plant microstructures  
*Abdul Rahman Razak, Abdul Ghani Yunus, Zakaria Wahab, Asiah Othman and Tengku Azmi Ibrahim, UPM*
- 1520 – 1530 **CLOSING BY THE PRESIDENT OF MSPP**

**THURSDAY 25 September 2003**

#### **POST CONFERENCE TOUR**

**Tour Head: Dr Mohd Haniff Haron, MPOB**

- 0800 – 0815 Assemble and board bus in front of Awana Golf and Country Resort, Genting Highlands
- 0815 – 1300 Visit to Monoluxury Sdn Bhd., Hydroponic Unit, Genting Highlands; Ginger Farm, Kg. Lurah, Janda Baik; and Ginger Harvest Collection Center, Kg. Cina, Bukit Tinggi, Bentong
- 1300 Return to Awana Golf and Country Resort, Genting Highlands

# ABSTRACTS

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## **FLUORESCENCE MEASUREMENT - A DIAGNOSTIC TOOL FOR ENVIRONMENTAL STRESS IN PLANTS**

**Elizabeth Philip**

Forest Research Institute Malaysia (FRIM) Kepong, 52109 Kuala Lumpur

Poor soils together with harsh environment are common feature of urban soils. They can impose serious constraints on tree establishment and growth. Initial symptoms of environmental stresses are manifested by reductions in the rate of photosynthesis. Hence, assessing the health or integrity of the internal “apparatus” within a leaf driving the photosynthetic process provides a rapid and non-destructive diagnostic system of detecting and quantifying plant tolerance to environmental stresses. Chlorophyll fluorescence potentially offers a rapid, accurate method to identify stress-tolerant trees for urban plantings without any destructive sampling.

A study was developed to assess if chlorophyll fluorescence measurement could be used as an option to identify environmental stresses in plants. Results obtained suggested that chlorophyll fluorescence kinetics provided useful data to determine if a plant is being subjected to environmental stress. Threshold values have been developed and will be discussed in detail in the paper.

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## **INTERACTIVE EFFECT OF SOIL WATER POTENTIAL AND TEMPERATURE ON WOOD DECOMPOSITION BY *RESINICIUM BICOLOR***

**<sup>1</sup>Abd Jamil Zakaria and <sup>2</sup>Lynne Boddy**

<sup>1</sup>Strategic Resource Research Center, MARDI Serdang, Selangor.

<sup>2</sup>Cardiff University, School of Biosciences, PO Box 915, Cardiff CF10 3TL, Wales, UK.

The effect of soil water potential ( $\psi$ ) and temperature on mycelial sustainability and wood decomposition by *Resinicium bicolor* was studied in laboratory microcosm comprising of compacted soil in 24cm x 24 cm tray, and using Scots pine (*Pinus sylvestris*) wood blocks of size 2 x 2 x 0.5 cm. Six incubation temperatures of 5, 10, 15, 20, 25 and 30 °C were factorially combined with five water potentials ( $\psi$ ) - 0.002, -0.0028, -0.004, -0.0057 and -0.008 MPa. The fungus was allowed to grow from the wood block in the tray and when the mycelia had completely regressed, the wood blocks were harvested and relative decay rate, final % weight loss of wood block and mycelial days to regression was estimated. Increase in temperature significantly ( $P < 0.001$ ) increased wood relative decay rate, decreased days to mycelial regression and final % weight loss. Increase in temperature from 5-25°C resulted in linear reduction of days to mycelial regression at the rate of 37.9 days, and increase in final % weight loss at 1.84 %, per °C rise in temperature. Decrease in  $\psi$  resulted in significant decrease days to mycelial regression ( $P < 0.001$ ), final % weight loss ( $P < 0.001$ ) and relative decay rate ( $P < 0.05$ ). Water potential ranging from -0.002 to -0.006 MPa is optimal for wood decomposition and mycelial sustainability, further decrease to -0.008 MPa resulted in earlier regression of mycelial system and reduced both the wood relative decay rate and % weight loss. At 5 °C the wood decay rate markedly decreased but mycelial growth were sustained longer and the system were finally able to decompose relatively large amount of wood. The  $\psi$ -temperature interaction effect on relative decay rate, days to regression and % weight loss were significant at  $P < 0.05$ ,  $P < 0.01$ ,  $P < 0.01$ , respectively. At high temperature (25 °C and 30 °C), the reduction in  $\psi$  from -0.004 to -0.008 MPa had resulted in relatively more reduction in % weight loss and relative decay rate than those at lower temperatures.

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## PHYSIOLOGICAL PERFORMANCE OF URBAN TREE (*MESUA FERREA* L. *CLUSIACEAE*) TO ATMOSPHERIC POLLUTANT SO<sub>2</sub> AND NO<sub>2</sub>.

<sup>1</sup>Ahmad Makmom Abdullah, <sup>1</sup>Nurul Azzura Shahadan, <sup>1</sup>Marzuki Ismail,  
<sup>1</sup>Suhana Musa, <sup>2</sup>Akio Furukawa

<sup>1</sup>Department of Environmental Science, Faculty of Science and Environmental Studies  
Universiti Putra Malaysia, Selangor Darul Ehsan.

<sup>2</sup>Faculty of Science, Nara Women's University, Nara 630-8506, Japan

SO<sub>2</sub> and NO<sub>2</sub> are the primary pollutants that were produced directly from man's industrial and domestic activities with transportation sector as one of its main sources. High concentration of these pollutants in the atmosphere will affect plant activities. A study has been conducted on the effect of ambient NO<sub>2</sub> and SO<sub>2</sub> on a selected urban tree (*Mesua ferreal* L. *Clusiaceae*.) locally known as Penaga Lilin, performed at three strategic locations in UPM main campus located at 3° 02' N, 101° 42' E. Photosynthetic and transpiration rates of *Mesua ferreal* L. *Clusiaceae*. at three canopy zone namely top, middle and low were measured. Subsequently, traffic volume together with concentration of SO<sub>2</sub> and NO<sub>2</sub> at each location was recorded.

Results of the study shows that net photosynthetic and transpiration rates of *Mesua ferreal* L. *Clusiaceae* was inversely proportional to the concentrations of SO<sub>2</sub> and NO<sub>2</sub> whereby higher pollutants concentration, i.e. increase in traffic volume will decrease the rates of photosynthesis and transpiration. Top canopy showed the highest photosynthetic and transpiration rates, followed by middle and lower canopy respectively.

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## SELECTION AND CHARACTERIZATION OF MAIZE GENOTYPES FOR WATER STRESS (DROUGHT) TOLERANCE

Aini Waznati Lasuan, Mohd. Ridzuan Mohd. Nor and Zakaria Wahab

Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, Selangor

Drought like many other environmental stresses, has adverse effects on crop yield especially in maize. Low water availability is one of the major causes for crop yield reductions affecting the majority of the farmed regions. Water stress will cause stresses in nutrient uptake, oxygen, pest and disease and mechanical impedence. A study was conducted on four maize inbred lines, which are G7-6, E5-5, E5-9 and UPM B. The inbreds were planted in Ladang 2, Univeristi Putra Malaysia under a sheltered area. The study was arranged using a Randomized Complete Design with five replications. Two treatments were applied, water stress and well watered a control. The main purpose of this study was to differentiate the responses of four maize inbreds when water stress was given in order to identify the inbred that has a potential resistant to drought condition. Characterization and selection for the inbreds were based on morphological (rood, leaf, stem, etc.) and physiological (photosynthesis, chlorophyll fluorescence, stomatal conductance, nutrient uptake, etc.) responses to water stress. The results showed that, E5-5 has failed to overcome the stress given and died. Meanwhile, G7-6 and E5-9 managed to survive and been compared. Both inbreds were harvested at taselling stage. UPM B also managed to survive until reproductive stage and the results were collected as extended data. As a conclusion, G7-6, E5-9 and UPM B have shown their responses to water stress treatment, but E5-9 is the most potential inbred because of its capability to tolerate water stress. Screening on the other 8 inbred lines randomly also has been done in the same location showed positive results to drought tolerance. A number of parameters are recorded for further study.

## **ENVIRONMENTAL STRESS ON RICE WITH SPECIAL REFERENCE TO O<sub>3</sub> AND SIMULATED HAZE**

**<sup>1</sup>Ahmad Makmom Abdullah, <sup>1</sup>Nurul Azzura Shahadan, <sup>1</sup>Marzuki Ismail, <sup>1</sup>Tay Ai Chen, <sup>2</sup>Furukawa Akio, <sup>1</sup>Lau Mun Yee and <sup>1</sup>Gan Pek Chuan,**

<sup>1</sup>Department of Environmental Science. Faculty of Science and Environmental Studies  
Universiti Putra Malaysia. Selangor Darul Ehsan.

<sup>2</sup>Faculty of Science. Nara Women's University. Nara 630-8506 Japan

Atmospheric pollution has, for many years, been considered an important factor causing and exacerbating plant stress. In Malaysia, haze and tropospheric ozone (O<sub>3</sub>) have been increasing over the past decades and will continue to do so with rapid industrialization and burning of fossil fuel.

The purpose of this study is to determine the direct effects of O<sub>3</sub> and simulated haze on physiological and growth performances of a local rice cultivar, MR211. During haze and O<sub>3</sub> exposure, the enhancement of CO<sub>2</sub> increases the plant heights, number of tillers and relative growth rate for the whole plants. Chlorophyll fluorescence indicated that the photosynthetic rate of rice seedlings increases after biomass exposure. Furthermore, scanning Electron Microscope (SEM) pictures show that the trapped particles were attached to each other and also affected the closure of stomata on the leaves. Nevertheless, there was no significant response of rice seedlings towards the simulated haze and O<sub>3</sub> due to short term experiment. On the whole, it can be concluded that rice of local variety MR211 is fairly resistant to this level of O<sub>3</sub> and simulated haze exposure.

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## **EFFECTS OF CHANGING LEVELS OF POTASSIUM NUTRITION ON PHOTOSYNTHETIC EFFICIENCY AND GROWTH OF BANANA (MUSA SP. CV. BERANGAN).**

**<sup>1</sup>M. N. Khan., <sup>2</sup>Zakaria Wahab., <sup>2</sup>Syed Omar S.R and <sup>3</sup>NorAini. M.F.**

<sup>1</sup>Department of Crop Science. <sup>2</sup>Department of Land Management. <sup>3</sup>Department of Biology,  
Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.

We assessed the influence of potassium (K) nutrition on the photosynthetic efficiency and morphological characters of banana (cv. Berangan). Plant supplied sufficient (300 kg/ha) and high (600 kg/ha) potassium maintained vigorous growth whereas deficient level of K (0 or available) tended to suppress to greater extent photosynthesis and growth (leaf area, pseudostem girth and plant height) of banana plant.

Potassium deficiency depressed photosynthetic efficiency more than 50% compared to plants with sufficient and increased K levels. Higher and sufficient rates of K application produced 32% and 41% more leaf area, respectively, compared to K deficient plants. Low K reduced pseudostem height by 27% compared to sufficient and high K treatments. Pseudostem girth was also reduced by 28% and 30%, respectively, compared to plants supplied with sufficient and more K.

Treatments with high levels of K application produced 13.85% more leaf area, 3% more stem girth and attained 10% more net-photosynthetic rate compared to sufficient/or control plants. The influence of K supply on growth and photosynthetic efficiency was discussed.

# THE EFFECT OF JASMONIC ACID ON DEVELOPMENT OF OIL PALM CULTURES

**Tarmizi A.H. and Zuraida A.R.**

Malaysian Palm Oil Board (MPOB), P.O Box 10620, 50720 K.L., Malaysia

Oil palm tissue culture protocols (solid or liquid culture systems) have been established for routine production of oil palm clonal plantlets. However, the efficiency of callusing, embryogenesis and conversion of embryoids still need to be improved. The manipulation of growth regulators is one of the approaches that can be used to address these problems. In this study, it was observed that jasmonic acid (JA) was effective in inducing higher proliferation rate of rooty and nodular callus types. It could also enhance embryogenesis in friable callus type. Comparatively, embryoids derived from pretreated calli (0.1 mg/l JA + 0.1 mg/l  $\alpha$ -Naphthaleneacetic acid (NAA) produced more shoots after 3 months on MS basal media. These observations indicated that JA could be exploited for further research in the improvement of oil palm tissue culture process.

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## EFFECT OF PARTIAL ROOTZONE DRYING (PRD) ON GROWTH, YIELD AND WATER USE EFFICIENCY (WUE) OF TOMATOES ON SOILLESS CULTURE

**<sup>1</sup>Hassan Ibrahim Ali, <sup>1</sup>Mohd Razi Ismail, <sup>2</sup>Mohd Mokhtaruddin Manan and <sup>2</sup>Halimi Mohd Saud**

<sup>1</sup>Crop Science Department, Faculty of Agriculture, <sup>2</sup>Department of Land Management, Faculty of Agriculture, UPM, Serdang 43400 Malaysia

Increasing water use efficiency became one of the main strategic goals of the researchers as well as decision-makers' world wide due to water scarcity and continues huge demand of water for agricultural irrigation. Consequently, studies in new low cost composted materials as well as irrigation techniques and approaches such as partial rootzone drying (PRD) seem to be of primary importance now and in the future for proper water use efficiency and rational water utilization.

This study was conducted at Hydroponics Unit, UPM, Malaysia to examine the effect of PRD using soilless media 70% of coca nut coir dust and peat 3:2 amended with 30% rice straw compost on different physiological and biological parameters, carbohydrate accumulations and water use efficiency of tomatoes grown under protected environment. The experiment was designed in a complete randomized (CRD) with three replicates. The two treatments were well-watered plants (control) or partially irrigated half of the roots of tomato plants alternately by 50% of the control water (PRD). The results showed that PRD significantly ( $p < 0.05$ ) reduced leaf expansion, plant leaf area and stomatal conductance, whereas proline was dramatically increased in the leaf. However, stomatal conductance, leaf expansion and proline accumulation significantly correlated with media drying. Dry matter partitioning showed no significant reduction in total dry matter and plant dry shoot, root weight and root to shoot ratio. Thus there were also no significant differences between plant total and marketable yields due to PRD application. Both WUEs increased significantly with PRD. This result suggests that PRD application could be affective with soilless media due to high total carbon provided under Malaysia humid condition that characterized by high evaporative demand.

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## HEAT TOLERANCE AND IMPROVEMENT OF FLOWERING AND FRUIT SET OF TOMATOES UNDER HIGH TEMPERATURE GROWING CONDITION

**Ismail Iberahim, Mohd. Razi Ismail and Effyanti Mohd. Shuib**  
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High temperature growing condition (24 – 41.5 °C) caused low fruit setting for tomatoes. The application of plant growth regulator (PGR) could improve fruit set and fruit size. *Lycopersicon esculentum* cv. Alboran and cv. Red Rock were selected to study the effect of external PGR application on fruit development and total yield. The application of PGR increased percentage of fruit set by two fold compared to non-application of PGR. At the same time the application of PGR increased fruit size and fruit weight. The plant applied with PGR gave the average yield per plant of 1429.5 g and 840.2 g in Alboran and Red Rock, respectively as compared to non-application of PGR which was 327.8 g and 272.7 g. It is concluded that the application of PGR was necessary to improve flowering and fruit set of tomatoes grown under high temperature conditions.

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## SEM OF THE MANGOSTEEN (*GARCINIA MANGOSTANA*) LEAF: A PROBABLE EXPLANATION TO THE SLOW PLANT DEVELOPMENT

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The abaxial surface is covered by thick wax layer and interspersed randomly by elliptical-shaped stomata, apparently absent on the adaxial surface. The cuticle on the adaxial surface is apparently three fold thicker than the abaxial surface. The elongated stomata were surrounded by slightly raised border that appears to be part of the subsidiary cells. Four strand-like cuticular apparatus at each end of the guard cells could probably be a characteristic to mangosteen. The abaxial and adaxial surfaces are covered by a single layer of epidermal cells. The mesophyll consisted of two tiers of closely packed palisade cells containing dense materials. The spongy cells consisted of interconnecting cells with thick walls. The xylem and phloem vessels are large and abundantly present. These inherent cellular features would apparently contribute to the overall slow growth of the plant.

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## LIGHT INTERCEPTION AND LEAF AREA INDEX MEASUREMENTS FROM THREE DIFFERENT OIL PALM PLANTING SYSTEMS

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Light is an important growth resource that has to be intercepted by the plant canopy for use in photosynthesis. Light interception and leaf area index measurements were taken from seven-year old oil palms grown under three different planting systems, i.e. normal triangular, single avenue and double avenue plantings, to find out which is the best oil palm planting system for intercropping. Measurements were taken at 0.5 meter intervals along a transect between two palms. The distribution of photosynthetically active radiation (PAR) that penetrates the oil palm canopy was reduced by as much as 50% in the normal triangular planting as compared against the two avenue plantings. This was significantly correlated with the higher leaf area index (LAI) value in the normal triangular planting as



compared with the avenue planting systems. The empty space between the oil palm avenue plantings is suitable for intercropping with selected crops, since the mean PAR transmitted through the palm canopy was about 40%. The normal triangular planting was unsuitable for intercropping since the mean PAR transmitted through the palm canopy was less than 23% in seven-year old palms.

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## **EFFECTS OF PINEAPPLE GREEN WASTE COMPOST ON GROWTH AND YIELD OF *CHILLI* (*CAPSICUM ANNUM*)**

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Composting is becoming one of the most environmentally means for waste recycling. Although, quality of compost of most important due to different methods and different brown and green materials used. Study was conducted at IPPT, Universiti of Putra Malaysia, to evaluate the effects of Pineapple Green Waste (PGW) compost which developed using different nitrogen source. Compost development phase using PGW with different nitrogen source and the treatment are PGW + bat manure (C1), PGW + chicken manure (C2), PGW + goat manure (C3) and PGW + cow manure (C4). Composting was done using estetic aeration pile and compost quality anthesis where monitor such as temperature, moisture content, E.C, pH, C:N ratio, nutrients and heavy metals accumulation during the compost. Accordingly, each compost will considered mature after a certain of time depending on the parameters mention ealier. After the composting preparation, the compost was mixed with Coconut Coir Dust (CCD) as the medium of cultivation. Further, these developed composts were tested for their effects on growth and yield of chilli. The results indicated that [CCD (60%) + C4 (40%)] grew better rather than [CCD (60%) + C1 (40%)], [CCD (60%) + C2 (40%)] and [CCD (60%) + C3 (40%)]. However, [CCD (60%) + Peat Grow (40%)] as the control showed the lowest growth and yield compared to other treatments.

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## **DEVELOPMENT OF BAC-BASED PHYSICAL MAP FOR THE YIELD RELATED QTL IN *ORYZA RUFIPOGON***

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*O. sativa* sequences are suitable for use as framework for the spacing and ordering of overgo probes in the screening of the BAC library of its wild relative. Based on the *O. sativa* sequences model, it may also be suggested that the contig assembly of *O. rufipogon* genomic region may be produced with a high degree of efficiency. The module of 20 overgos is yet to be deconvulated in order to assign BAC identity to each overgo probe. Effort to date primarily have focused on the identity confirmation procedure and fingerprint analysis of the positive BAC clones.

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# VERSATILITY OF LOW VACUUM SCANNING ELECTRON MICROSCOPE IN THE STUDY OF PLANT MICROSTRUCTURES

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Scanning electron microscope (SEM) is a common tool in the study of plant microstructure today. Advantages of the Low Vacuum Scanning Electron Microscope (LVSEM) over the Transmission Electron Microscope and the Optical Stereo binocular Dissecting microscope for study of plant microstructures are highlighted. Micrographs of microstructures of the palisade cells of mangosteen leaf and durian anther and pollen grains generated by secondary electrons (SE) and backscattered (BE) electrons under different preparation process and vacuum modes of LVSEM are discussed.

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## P1

### SOMATIC EMBRYO FORMATION AND GERMINATION FROM MALE FLOWER CLUSTER-DERIVED SUSPENSIONS OF BANANA CULTIVAR RASTALI

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A protocol for somatic embryo formation and germination from male flower cluster-derived cell suspensions of banana cultivar Rastali was developed. Flower clusters from position one to ten were excised from male inflorescences and cultured onto modified M1 semi-solid medium. Callus were initiated from flower cluster positions five to ten within six months of culture. Callus produced from the most responsive cluster positions were transferred onto Dhed'a liquid medium to produce cell suspension cultures. The cell suspensions were sieved and subcultured thrice at an interval of four weeks. After the third subculture, fine granules (embryogenic cell clusters) produced in the cell suspensions were transferred onto hormone-free solid MS maturation medium. Within two months, the embryogenic cell clusters developed into embryogenic callus and then into whitish globular structures. The globular-stage somatic embryos were transferred onto germination medium and regenerated into plantlets.

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## P2

### CONSTRUCTION OF CAPSANTHIN-CAPSORUBIN SYNTHASE (CCS) -ANTISENSE GENE

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The capsanthin-capsorubin synthase (CCS) gene is involved in the final stages of carotenoid biosynthetic pathway in chilli fruits. CCS catalyses the conversion of violaxanthin and antheraxanthin into capsanthin and capsorubin, red pigments of chilli fruit when the fruit start to develop colors formation. In order to

elucidate the gene function an antisense construct of this gene was produced and will be transformed into chilli plant. 444 and 728 bp fragment *CCS*-antisense gene were cloned separately into pCAMBIA 1301 vector.

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### **P3**

#### **SHOOT INDUCTION FROM HYPOCOTYL EXPLANT OF CABBAGE CULTIVARS 88 AND KY CROSS AS AFFECTED BY BAP**

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Multiple shoot formation from hypocotyl explants of cabbage cultivar 88 and KY cross were evaluated on MS medium containing different concentrations of BAP (0, 1.0, 2.0, 4.0, 6.0, 8.0 and 10.0 mg/L). All treatments containing BAP showed significant differences on the percentage of shoot formation compared to the control in both the cultivars. However, the percentage of shoot formation did not differ significantly among the BAP treatments in both cultivars. Mean number of shoots produced per explant was highest on 4.0 mg./L BAP for cultivar 88 and 1.0 mg/l for cultivar KY cross. Shoot formation was initiated in both cultivars as early as the third week of culture.

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### **P4**

#### **EFFECT OF RICE STRAW COMPOST AND WATER DEFICIT ON PHYSIOLOGICAL PARAMETERS, YIELD AND WATER USE IN PRODUCTION OF TOMATOES WITH DIFFERENT GROWING MEDIA UNDER PROTECTED ENVIRONMENT**

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There is often immediate need by the farmers in different parts of the world to obtain simple technology in cultural practices that can be used to alleviate environmental stress conditions in order to sustain yield, quality and to increase plant water use for the agricultural products. However, the uses of the clean water and chemical solutions as fertilizers were very costly. Although, the use of organic matter amended composts as most cost effective and environmentally sound alternatives for organic waste recycling will be crucial for increasing water use and other agronomic aspects.

This study was conducted at Hydroponics Unit, UPM, Malaysia to evaluate the use of rice straw compost under two stress cycles with different growing media, namely soilless media {coca nut coir dust and peat 3:2} and greenhouse soil {top soil, sand and peat 2:1:2} for improvement of yield quality and water use efficiency (WUE) of tomatoes grown under protected environment. The experiment was designed as four-by-two factorial in a complete randomized with three replicates. The two factors were water regime {well watered or stress (withhold water)}. Others factors were the media mentioned above with 30% compost or without.

The results indicated that addition of rice straw compost significantly increased yield and WUE in both media, whereas water deficit significantly decreased yield and WUE in most of the treatments. The increase in total yield and WUE in both media might be due to the increasing of total carbon or/and to nutrient efficiency. However, Significant interaction was obtained with media and water in plants dry biomass, total yield, fruit diameter and WUE. The results indicated that soilless media was not affected

by the stress regime in most of these parameters. This suggests that soilless media increased water holding capacity and others physical properties better than greenhouse soil. The results also indicated that media drying decreased leaf water potential, stomatal conductance as well as plant dry biomass, whereas increased proline accumulations with slightly differences within the different media.

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## **P5**

### **PCR AND GUS HISTOCHEMICAL ANALYSIS REVEAL VARIABILITY IN T-DNA EXPRESSION AND POSSIBLE GENE SILENCING IN PROGENIES OF CHIMERIC TRANSGENIC *C. ANNUM***

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The generation of T1 transgenic chilli was obtained through self pollination of the T0 plants. Attempts to transform chilli through direct seed transformation were carried out since chilli is highly recalcitrant thus differentiation and regeneration through in-vitro technique is difficult. Combination of molecular and biochemical analysis have shown that this transformation procedure was successful. The seedlings of A2, B3, D7, D10, G5 and H10 were germinated on MS medium containing 10 ug/ml hygromycin for selection purposes. Based on the high percentage of germination obtained (around 46 -88 %), the concentration of 10 ug/ml hygromycin was not optimum concentration for primary screening. PCR was carried out on 3 types of samples, 2 of which failed to detect the presence of transgene. B-glucuronidase histochemical analysis and PCR carried out on germinating seedlings of A2, B3, D7, D10 and H10 revealed that transgene could be inherited and expressed in the T1 stage. Gene gus expression was detected based on the presence of blue spots in the explants. Sample D7 showed the highest positive for hypocotyls and the colour intensity was much reduced compared to those in T0 stage. PCR result was obtained through amplification of gus gene fragment of 789 base pair and hpt gene fragments of 519 bp. A2, D7, G5 and H10 with negative results on GUS assay had shown the presence of gus gene in the PCR analysis. This suggested that gene silencing had occurred in the T0 stage and the gene could still be inherited to the progenies. Molecular analysis carried out on the whole explants has shown the presence of the transgenes, but PCR analysis on individual leave samples failed to do so. This finding proposed that through this genetic transformation technique, chimaeric plants generation was unavoidable even though constitutive CaMV 35 S promoter was used.

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## **P6**

### **RAPID PCR SCREENING OF TRANSGENIC PINEAPPLE USING FTA CARDS**

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A method for the rapid screening of transgenic pineapple plants is described. DNA from the leaves was transferred onto FTA card. A disc of 2 mm diameter was punched from the FTA card and put into a PCR tube. The FTA card was washed twice with FTA purification buffer and twice with TE buffer, dried and a PCR mix added. The primers used screened for part of the promoter of the antisense gene and the *npt II* genes. This method is rapid and does not make use of chemicals to extract DNA. Moreover, the DNA in the FTA card can be easily stored at room temperature.

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P7

## DETERMINATION OF ANTIOXIDANT ACTIVITIES IN VARIOUS ORGANIC EXTRACTS FROM DIFFERENT PARTS OF LOCAL *CITRUS GRANDIS* (LIMAU BALI)

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This preliminary study was analytically performed in order to investigate the percentage of yields and antioxidant activities of various organic extracts such as diethylether, ethanol, methanol and water from peels, leaves and juices of *Citrus grandis*. Among four organic solvents used, ethanol extract of peels yielded of :  $29.733 \pm 0.64\%$ , juices:  $26.05 \pm 0.97\%$  and leaves:  $17.83 \pm 0.52\%$  and methanol extract of peel yields:  $20.153 \pm 0.45\%$ , juices:  $25.86 \pm 0.75\%$  and leaves:  $19.37 \pm 0.80\%$  are showed the most effective in extracting of studied of *C. grandis* respectively compared to diethylether extract of peels yielded of :  $2.60 \pm 0.11\%$ , juices:  $14.27 \pm 0.87\%$  and leaves  $2.13 \pm 0.25\%$  and water extract of peels yielded of :  $12.80 \pm 0.20\%$ , juices:  $14.27 \pm 0.87\%$  and leaves  $10.132 \pm 0.42\%$ . However, water extract also showed an appreciable yield. Results indicated that the yield of most extracts was greater with the more polar solvents used. Antioxidant activities of various extracts were biochemically evaluated by using two established tests :- (a) Linoleic acid model system (conjugated diene) and (b) 1,1-diphenyl-2-picrylhydrazyl (DPPH) scavenging test. The antioxidant activities were scientifically compared with authentic standard antioxidants such as butylated hydroxytoluene (BHT) and  $\alpha$ -tocopherol (Vitamin E). Results of conjugated diene test were as followed for ethanolic extract of peels:  $0.97 \pm 0.03$  activity per  $10\mu\text{l}$  soluble extracts, leaves:  $0.775 \pm 0.06$  activity per  $10\mu\text{l}$  soluble extracts and juices:  $0.74 \pm 0.06$  activity per 10ml soluble extracts, methanolic extract of peel:  $0.818 \pm 0.02$  activity per 10ml soluble extracts, leaves:  $0.884 \pm 0.02$  activity per 10ml soluble extracts and juices:  $0.70 \pm 0.03$  activity per 10ml soluble extracts, water extract of peel:  $0.924 \pm 0.03$  activity per 10ml soluble extracts, leaves:  $0.653 \pm 0.02$  activity per 10ml soluble extracts and juices  $0.615 \pm 0.04$  activity per 10ml soluble extracts and diethylether extract of peels:  $0.15 \pm 0.04$  activity per 10ml soluble extracts, leaves:  $0.102 \pm 03$  activity per 10ml soluble extracts and juices  $0.069 \pm 0.04$  activity per 10ml soluble extracts. Results also exhibited that antioxidant activity of peel in ethanolic extract ( $0.97 \pm 0.03$  activity per 10ml soluble extracts) was found to be a best as compared to synthetic antioxidant, butylated hydroxytoluene (BHT) ( $0.98 \pm 0.04$  activity per 10ml soluble extracts) and it was showed a slightly less potent antioxidant than  $\alpha$ -tocopherol ( $0.95 \pm 0.04$  activity per 10ml extract). DPPH antioxidant activity test showed a positive result by decreasing absorbance with time in all types of organic solvents used for different samples of *Citrus grandis*.

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P8

## EFFECT OF HIGH TEMPERATURE ON THE EPICUTICULAR WAX OF LOCAL FRESH DESSERT BANANAS (*MUSA SAPIENTUM* VAR. BERANGAN) RIPENED BY CALCIUM CARBIDE

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A study was conducted to determine the effects of high temperature treatment on the changes of epicuticular wax of a local fresh dessert banana (*Musa sapientum* cv. Berangan). Mature green fruit were ripened at 25 and 37 °C using calcium carbide (0.2 g/kg fruit) for 24 hours. The individual fingers were then allowed to continue ripening at ambient condition (25 °C, 85-95% RH). Samples of five fruit per 4

treatment were randomly taken and rind sections of 1 cm of diameter were cut from the equatorial zone of fruit peel with a razor blade. The sections were immersed in fixative solution, rinsed, dehydrated and dried by a critical point dryer. The samples were then placed on the stubs and coated by gold-palladium using the sputter-coater and examined under a scanning electron microscope. An environmental-scanning microscope was also used to observe the fresh surface of the fruit at low temperature condition. The results of the study showed that banana exposed to 37 °C had a dehydrated peel surface, especially on the cuticular tips. It was noted that there was excessive water evaporation from the surface of the fruit peel treated at high temperature. The high amount of water loss on the peel surface of the heated fruit could be associated with the loss membrane integrity and apparent change in structural morphology of cuticular waxes. They also showed broadening of cuticular cracks as compared with control. However, there was no significant difference in water loss during the storage period. The percentage moisture loss at both temperatures were in the range of 77 to 78%. This was caused by a slight partial melting at the edges of the cuticular tips at 37 °C. Apparently, exposure of the fruit to 37 °C changed the cuticle structure by reducing the width of cracks and cuticle permeability. Alternatively the high temperature treatment could have stimulate an increase in the synthesis of wax that filled up the cracks. Other investigations using controlled environmental conditions have indicated that temperature affects the quantity and structure of the epicuticular wax and that the shape of wax crystals was strongly correlated with their chemistry. As a result, the high temperature treatment exhibited a change in the epicuticular structure but had no effect on water loss of the fruit

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**P9**

## **QUALITY CHARACTERISTICS OF MUSA AAA ‘BERANGAN’ AND ‘CAVENDISH’ DURING RIPENING**

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Mature green Berangan and Cavendish banana obtained from Pasar Borong Selayang and Pasar Borong Puchong respectively were immediately transported to the Postharvest Laboratory, UPM. The fruit were packed in a polystyrene tray (27 x 20 cm), wrapped with a cling wrapper and induced ripening with calcium carbide (1 g/5 fruit). Both Berangan and Cavendish banana were ripened in a 90% relative humidity (RH) controlled chamber, with Berangan at 27 °C while Cavendish at 18 °C. Duration for fruit to ripen from one maturity index (MI) to another MI was recorded until fruit turned full yellow at MI 6. Sensory evaluation was carried out by 12 untrained sensory panelists to evaluate consumer perception of eating quality on fresh banana among MI 4, MI 5 and MI 6 fruit. Peel colour ( $L^*$ ,  $C^*$  h0), soluble solids concentration (SSC), titratable acidity (TA), ascorbic acid (AA), pH and firmness were determined at every MI. The experiment design was RCBD with 5 replications. Data were analyzed using ANOVA and means were separated by LSD. There was a significant difference in the ripening duration for both varieties as ripening took place. Cavendish banana took 186 h (~8 d) while Berangan took only 93 h (~4 d) to reach MI 6. From sensory evaluation, it was found that 50% of the untrained panelists prefer Berangan that had ripened to MI 5, 42% prefer Berangan of MI 6 while 8% prefer Berangan of MI 4. For Cavendish, 58 % of the untrained panelists prefer fruit of MI 6 and others prefer MI 5 fruit. Berangan showed significant changes in all quality characteristics. Cavendish also showed significant changes in all quality characteristics except AA.  $L^*$  and  $C^*$  values of Berangan and Cavendish peels were greatest at MI 6 and lowest at MI 2. The h0 value for Berangan was highest at MI 1 while Cavendish showed the highest value at MI 2. Firmness of both varieties were significantly decreased while SSC increased as fruit ripened. TA of both varieties decreased as fruit ripened. The pH values of Berangan decreased significantly as ripening occurred. However, Cavendish showed inconsistent changes in pH during ripening.

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## **P10**

### **CONSTRUCTION OF A PLANT EXPRESSION VECTOR FOR SUPPRESSION SUBTRACTIVE HYBRIDIZATION CDNA LIBRARY APPLICATION**

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To accelerate gene isolation from plant and in order to carry out functional genomics studies of plant genes, we must be able to readily manipulate and express all the genes in a vector driven by a promoter that is suitable for plant gene expression. Most of the available vectors in the market are utilizing bacterial promoter and thus not suitable for plant gene study. Two vectors were designed to allow directional cloning and expression of plant cDNAs that have undergone the Suppression Subtractive Hybridization procedure. The plasmid and phage library constructed are driven by CaMV35S, a constitutive promoter that allows the expression of naked plant cDNAs that will be introduced into plant cells via particle bombardment.

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## **P11**

### **SOFTENING OF *MUSA AAA* 'CAVENDISH' BANANA DURING RIPENING**

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Transmission electron microscopy (TEM) and light microscopy (LM) were used to study cell changes during softening of Cavendish banana as the fruit ripened at 18 °C from mature green to full yellow stage. Pulp firmness and soluble solids concentration were also determined. TEM indicated that at initial stage of ripening, the middle lamellae that separated adjacent cells in the banana peel appeared electron-dense. Then, as ripening progressed, this electron-dense region became partially translucent and contained deposits that were electron dense. When the fruit peel turned full yellow, the middle lamellae had become fully electron-translucent and were filled with electron dense deposits. LM revealed that at initial stage of ripening, starch granules were observed in pulp cells and the cells were still intact with cell walls. Intercellular airspaces in between the cells could be clearly seen and were in abundance. However, when the fruit turned full yellow the cell walls had disintegrated while the starch granules had degraded leaving a mass of unidentified pulp tissue. There was a significant quadratic decrease in pulp firmness and this corresponded with a significant linear increase in soluble solids concentration. These findings demonstrate that softening of banana during ripening was associated with disintegration of peel cell walls and degradation of pulp starch granules.

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## **P12**

### **PRELIMINARY TRANSFORMATION STUDY OF POMELO (*CITRUS GRANDIS*)**

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Various factors affecting gene transformation through hypocotyl explants of *Citrus grandis* were investigated to optimize gene transformation. Those factors included strains of *Agrobacterium*, bacterial densities, transformation enhancer concentrations and co-culture conditions. The results showed that



hypocotyl explants infected with *Agrobacterium* strain EHA 105 demonstrated higher level of transient GUS expression than those infected with AGL1 and LBA 4404 and strain EHA 105 was used in all subsequent experiment as the basis for identifying the most appropriate condition for transformation. Higher percentage of GUS expression was obtained with explants inoculated with *Agrobacterium* strain EHA 105 (OD<sub>600</sub> 0.2) for 40 min. The best co-culture condition was the incubation of the explants for three days in culture medium supplemented with 200 µM acetosyringone.

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## **P13**

### **A FRUIT SPECIFIC AND RIPENING RELATED ENDOPOLY GALACTURONASE GENE FROM PAPAYA (*CARICA PAPAYA* L.)**

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Fruit ripening is caused by a series of coordinated physiological and biochemical processes resulting in changes in its texture. Fruit softening is associated with extensive solubilization and degradation of cell-wall polysaccharides, which result from the action of a number of cell-wall hydrolytic enzymes including polygalacturonase. Endopolygalacturonase has been extensively studied in tomato fruit where it accumulates during ripening and is responsible for the degradation of polyuronides in the fruit cell wall. A fruit specific and ripening related endopolygalacturonase clone 2.5 kb in length has been isolated from papaya cDNA library using differential screening method. The papaya endopolygalacturonase transcript showed increasing expression during fruit ripening but was undetectable in other tissues hence indicating its specificity in ripening fruit tissues.

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## **P14**

### **CHANGES IN COLOUR AND CHLOROPHYLL CONTENTS DURING RIPENING OF *MUSA* AAA 'CAVENDISH' AND 'BERANGAN' WITH DIFFERENT CONCENTRATIONS OF CALCIUM CARBIDE**

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A study on the changes in colour and chlorophyll contents during ripening of *Musa* AAA 'Berangan' and 'Cavendish' with different concentrations of calcium carbide was conducted. Five concentrations of calcium carbide (0; 0.2, 0.4, 0.6, 0.8, 1.0 g/5 fruit) were used to initiate ripening of mature green (maturity index 1) 'Cavendish' and 'Berangan' at 18 and 27 °C, respectively. Peel colour, chlorophyll a, chlorophyll b and total chlorophyll contents of fruit that have ripened to yellow with green tips (maturity index 5) were analysed. The experiment was conducted using a randomized complete block design with five concentrations of calcium carbide and three replications. Data obtained were analyzed using ANOVA and means separated using DMRT. The peel colour of bananas were expressed in chromaticity values of L\*, C\* and h0. The chlorophyll contents of banana peel were carried out using spectrophotometer. At maturity index 5, the L\* and C\* values of 'Berangan' peel colour increased significantly as fruit ripened using calcium carbide from 0.4 g/5 fruit to 0.6 g/5 fruit. However, h0 value of 'Berangan' peel colour decreased significantly as fruit ripened using calcium carbide ranged from 0.2 g/5 fruit to 1.0 g/5 fruit. Maturity index 5 of 'Berangan' fruit that ripened using calcium carbide ranged from 0.2 g/5 fruit to 1.0 g/5 fruit showed significant decreased in chlorophyll a, chlorophyll b and total chlorophyll contents. This indicates that calcium carbide at concentration 0.4 g/5 fruit is sufficient to induce change of peel colour

from mature green to yellow with green tips and chlorophylls retained in 'Berangan' fruit was the least among rate used. In contrast, there was no significant differences in 'Cavendish' peel colour values and chlorophyll contents for all the rates of calcium carbide used. It shows that for 'Cavendish' banana, even with the rate of 0.2 g/5 fruit is sufficient to induce peel colour change and chlorophyll breakdown.

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**P15**

**MAINTAINING LANDSCAPE PLANTS OF *ACALYPHA SIAMENSIS*, *FICUS MICROCARPA* AND *SYZYGIUM OLEINA* BY THE APPLICATION OF PACLOBUTRAZOL : A NON-MECHANICAL APPROACH**

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Trimming procedures in the maintenance of a landscaped area are costly, time consuming and labour intensive. Disposal of the great quantity of trimmed biomass is also an issue in certain countries. Paclobutrazol, which inhibits the gibberellin biosynthesis in plants, was studied for its potential of retaining the landscape functions of some common hedge plants in Malaysia. The species under study were *Acalypha siamensis*, *Ficus microcarpa* and *Syzygium oleina*. Appropriate dosages of this plant growth regulator were better in controlling the growth of these species as compared to the conventional method of shoot trimming.

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**P16**

**PHYSICO-CHEMICAL CHARACTERISTICS OF PISANG MAS (*MUSA SAPIENTUM* CV MAS) WITH PEEL/PULP SPLITTING DISORDER**

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Pisang Mas (*Musa sapientum* cv Mas) is susceptible to peel/pulp splitting (PPS) disorder. PPS is an abiotic disorder, caused by environmental or cultural conditions. It has been associated with high fruit sugar content, water absorption through the cuticle and calcium content. The physico-chemical characteristics of the PPS affected (split fruits) and unaffected fruits (non-split fruits) were evaluated, to be used as a platform in further study on the causal factors determination. Split fruits were found to ripen more rapidly as compared to non-split fruits. Significantly ( $p < 0.05$ ) higher soluble solids concentration and pulp moisture content in split fruits suggested that excess nutrient and moisture might be the causal factors of PPS disorder.

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**P17**

**EFFECT OF METHYUL OLEATE ON THE EFFICACY OF GLYPHOSATE ON *MIKANIA MICRANTHA* AND *DIODIA OCIMIFOLIA***

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The effect of addition of methyl oleate in comparison with ammonium sulphate in the preparation of

glyphosate formulation to *Diodia ocimifolia* and *Mikania micrantha* were evaluated in the glass house. The 6-week old plants were sprayed with knapsack sprayer at 1.23 kg a.i./ha and spray volume of 200 L/ha. Formulation of glyphosate with methyle oleate 1% showed the highest spray deposit on both weeds. In visual assessment, similar formulation showed the highest percentage of mortality on both weeds at 7 and 10 days after treatment. Similar result was observed on the reduction of leaf chlorophyll, fresh and dry weight. The result indicated that methyl oleate showed the best result in the concentration of 1%.

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## P18

### THE VOLATILE COMPOSITION OF ESSENTIAL OIL IN DIFFERENT PARTS OF *MICHELIA ALBA* ('CEMPAKA PUTIH').

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The essential oils of several parts of *Michelia alba*, namely, petal, young shoot and stem have been investigated for their chemical composition. Samples were extracted using Simultaneous Distillation Extraction (SDE) and the essential oils obtained were analysed by gas chromatography-mass spectrometry (GC-MS). Approximately 68 compounds were identified in essential oils obtained from petal, young shoot and stem of *M. alba*. The volatile compounds present in essential oils of petal, young shoot and stem varied from each other as well as their percentage. The major compounds identified were linalool (1,6-octadien-3-ol), cyclohexanol (dihydrocarveol), cyclohexane (1-ethenyl-1-methyl-2, 4-bis (1-methyl-ethanol) and butanoic acid, 2-methyl-methyl ester. Linalool was the major compound detected in petal and stem i.e 59% and 32% respectively, whilst the major compound detected in young shoot was cyclohexanol (dihydrocarveol) (45%) and cyclohexane (12%). Linalool was only detected in petal and stem, whereas dihydrocarveol was only present in young shoot. In this study, most of the compounds detected in petal, young shoot and stem of *M. alba* were belonged to the group of isoprenoids, benzenoid, fatty acid and furan derivatives and miscellaneous volatile compounds.

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## P19

### POTENTIAL USE OF CHITOSAN IN EXTENDING THE VASE LIFE OF CHRYSANTHEMUM (*DENDRANTHEMA MORIFOLIUM* RAMAT) AND CONTROLLING MICROORGANISMS IN THE VASE SOLUTION

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A study was carried out to look at the potential use of chitosan as a vase life preservative. Chitosan was also used to control pathogenic fungi and bacteria found in the vase solution after a substantial period the flowers were held in the vases. Cut chrysanthemum (*Dendranthema morifolium* Ramat) were treated with chitosan at 0, 25, 50, 75 and 100 mgL<sup>-1</sup> dissolved in 0.05% ascorbic acid and displayed in the Postharvest Lab with the environmental conditions, 25±2°C, 70% RH and 15 mol m<sup>-2</sup> s<sup>-1</sup> light intensity

from cool-white fluorescent lamps for 12 hours. The results showed that chitosan contained preservative vase solutions at 25 and 50 mgL<sup>-1</sup> significantly increased water uptake, fresh weight and delaying wilt of cut flowers compared to the control. However, chitosan at higher concentrations, 75 and 100 mg L<sup>-1</sup> were not effective in controlling vase life of the cut flowers. The former two concentrations were also found to reduce the number of bacterial colonies and inhibited the fungal growth found in the vase solutions. *In vitro* observations found that chitosan at 50, 75 and 100 mgL<sup>-1</sup> inhibited the diameter of mycelial growth 2 days after incubation as well as reducing bacterial colonies.

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## **P20**

### **ANTHOCYANIN CONTENT IN FLOWER PETALS OF SCENTED ORCHID, *PHALAENOPSIS VIOLACEA***

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*Phalaenopsis violacea* is an economically important high priced scented orchid species which is endemic to the island of Borneo. The plants produce purple-white flowers which are extremely fragrant and they can bloom for several months, particularly in the months of January to March. A study was conducted to select the plants having high anthocyanin content in flower petals of *Phalaenopsis violacea*. Flower petals were extracted to determine anthocyanin content using thin layer chromatography (TLC) and UV-spectrophotometer. The major pigments present in this flower are anthocyanins and petunidin is the main anthocyanidin. The anthocyanin content at different stages of flower development was determined in order to select the best plant producing high anthocyanin content.

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## **P21**

### **EFFECT OF SHADE ON GROWTH CHARACTERISTICS OF MINT (*MENTHA ARVENSIS* L.)**

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In Malaysia herbs are considered as the crop of the future. The local herbs have commercial potential but have not been fully exploited. To successfully cultivate herbs on a commercial scale, responses to various environmental factors which control productivity need to be examined. One such factor is light level. Biomass production plant grown in nonlimiting conditions depends upon the energy of solar radiation intercepted. On the other hand, light ultimately will determine the texture and quality of the leaf. Herbs such as mint and pegaga leaf either as fresh or for extraction is the main product used commercially. For fresh, the tender, green leaves are preferred. Higher light intensity increases oil production such as menthol in mint but plants however had bigger stems and smaller leaves. Hence this experiment has been conducted to determine the effect of light intensity on growth of mint.

Rooted cuttings were planted in 25 x 30 cm polyethylene bags containing compost and sand (7:3 v/v). Organic fertilizer of 8:8:8 (% N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) was applied monthly at rate of 10 g/bag. Water was supplied manually as needed. Plants were placed at four light levels i.e. under full sunlight and at 30, 60 and 90 % shade. After two months, plants were harvested and separately oven-dried at 70 °C for growth determination. The total leaf area and chlorophyll contents were measured. The newly expanded leaves were used to determine calcium, potassium and magnesium contents.

Plants produced more branches under full sunlight. The total leaf area was highest under 60 %

shade. The leaf mass however was higher at higher light levels. Consequently, the shaded plants had greater leaf area specific as compared to plants under full sunlight. The root and shoot ratio of plants grown under full sunlight was higher than those grown under shade. The leaves of plants grown under shade were greener and contained higher amounts of potassium, calcium and magnesium. The results suggested that mint should be planted under partly shaded conditions to produce tender, dark and big leaves and higher mineral content. Further research is recommended to determine the role of light in essential oil content of leaves.

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**P22**

## **BIOCHEMICAL ANALYSES OF SEEDS OF SELECTED RICE CULTIVARS**

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Biochemical analyses were carried in an effort to assess the superior quality of rice seeds. Seeds of thirteen rice cultivars, IR64, MR84, MR151, MR159, MR167, MR185, MR207, MR209, MR211, MR219, Muda, RU 2242-1-1 and Setanjung, were analyzed for starch and protein content. In addition, ascorbic acid content and glutathione reductase (GR) activity were also determined for their antioxidative properties. The dry weight of seeds was recorded. The results obtained showed that seeds of cultivar RU 2242-1-1 contained the highest starch content (34.06 mg/g fr.wt) followed by MR209 (26.21 mg/g fr.wt) and IR64 (24.07 mg/g). The seeds with low starch content are MR207 (18.11 mg/g), MR159 (18.48 mg/g) and Setanjung (18.73 mg/g). The level of starch present in the seeds may indicate the photosynthetic and starch synthesis efficiency of the cultivars. Seeds of MR211 exhibited the highest protein content (147.77 µg/g fr.wt) followed by MR84 (141.59 µg/g fr.wt) and MR159 (100.52 µg/g fr.wt) while seeds of cultivars MR207 (26.63 µg/g fr.wt), MR167 (33.55 µg/g fr.wt) and Setanjung 37.39 (µg/g fr.wt) have low protein content. Ascorbic acid content, measured by the 2,6 dichlorophenol-indo-phenol (2,6-DCPIP) titration method, was observed to be highest in seeds of MR209 (1713 µg/g fr.wt), followed by IR64 (1395 µg/g fr.wt) and MR84 (1131 µg/g fr.wt). Seeds of RU 2242-1-1 showed the highest specific GR activity (20.68 nmol/min/mg protein), followed by MR219 (12.55 nmol/min/mg protein), Setanjung (11.71 nmol/min/mg protein) and IR 64 (11.40 nmol/min/mg protein). The seeds dry weight was lowest in seeds of MR209 (3.00%), followed by MR 151 (3.25%), RU 2242-1-1 (3.50%) and Muda (3.50%). Low moisture content in seeds may reflect storage quality. From the biochemical parameters carried out, the cultivars that appear to have potential are MR209, RU 2242-1-1 and IR64. The seedlings produced from these seeds will be further evaluated to determine their quality and potential as superior seed stock.

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**P23**

## **POTENTIAL OF *TRICHODERMA VIRIDE* IN DEGRADATION OF LIGNOCELLULOSE FOR HUMIC ACID PRODUCTION**

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Fungal species of *Trichoderma viride* isolated from compost was used in solid fermentation of oil palm empty fruit bunch (EFB) incubated at 30 °C. Humic acid was extracted using a mixture of 0.1 M sodium pyrophosphate and sodium hydroxide, pH 13. Humic acid can be extracted with considerable yield after about 3-4 weeks solid fermentation of EFB with *T. viride*. Chemical analysis and microscopic

observation of the humic acid from this study showed a similar quality as those reported by other researchers in the literature.

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**P24**

### **ASSESSMENT ON GROWTH OF BAMBOOS PLANTED ON ACID SULPHATE SOIL**

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The growth performance of two selected bamboo (*Gigantochloa ligulata* and *Dendrocalamus asper*) grown on acid sulphate soil located in Pulau Gadong, Melaka was assessed three years of planting. The results indicated that bamboo regenerated better in terms of survival and culms production under the application of organic fertilizer. Comparatively, *G. ligulata* performs better than *D. asper* under this poor soil condition.

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**P25**

### **A STUDY ON THE DEVELOPMENT OF QUIESCENT MANGOSTEEN SHOOT**

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Mangosteen is classified by Verheij (1986) as a poly-axial species with synchronous, rhythmic growth and terminal bearer. The onset of wet season after prolong dry period stimulates the flush from the quiescent phase. This paper describes the development of terminal quiescent shoot in response to the weak environmental stimuli. Apparently, the differentiation of the terminal shoot had been predetermined during the quiescent phase. The bud primordium is located at center of stem terminus, between the short, enlarged, hemispherical base of the petiole of the terminal pair of leaves. The bud primordium can develop into three forms, a pair of new leaves, three new vegetative shoots or the flower bud. A single lanceolate shaped leaf initials with a clear line of demarcation running along the long axis, indicating the pair of leaves that will emerge between the hemispherical base of the petiole. Three lanceolate initials suggest the formation of the three stem shoots, while a swollen base initial will develop into the flower buds. Emergence of the respective organ beyond the petiole base takes about 7 to 10 days.

The secondary branch on the plagiotropic main branch may have three to nine terminal shoots. Not all terminal shoots of the secondary branch will produce flower buds. Terminal shoots which failed to develop into flower buds, will remain quiescent. Likewise, if the secondary branch shoot terminus develops into leaves, all the terminal shoots of the branch will produce new leaves. There were no other morphological features of the apical shoot to indicate the form of organs that will emerge from the apical shoot, except for the length of the internodes. Internodes preceding flower bud is shorter than that of to be shoot or leaves. These findings have not been documented previously.

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P26

## EFFECTS OF ENVIRONMENTAL FACTORS ON GERMINATION OF GLYPHOSATE-RESISTANT AND -SUSCEPTIBLE BIOTYPES OF GOOSEGRASS [*ELEUSINE INDICA* (L.) GAERTN] FROM TEMERLOH

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Effects of several environmental factors on germination of glyphosate-resistant (R) and -susceptible (S) biotypes of *Eleusine indica* were examined under laboratory conditions. Light was found to be not an essential factor for germination of either the R or the S biotypes. Both biotypes showed more than 85% germination either at constant temperatures of 25 and 30 °C under darkness or at alternating temperatures of 30/20 and 35/20 °C with a 12-h photo period. The R biotype, however, showed higher germination than the S biotype at 20 and 35 °C under darkness as well as at 35/25 and 30/25 °C with a 12-h photo period. The percentage germination for both biotypes decreased with increasing simulated moisture stress, and no germination was observed at osmotic potential  $-0.80$  MPa. However, the R biotype exhibited higher germination (24%) than the S biotype (7%) at  $-0.60$  MPa. Both biotypes were able to germinate under a wide range of pH, exhibiting 79-100% germination at pH 3-11. Neither biotype entered innate dormancy 1 month after ripening. Three months after ripening, the S biotype exhibited 12% induced dormancy whereas the R biotype did not show any dormancy. These results reflect the inherent short life cycle of the R seed in the soil. In a field infested with the R biotype, scheduled tillage may be practised in order to promote the R over the S seedling emergence, and consequently reduce the R seed carry-over into the seed bank.

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P27

## SURVIVAL OF MICROPROPAGATED JELUTONG AT ACCLIMATIZATION STAGE

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Investigation was made on the influence of *in vitro* formed roots on the acclimatization of micropropagated jelutong. Survival was higher for shoots treated with auxin in the previous stage. This study also indicated that the type of auxin used strongly affect the (Aziah *et. al.*, 1999), *Endospermum malaccense* (Aziah, 2003) and *Tectona grandis* (Monteuuis *et. al.*, 1999). Studies on jelutong showed promising results (Aziah and Darus, 1995; Aziah, 1996). However, transfer to pre nursery stage resulted in very low survival. survival of micropropagated jelutong. The best auxins for *in vitro* rooting were IBA and IAA at  $10^{-5}$  M. These gave higher rooting percentage, higher survival percentage and better performance. Greenhouse conditions greatly affect the survival at acclimatization stage and emphasis has to be put on this. Finally fine droplets of misting system with plastic chamber as humidity tent could improve survival and shoot quality.



**P28**

## **EFFECTS OF WATER STRESS ON ANTHESIS AND FLOWER ABSCISSION IN THE GLASSHOUSE SWEET PEPPER (*CAPSICUM ANNUUM* L.)**

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Generally, water deficit occurring at the reproductive stage is potentially most damaging to yields. In anticipation of the frequent drought incidences resulted from reduced precipitation due to local weather variability, and impact from global climate change, a series of experiments were conducted to investigate the impact of water stress on growth and development of glasshouse sweet pepper when imposed at different intensity, duration and stages of growth. This paper investigates and discusses the extent to which the imposition of water stress enhances reproductive development of *Capsicum annuum* L. in particular the anthesis. It also examines the possible role of leaf water potentials in development of the reproductive structures, particularly in flower abscission.

Mean radiation of 9.1 MJ m<sup>-2</sup> d<sup>-1</sup> and mean daily temperature of 27 °C allowed normal development of both the primary and secondary flowers of *Capsicum annuum* L. under glasshouse. The development of the primary flowers was significantly accelerated when increasingly severe water stress was imposed at the appearance of the first flower bud. This effect was also dependent upon the duration of stress. Prolonged severe stress clearly enhanced anthesis in the primary but not in the secondary flowers. The initial acceleration of the reproductive development induced by severe water stress did not continue after anthesis, due to early onset of extensive flower abscission. The severity of abscission consistently followed the stress harshness order i.e. SS>HS>MS>NS, with almost complete abscission (97%) occurring under SS condition. During the period of progressive water stress, leaf water potentials ( $\psi_l$ ) declined with duration of stress from -0.43 MPa at the start of treatment to -1.63 MPa at 42 days after treatment compared to the  $\psi_l$  in the NS treatment, which recorded respective values of -0.11 to -0.53 MPa. Anthesis seemed to occur at  $\psi_l$  of -1.29 MPa. Continuing stress and further declining the  $\psi_l$  to about -1.35 MPa seemed to induce abscission of the opened flowers. Wilting of leaves and almost complete abscission of primary flowers occurred when the  $\psi_l$  reached values between -1.44 and -1.63 MPa. Although  $\psi_l$  declined with severity and prolonging of stress duration, the  $\psi_l$  did not correlate well with the incidences of anthesis and flower abscission, implying that there could be other underlying factors enhancing anthesis and inducing flower abscission during progressive stress.

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**P29**

## **CALLUS PROLIFERATION IN WOODY PLANT OF *MICHELIA ALBA* DC. YOUNG FLOWER AND LEAF EXPLANTS**

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Two types of established basal media were used in order to select the best media for callus proliferation and organogenesis in *Michelia alba* flower and leaf explants. Petal excised from flower of stage 8 and lamina with midrib from leaf of stage 2 were separately cultured on MS (1962) medium and woody plant medium (Lloyd and McCown, 1981). Each of the studied media was supplemented with various concentrations of plant growth regulators such as NAA and BAP. Both media with supplemented with plant growth regulators have produced pale colour and friable callus. However, the woody plant media produce remarkable callus proliferation compared to MS medium which are around 50% to 100% of the

explants have induced callus formation. Most of the calluses were friable to compactly nodular and leaf explants produce better yield than flower explants.

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**P30**

### **GROWTH AND PHOTOSYNTHETIC RATE RESPONSES OF NITROGEN FERTILIZED *SHOREA PLATYCLADOS* SEEDLINGS**

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The effects of urea application on growth and rate of photosynthesis in *Shorea platyclados* (meranti bukit) seedlings were assessed in a pot experiment. The levels of fertilizer tested were 0 g, 3 g, 6 g and 9 g of urea per pot. Fertilizer led to significantly higher productivity and photosynthetic rate ( $A$ ). The  $A$  of *S. platyclados* was within the range reported for other timber tree species in Malaysia. Whole-plant N concentrations (wpN) were also higher in N treated seedlings than the control. Relative growth rate (RGR) and foliar N ( $N_{la}$ ) increased linearly with wpN. The  $A$  increased linearly with  $N_{la}$  to a maximum at 18 mg g<sup>-1</sup> and declined at higher  $N_{la}$ . The results also indicated that the increase in productivity could be due to the higher leaf area of fertilized plants which enable the plants to intercept larger amounts of light and hence grow more rapidly.

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**P31**

### **THE EFFECT OF PHYSICAL AND NUTRITIONAL FACTORS ON GROWTH PERFORMANCE OF *MICHELIA ALBA* CALLUS CULTURES**

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Callus of *Michelia alba* ('cempaka putih') was obtained by inoculating the green petals explants on a basal Murashige & Skoog (MS) media supplemented with 30 g/L Sucrose, 3% Phytagel, Casein Hydrolysate and Cystein-HCl. All the cultures were incubated in the dark condition at 25 ± 2 °C. The medium was supplemented with NAA and BAP as growth regulators. The cultures were then maintained in similar medium but containing 25 mg/L Casein Hydrolysate (CH) before treating with different concentration of Casein Hydrolysate, Sucrose and pH. The growth profile of the callus was studied. The maximum growth of the callus treated with 25 mg/L (control), 50 mg/L, 100 mg/L and 100 mg/L of CH was obtained during the second week of culture (day 15). Treatment with 25 mg/L CH (control) showed the highest biomass accumulation i.e. 93 mg for dry weight, whereas treatment with 50 mg/L CH showed the lowest accumulation i.e. 70 mg for dry weight. It showed that the increment of CH concentration did not have any effect on the growth of cultures. The levels of biomass accumulation in all treatments of CH were reduced gradually as the cultures reached third and fourth week. Cultures treated with different concentration of sucrose i.e. 2%, 3% (control) and 4% showed that the highest biomass accumulation was observed on the second week of cultures (day 15). Treatment with 2% sucrose showed highest biomass accumulation i.e. 73 mg for dry weight as compared to the treatments with 3% and 4% sucrose. Similar to the treatment with CH, the percentage of biomass accumulation was reduced when the cultures reached third and fourth week. Treatment with different pH values i.e. 5.0, 5.3, 5.5, 5.6, 5.7 (control), 5.8 and 6.0 showed that the highest biomass accumulation was obtained when cultures were treated with pH 5.8, i.e. 8 mg for dry weight. Most of the cultures showed highest biomass accumulation on the second week of cultures except for treatment with pH 5.0 which showed highest biomass accumulation on the third week of cultures (day 21). These results showed that the growth performance of *M.alba* callus cultures can be further optimized by treating the cultures with 25 mg/L CH, 2% sucrose and pH 5.8

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**P32**

**EFFECTS OF DIFFERENT WATER REGIMES ON WATER RELATIONS,  
FLOWERING AND FRUITING OF MANGO  
(*MANGIFERA INDICA* CV CHOKANAN)**

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One of the major constraints in production of fresh fruits in Malaysia is irregularity of fruit supply mainly due to climatic factors. Most tropical fruit trees require a certain degree of root stress for flowering and fruit setting. Climatic change often upsets reproductive and fruiting development. The utmost microclimatic factor that governs flowering and fruiting of most tropical crops is water regime. The introduction of a new cultivar that can be considered to be less climatic dependent such as Chokanan has brought a tremendous increase in cultivation of mango in Malaysia. This investigation was carried out to ascertain the role of moisture regimes in flowering and fruiting of mango cv Chokanan. In the first experiment, four irrigation regimes were imposed by using 0 (without irrigation and rain-fed); 1, 2 and 4 emitters per plant. The micro-sprinkler was run continuously for 45 minutes daily. The greatest reduction in soil water content, leaf water potential and stomatal conductance with respect to the control values was observed in plants from plants without and only one emitter. A clear distinction on the advantages of deficit irrigation was that plants supplied with adequate water failed to flower and fruit set. Yield and quality were severely depressed with high water availability. The highest yield was obtained when plants were irrigated with two emitters per plant.

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**P33**

**DIRECT SHOOT REGENERATION ON PETIOLE AND LEAF EXPLANTS OF  
PAPAYA CV. EKSOTIKA USING BAP AND NAA**

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An experiment was carried out to determine the most suitable concentration of BAP and NAA for direct shoot regeneration from petiole and leaf explants of papaya cv. Eksotika. Explants were cultured on MS medium supplemented with 500 mgL<sup>-1</sup> caseine hydrolysate, 0.2% phytigel and different combinations and concentrations of BAP and NAA. For petiole explant, MS medium containing 1.0 mgL<sup>-1</sup> BAP and 0.05 mgL<sup>-1</sup> NAA produced the highest percentage of shoot formation (60.24%) and mean number of shoots per explant (9.5), while MS medium containing 0.1 mgL<sup>-1</sup> BAP and 0.05 mgL<sup>-1</sup> NAA resulted in the highest shoot length (0.69 cm). No shoot formation occurred on MS medium without BAP. With leaf explants, MS medium containing 1.0 mgL<sup>-1</sup> BAP and 0.05 mgL<sup>-1</sup> NAA produced the highest percentage of shoot formation (70.07%) and mean number of shoots per explant (46.5). The treatment also showed significant difference on mean number of shoots formed per explant compared to other treatments including the control. The treatment also resulted in high shoot length (0.48 cm). Shoot formation did not occur on MS medium without BAP.

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**P34**

## **EFFECT OF FARMYARD MANURE ON THE PHYSIOLOGY AND NUTRITIVE QUALITY OF *STYLOSANTHES-PANICUM* MIXED PASTURE**

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The effect of farmyard manure (FYM) was evaluated under slightly acidic soil at the Faculty of Agriculture research site, Universiti Putra Malaysia. The aim of this study was to evaluate the effect of level of FYM and P & K fertilizers on the physiology, dry matter (DM) production and certain qualitative parameters of *Panicum maximum* cv. Green panic and *Stylosanthes guianensis* cv. *Pauciflora* mixed pasture. The treatments were six levels of FYM fertilization (0, 10, 20, 30, 40, 50 t FYM/ha and 50 kg P and K/ha and randomized complete block design was used. *Panicum maximum* was transplanted by rootstocks, while *Stylosanthes* seeds were sown between rows. The first and the fourth cutting were determined for quantitative and qualitative character of both species. The highest dry matter (DM), crude protein (CP), photosynthesis rate (PR), leaf area index (LAI), and stomatal conductance (SC) were obtained from treatment 50 t FYM/ha, which was significantly ( $P < 0.01$ ) different from other treatments for *Panicum maximum* at both the first and the fourth cut. However, the lowest acid detergent fiber (ADF) and neutral detergent fiber (NDF) was obtained at treatments 40 and 50 t FYM/ha. The chemical compositions (percentages on dry matter basis) showed that CP content of *Stylosanthes* was also significantly ( $P < 0.01$ ) higher than other treatments at 50 t/ha FYM, however, there was no significant difference for DM and PR at fourth cut.

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**P35**

## **PECTIN METHYL ESTERASE IN RELATION TO SEED QUALITY OF SOYBEAN**

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Pectin methyl esterase (PME) is an enzyme responsible for the release of methanol which is implicated to play role in causing seed deterioration. The relative intensity of PME (pectin methyl esterase) band of seed protein from seed lots differing in seed size in soybean cv. Wilis produced under field condition in dry season (August – November 2001) were compared with those in wet season (December 2001 – March 2002) and were related to seed quality in order to know its possible role as the cause of seed quality differences. The relative intensity of PME band was used to estimate the content of PME. Large seed had lower amount of PME, both in dry and wet seasons. The content of PME from seed produced in dry season was lower than those from wet season. Since lower amount and activity of PME are indicative of higher seed quality, it suggests that the low quality in small sized seed and the poor quality of seed produced in wet season may be due to higher PME content and activity in such seeds.

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**P36**

## **APPLICATION OF PLANT GROWTH REGULATORS (PGR) FOR IMPROVEMENT OF TOMATO FRUIT SET UNDER HIGH TEMPERATAURE GROWING CONDITIONS**

**Effyanti Mohd Shuib and Mohd Razi Ismail**

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Application of five treatments of plant growth regulators (PGR); Tomat R 75 ppm, Benzylaminopurine (BAP or BA) 20 ppm, 10 ppm, Tomatlane and without PGR were given to a tomato variety. This experiment was conducted at Hydroponics Unit UPM, to study the effect of using different plant growth regulators on physiological and yield to the Beril variety (F1 Hybrid). The plants were grown in a tunnel with temperature ranged between 24 – 41.5 °C. This experiment was conducted in complete randomized design: five PGR treatments with six replication. The PGR were applied directly to the open flowers in the early morning. The results of the study indicate that application of Tomat R 75 ppm, BAP 20 ppm and Tomatlane improved the fruit yield by increasing fruit set, shortened the days to maturity and large fruit. Based on the results, it could be concluded that application of PGR will improve the fruit set and yield of tomato plants that were grown under high temperature.

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**P37**

## **GROWTH AND DEVELOPMENT OF SELECTED SPICES**

**Hui T. F. and Philip E.**

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The annual average world trade on spices between 1996-2000 was about US\$2.4 billions, with Malaysia contributing about 3%. Spices have a considerable market because they are used extensively in the natural and synthetic flavours and fragrances. Recent trade figures and growing awareness on the benefit of spices suggest that there is a potential for spice industry in this country.

Malaysia imported 57,764 t of spices valued at US\$64 million in 2000. The demand for spices in this country is large due to the diverse cultural composition. In order to meet local demand and to compete in the world market, it is important that growers are well equipped with knowledge on growth and development of spice crops and its environment. Hence, this paper highlights the growth requirements of selected spices and evaluates their potential as an income-generating commodity.

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**P38**

## **EFFECTS OF WATER REGIMES AND ROOT RESTRICTION ON GROWTH AND YIELD OF TOMATO UNDER HIGH TEMPERATURE CONDITIONS**

**Ismail Iberahim and Mohd. Razi Ismail**

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A greenhouse experiment was conducted to determine the effects of water regimes and root restrictions on growth and yield of tomato plants. The plants were grown in 2 L and 6 L pot containing mixture of coconut dust and peat were irrigated daily with 150 ml and 500 ml. The availability of water gave more effect on photosynthesis, stomatal conductance and yield of tomato rather than root zone volume. However, the low water availability increased quality of fruit, showed in increasing of total soluble solids (% Brix). Almost all measurements determined gave a lower reading in 2 L pots even at the same amount

of given water compared with 6 L pots. Effect of these two different water regimes were clearly shown in total yields with 1901 g, 377 g, 935 g and 388 g for 6 L 500 ml, 2 L 500 ml, 2 L 150 ml and 2 L 150 ml/day, respectively. From this experiment it could be concluded that the amount of water given to tomato plants were more important than root zone volume.

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**P39**

## **TREE PLANTING AMONG SMALL FARMERS IN MALAYSIA**

**Lim Hin Fui & Mohd Parid Mamat**

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Until the last few decades of the 20<sup>th</sup> century, planting tree was not so important as the natural resources were abundant and the human population was small and scattered. As world population increased from 3.9 billion in 1970 to 6.3 billions (2003), there was more pressure to utilize the natural resources to meet human consumption needs. Consequently, the world forested area reduced from 1,935 million ha in 1980 to 1,882 million ha in 1990. It was estimated that in the 1990s, forests were lost at the rate of 15-17 million hectares per year globally. It was also estimated that forest loss is responsible for 2-5 percent per decade of global biodiversity loss and contributing to global warming. It is in this context that tree planting is viewed as an important means to reforest the logged over areas.

The small farmers have been playing a silent role in terms of tree planting in Malaysia. These small farmers comprise two main groups, i.e. the forest dwellers and the rural farmers. Tree planting among the forest dwellers (namely the Orang Asli in Peninsular Malaysia and the natives in Sabah and Sarawak) is intended to meet micro needs at the household levels. It is common to find the aborigines and the natives to plant trees near their residence to provide shed, fruits and protection against wind and rain. Among the Orang Asli, trees are planted near their houses, along the main road, individual farming area and community land area. For the natives in Sarawak, fruit trees are planted in *menoa* (i.e. all lands surrounding the long house whose members have exclusive rights to the use of the territory, forests and all waters running through this territory) and their farm lands. In the *Jeremie-temuda* lands (i.e. secondary forests which is fallow land for swidden agriculture), pepper, cocoa and fruit trees are planted to meet home consumption and generate cash income.

Other than the aborigines and natives, the small farmers in the rural area has also played a key role in tree planting. The main focus of tree planting among this group is planting commercial trees to generate cash income. Before the coming of the migrant Chinese and Indians, tree planting among the Malays was mainly for own use. With more migrants coming to Malaysia since the 19th century, gambier (used for tanning and dyeing purposes) and pepper were planted commercially by the Chinese. By the early 20<sup>th</sup> century, world demand for rubber resulted in small farmers switching to rubber cultivation. By the 1970s, due to unstable rubber prices, some small farmers, together with the estates, have gradually switched to oil palm tree cultivation.

All in all, the small farmers, albeit the small size of land operated, could play an important role in Malaysia's "greening the earth" activities. The government could consider support tree planting activities in abandoned hill padi cultivation areas. Similarly, more incentives could be considered for small farmers planting rubber trees on private land to sustain the furniture manufacturing industries in Malaysia.

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**P40**

## **MUTATION INDUCTION AND PROPAGATION OF *ASPLENIUM NIDUS*, A FERN SPECIES FROM SPORES**

**Norazlin N. and Rosli I,**

Malaysian Institute for Nuclear Technology Research, Malaysia

Ferns are one of the most diverse groups of living land plants, it is estimated that there are 11,000 species in 300 genera. One of the well-known species is *Asplenium nidus*. This fern is also well-known as Bird's-nest fern, a medium to large fern with erect, stout, unbranched rhizomes. In creating variability for ferns, mutation induction is used as an alternative way to change the characteristics. Information on the radiosensitivity test is an important factor in deciding the approach to be taken for genetic changes of the fern in mutation breeding. In this study, spore cultures of *Asplenium nidus* were irradiated with doses of 0, 10, 20, 30, 90 and 180 Gy using gamma cell with  $^{60}\text{Co}$  source at dose rate of  $0.25 \text{ Gy s}^{-1}$ . It was found that the most suitable dose for spore culture induction was at 20 Gy. Both irradiated spore cultures (20 Gy) and control cultures (0 Gy) were then cultured onto semi-solid modified  $\alpha$  MS basal medium without hormone. Spore cultures were incubated in growth room at 24 °C with 16 hours photoperiod (3500 lux). After 1-2 months of culture, it was observed that young gametophytes (green in colour) production was higher for irradiated spore cultures (20Gy) when compared to the control cultures (0 Gy). The production was about 68 % for 30 Gy spore cultures and at 20 % for 0 Gy. Gametophytes were subcultured at monthly intervals to ensure further development and propagation. Later, plantlets were then transferred to nursery for hardening process for about 1-2 months and will be then maintained for further propagation and frequently monitored for any changes in the morphology of the irradiated *Asplenium nidus* plants.

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**P41**

## **REGULATION OF FLOWERING FOR STAGGERED PRODUCTION OF CARAMBOLA BY USING GROWTH RETARDANT PACLOBUTRAZOL**

**Omran. H**

Stesen MARDI Bukit Tangga, 06050 Bukit Kayu Hitam, Kedah

An experiment was conducted to regulate flowering and stagger fruit production of carambola by using growth retardant paclobutrazol. The results showed that paclobutrazol significantly induced uniform flowering and fruit production in carambola cultivation. However, repeated application of this chemical caused adverse impact on new flushes growth and development, hence, reduced fruit production from season to seasons respectively.

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**P42**

## **PESTICIDES RESIDUES ANALYSIS IN CHINESE MUSTARD GROWN UNDER NETTED STRUCTURE VERSUS OPEN FIELD PLANTING SYSTEM**

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A study was carried out to compare the pesticide residues degradation activity in vegetables which were grown under open field and netted structure system. Chinese mustard (*Brassica chinensis* var. *parhinesis*)

*communis*) was treated with chlorpyrifos with normal rate (once a week) and double rate (twice a week) and was harvested daily for a period of 9 days. The chemical residues analysis was done using Gas Chromatography and Rapid Bioassay method. There was almost 80% pesticides degradation activity for a first few days of the harvesting period which could be monitored by both methods. Chlorpyrifos residues in vegetables samples grown under netted structure were found to be higher than those from the open field for samples taken at the same period of harvesting. Rapid degradation of pesticide activity for both treatments was observed after the 4<sup>th</sup> day of harvesting. In conclusion, the trend of pesticide degradation activity in Chinese mustard grown under open field versus netted structure planting system were found to be identical whether it was analysed by analytical instrument (Gas chromatography) or by Rapid Bioassay.

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**P43**

### **THE EFFECT OF DIFFERENT CYTOKININS IN COMBINATION OR ALONE ON SHOOT PROLIFERATION ON PLANT MICROPROPAGATION IN MANGOSTEEN (*GARCINIA MANGOSTANA* L.)**

**Suci Rahayu, Mihdzar Abdul Kadir, Maheran Abdul Aziz and Azmi Abdul Rashid.**

Department of Agricultural Technology, Faculty of Agriculture of Universiti Putera Malaysia

Mangosteen (*Garcinia mangostana* L.) is an under exploited tropical fruit tree with promising economic value. Propagation of mangosteen is commonly by seeds. Mangosteen fruits seasonally and produce seeds at the rate of two seeds per fruit. The development of mangosteen plant is slow and it takes about 10 – 12 years before fruiting. They are included in the group of seeds known as recalcitrant. The recalcitrant behaviour causes difficulties in producing planting materials throughout the year. Up to now, there is no suitable method for storing mangosteen seeds. Thus, there exist a problem of not having enough planting materials for large scale planting. The conventional vegetative propagation method has low percentage of success. One of the alternative approaches for mass propagation of mangosteen is through tissue culture. With this technique, large number of seedlings can be produced in a short time. By the method hopefully shoots can be regenerated. Thus, the requirement of planting materials for mangosteen can be fulfilled. Shoot proliferation from seed segments of mangosteen has been conducted. Multiplication was achieved by culturing seed segments on Murashige and Skoog medium enriched with various concentrations of cytokinins, i.e.: BAP, kinetin and 100 mg/l Adenine sulfate in combination or alone, 30 g/l sucrose, 3.9 mg/l Gelrite agar and kept 8 weeks in culture. Shoots were obtained in all those media after 2 weeks in culture. After 8 weeks in culture, there were significantly different among the treatments used on the induction of shoot. The best media for shoot proliferation was 8 mg/l BAP (11.82 shoots per explant) and the highest shoot was obtained from 1 mg/l kinetin (2.27 cm).

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**P44**

### **AN INNOVATIVE METHOD OF PRODUCTION OF PLANTING STOCK OF *HOPEA ODORATA*, *HOPEA HELFERI* AND *HOPEA WIGHTIANA* IN THE SHADE HOUSES**

**Tsan F.Y., Ahmad Fauzi M.S. and Wan Rasidah K.**

Forest Research Institute Malaysia (FRIM), Kepong, 52109 Kuala Lumpur.

Production of planting materials of *Hopea odorata*, *Hopea helferi* and *Hopea wightiana* was limited by the recalcitrant behaviour of their seeds. These seeds generally survived 2-4 weeks after they shed from their mother trees. Only *H. odorata* seeds retained their viability of above 60% when cold stored for a period of up to 2 months at 18±2 °C. The seedlings of these three species, however, could be maintained at a slow growth



phase at densities of 300-600 seedlings/m<sup>2</sup> in the shade houses of 20% and 30% RLI, depending on the species. The survival rates were above 70% while the height and stem diameter growth was only approximately 10cm and 0.2cm respectively at one year after storage under such low light conditions.

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**P45**

### **QUALITY AND SHELF-LIFE OF FRESH CUT CUCUMBER SLICES AS INFLUENCED BY SLICING METHODS**

**<sup>1</sup>Zaulia Othman, <sup>1</sup>Razali Mustaffa, <sup>2</sup>Aminuddin Hussin, <sup>1</sup>Omar Dali and <sup>1</sup>Habsah Mohamad.**

<sup>1</sup>Horticulture Research Centre,

<sup>2</sup>Food Technology Research Centre,

MARDI Headquarters, P.O. Box 12301, 50774 Kuala Lumpur, Malaysia

The effect of different slicing methods were studied on the quality and shelf life of fresh cut cucumber. Cucumber was sliced into 3 different shapes which are normally used by consumers i.e. round (RS), half-round (HR) and small pieces (SP). Samples were packed in round polypropylene containers' capped (250 ml) and stored at 2 °C, for 24 days, and at 25 °C as control. The difference in slicing methods were significantly (P<0.05) affected respiration rate (CO<sub>2</sub> production) and changes in acidity (pH) of fresh cut cucumber. The quality (texture, taste, colour and odour) of round shaped (RS) fresh cut cucumber that was sliced using slicer reduced faster than HR and SP samples that were sliced using sharp knife. At storage temperature of 2 °C, the quality and shelf life of HR and SP samples lasted longer (24 days) than RS samples (9 days). Percentage weight loss, ascorbic acid content and ethylene production were not affected by cutting methods and size of fresh cut cucumber.

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**P46**

### **THE EFFECT OF GA AND AVG ON MAURITIUS PINEAPPLE**

**Mohammed Selamat, M and Ahmad Tarmizi, S**

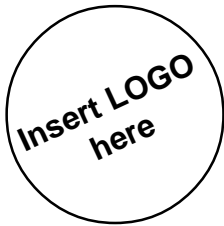
Horticulture Research Centre, Malaysian Agricultural Research and Development Institute (MARDI)

A study was conducted to determine the effect of pre-harvest application of AVG (Aminoethoxyvenylglycine) and GA (Gibberellic acid) on the fruit size and quality of Mauritius pineapple. Field treatments were carried out in a farmer's plot in Kampung Parit Tengah Darat, Parit Raja, Johor during Mei-June 2003. AVG treated fruits were sprayed with 250 ppm AVG at 26, 19 and 12 days before harvest. GA treated fruits were sprayed with 20 ppm GA at 26 and 19 days before harvest. The control plot was sprayed with distilled water at 26 days before harvest. Fruits were harvested at the breaker stage (Index 2- white bract) on the 8<sup>th</sup> June 2003. Results obtained showed that fruits treated with GA were significantly heavier than those treated with AVG and the control. The GA treated fruits have longer and heavier crown compared to AVG treated and the control. There was no significant different with respect to the fruit sugar content indicated by the TSS (total soluble solid) values, among the treatments. Fruits treated with GA had the highest acidity content (0.72 and 0.71 percent citric acid equivalent) and significantly different from the control. However, the sugar to acid ratio was not significantly different between the treatments. The average value of the sugar to acid ratio was 19.33.

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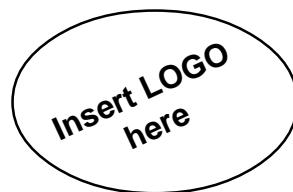
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