RESEARCH THEMES FOR SCIENCEFUND

No	Research Area/ Commodity	Research Themes	Issues to be Addressed
1	Rice	High yielding rice production system	• Improvement of yield component characters • Improvement of plant type and yield potential • Decline in productivity • High production cost • Agronomic package • Yield loss due to lodging, pests and harvesting • Mechanization package
		Hybrid rice variety and its production system	• Identification of potential hybrids • Efficiency of hybrid rice seed production • Development of local Male Sterile lines • Agronomic and mechanization package for hybrid rice
		Development of new rice varieties for specialty rice and rice products	• Increased demand for aromatic rice • Low utilization of local rice for food products • Lack of data on the functional, phyto-chemical, chemical and nutritional characteristics of Malaysian rice varieties
		Development of aromatic Malaysian rice varieties through molecular breeding	• Difficult to detect characteristics of the aromatic trait which is controlled by a recessive gene using conventional means. It is also difficult to assay the aroma
		Technology for aerobic rice production	• The need for new irrigated rice production system that save water or require less water

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			• Problems of weed competition and emerging threats of subterranean pests
		Management of major diseases and pests of rice	• Yield loss due to disease and pest infestation • Varieties resistant to major pests and diseases • Bio-based and sustainable pest management practices • Varieties resistant to major disease and pests • Overdependence on chemical control of rice pests leads to environmental pollution and health concerns. • Biological controls • Biological indicators for assessing impacts of pest management.
		Management of rice field weeds and padi angin	• Yield loss due to weeds and padi angin infestation • Effective technique of controlling weeds and padi angin infestation • Cultural practice to control weeds and padi angin. .
		Technology for field management of Golden Apple Snail (GAS) in Malaysia	• Current area under infestation estimated at 17,000 ha, and no single control measure had been effective at the farm level • The need to develop a practical and user friendly approach for effective management of GAS and establish an integrated snail management technique to ensure the effectiveness and sustainability of technology at farm level
		Technology for preservation of rice quality during storage	• High rancidity in stored milled rice due to free fatty acids (FFA) is a food safety concern to the fast growing health conscious local population. • Rice turning yellow after short storage period priced down rice to sample grade (50% of normal value) - a loss to traders and unattractive to consumers. • Rancidity and yellowing impedes future plan for development of national food security reserves (rice stockpile)

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		Development of new and improved rice based products	• Lack of data on the phytochemical, chemical and nutritional characteristics of Malaysian rice varieties • Lack of rice-based processing industries • Lack of information on the suitability of rice for different food products • No Malaysian specification and standard of rice as raw materials for processed food • Low utilization of local rice for food products • Lack of technologies for improved and new value-added rice based products • Current products can be improved to attract more consumers and exploit new markets • Processed rice products still imported. • Dependence on imported rice flour of inconsistent quality • Lack of diversified rice product range • Consumer demand for new value added food products and ingredients
		Mechanization system of rice production	• Low labour and land productivity • High post-harvest losses during combine harvesting • Lack of reliable grading techniques to overcome the currently tedious, inconsistent, time consuming and labour intensive methods

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2	Herbs	Extraction, profiling and standardization of prioritized herbs.	• Lack of basic chemical profiles of local herbs • Lack of information on the best extraction methods for different applications • Lack of chemical information for verification of efficacy and safety • Lack of information on chemical markers and biomarkers of local herbs, including their stability and bioactivity • Standard compounds for most local herbs are not easily available, affecting standardisation of local herbal products • Fast identification and quantification procedures for standard compounds for these herbs are not well established.
		The production technology for the maximization of the bioactive compounds in herbs.	• Need to identify herb varieties with maximum bioactive contents • Need to identify the production technology (cultural practices, fertilization & time to harvest) for maximum bioactive contents.
		Technology for processing of herbal products	• Lack of suitable technologies for value added products from herbs • Crude processing techniques and equipment • Absence of commercial scale extraction facilities • Need for efficient handling and processing for medium scale production
		Development of herbal-based products	• Lack of up-to-date formulation technologies • Poor product design, presentation and packaging • Production of herbal products are still very traditional, utilising crude processes • Most herbs and their products have not been adequately assessed for their safety and efficacy • The increasing use of herbal products means increased concerns as to the aspects of toxicity and modern drug-herb interaction

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3.	Pineapple	Increased production of pineapple on mineral and peat soils	• Declining yield of canning variety , Gandul on peat soil • Limited superior good quality fresh pineapple varieties with resistance or tolerance to Bacterial Heart Rot (BHR)/ Black Heart Disorder (BHD) • Acute shortage of (Maspine) planting materials due to poor sucker production • Poor response of Maspine to flowering induction • Limited pineapple production technology related to fertilizer, fruit size ; pest, disease and weed management; and high labour requirement on mineral soil
		Mechanized pineapple production on mineral soil	• Rising cost of production • Farm labour shortages and low farm productivity • Need for large scale production of pineapple on mineral soil
		Post-harvest handling technology of pineapple	• Short storage life and blackheart disorder restricts export to far distance markets • Incidence of high post harvest losses during the period after harvest • Mechanical damage of pineapple due to mishandling along the supply chain • Lack of post harvest handling technology and mechanization
4.	Papaya	Development of new papaya varieties with high yield, good quality and resistant to Papaya Ringspot virus (PRSV) and Papaya Bacterial Dieback (PBD) diseases	• Rapid reduction of papaya growing areas due to the PRSV and PBD diseases outbreak • Lack of resistant/tolerant (PRSV & DB) commercial papaya varieties • Poor understanding of PBD epidemiology • Lack of precise fertilizer management which influence overall fruit quality and shelf life. • Short storage life

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5.	Other Fruits	Development of package technology for high density planting (HDP) of mango	• Laborious pruning of large trees which difficult to manage • Lack of dwarf cultivars which are precocious, high yielding and easier to manage • Absence of suitable clonal dwarfing rootstocks to reduce seedling variation • Inadequate growth control by pruning resulting in reduced yield and poor fruit quality • Optimum fertilizer requirement under HDP not well established • Indiscriminate use of pesticide and high pesticide residue • Pest resistance to pesticides. • Lack of suitable machines for crop management under HDP
		Development of package technology for fruits under protective structure (starfruit, citrus and melons) : Starfruit	• Need to meet demand for fruit fly-free and organic starfruit in Europe • Problem of low yield at initial phases of organic production • Non-availabilty of organic pesticide • Lack of promotion of organic starfruit as functional food for its phytochemical content • Post harvest handling technology of organic starfruit not well-established
		Citrus	• Significant impact (reduction) of citrus Madu growing areas due to citrus greening disease and lack of good agricultural practice
		Melons	• High price of imported watermelons seeds • Demand for mini or personal size water melon

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			• Soil born disease hinder continuous cropping of water melon and rock melon • Heavy rainfall prevent year round production of watermelon and rock melon in the open • Low yield and poor fruit quality of watermelon and rock melon
		Emerging fruits e.g. pitaya	• Lack of knowledge on diseases
		Post-harvest handling technology for fruits export	• Short storage life and high cost of air transportation restrict export to far distance markets • Rapid deterioration affects quality and safety of minimally processed fruits
		Handling technology of minimally processed fruits	• Capturing export markets with new form of fruit products
		Quarantine treatment protocols for fruits	• Lack of market access of Malaysian tropical fruits. • No proper quarantine protocol for fruits. • Most Malaysian fruits are hosts of quarantine pests, especially fruit flies
6.	Vegetables	Development of chilli hybrids for high yield with superior fruit quality and resistance to diseases.	• Low yield and susceptibility to diseases (anthracnose and viruses) • Low pungency in most locally cultivated chilli • Inconsistent crop performance over locationsContinuous cropping with minimal use of pesticides
		Development of chilli hybrids for processing.	• Development of dry red chilli for the whole dry chili and chili powder market. • Currently all dry chili used by local manufacturers is imported.

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			• Imported raw materials from India/China often are poor in quality e.g presence of foreign matter (sand) and high in microbial load and pesticide residues) • Develop appropriate drying technology that is competitive, suitable for local farmers and cooperatives (e.g. LPP)
		Sustainable management of pest and disease of chilli	• High yield loss. • Indiscriminate use of pesticide. • High pesticide residue • Pest resistance to pesticides. • Harmful effects on beneficial organisms.
		Development of high yielding tomato hybrid varieties for processing	• Lack of high yielding processing varieties. • Expensive seeds • Unsynchronized flowering. • Susceptible to bacterial wilt and viral diseases
		Production system of cruciferous vegetables under protective structures	• Lack of good high yielding varieties (cabbage, cauliflower, broccoli). • High cost of protective structures • Fertilizer technology for organic production system using soil and soilless culture not well established • Limited availability of suitable growth medium in soilless system • Lack of suitable machines and systems that can accommodate production schedule and product quality
		Quality maintenance of selected vegetables	• Rapid deterioration of vegetable quality after harvest limits marketing and distribution. • Greater consumer's awareness for quality vegetable. supply for propagation

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			• Vegetative propagation has very low success • Lack of data on adaptability of different native species in various ecological habitat for creation of new landscape designs • Lack of commercial nursery production technology for local and export market
		Handling technology of minimally processed vegetables	• Rapid deterioration affects quality of minimally processed vegetables
7.	Floriculture	Domestication of native species (herbaceous, shrubs and trees) for landscaping	• Limited choices of species for local landscape • High demand of native species for local and export market • Loss of valuable species due to deforestation and rapid development • Low utilization of native species in Malaysian landscape is < 5% • Inconsistent seed supply for propagation • Vegetative propagation has very low success • Lack of data on adaptability of different native species in various ecological habitat for creation of new landscape designs • Lack of commercial nursery production technology for local and export market
		Development of exotic species (heliconia, annual, herbaceous perennials and landscape trees) for Malaysian landscape	• Limited choices of colorful and attractive species for local landscape • Increasing demand for new attractive types of ornamentals • Planting materials of exotic species are expensive to import • Low quality planting material – heterogeneous, no standardization • Irregular flowering of selected landscape trees • Shifting from monotonous single planting to attractive and sustainable multi-species plant community

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		Development of new orchid hybrids for commercialization	• Dynamic changes of consumer's preferences for new orchid hybrids. • Short shelf life. • Lack of fingerprinting for Plant Variety Protection (PVP). • Difficulty in propagation and lack of quality and uniform planting materials • Few cost competitive varieties
		Development of new highland flowers varieties e.g. chrysanthemum, bulbous flowers	• High cost of imported seeds/bulbs
		Storage and handling of cut flower orchids and selected potted and bare-rooted landscape plants for export	• Short shelf life and lack of handling technology for locally grown cut flower orchids for export. • Lack of technology on handling of potted and bare-rooted landscape plants for export
		Quarantine treatment protocols for flowers, potted plants and	• Lack of market access of Malaysian flowers, potted plants and foliages • Flowers, potted plants and foliages are hosts of quarantine pests
8.	Coconut	Development of coconut-based value added products	• Lack of new products, e.g. environment-friendly packaging materials products from coconut fiber, fillers as well as improved coconut-based value added products. • Need for value adding to existing products to enhance the quality and special characteristics.

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9.	Emerging crops e.g. Energy Crop – *Jatropha Curcas*	Development of suitable accessions or varieties and production technology for maximum biofuel yield	• Poor yield of current accessions • Gaps in knowledge on the agronomy and on pests and diseases • High labor costs for harvesting • Poor knowledge of post harvest management
10	Livestock and poultry	Beef, dairy cattle and goat breeding, reproduction and production systems	• Lack of suitable productive breed for hot and humid climate • Small beef cattle population in the country • Low reproductive rate • Technology not being fully utilized • Lack of economically viable and sustainable production systems suitable for the local environment • Utilization of exotic germplasm • Strategic sourcing of breeds
		Local feed resources for livestock, poultry, pets and aquaculture	• High cost of imported feedstuffs • Quality and availability of suitable local feed substitutes • Limited substitution of major imported feed ingredients with local feeds • Reduction of production costs through mechanization • Reduction of feed spoilage through processing, drying and storage mechanisms
		Feed supplements for efficient production of high quality livestock, aquaculture and poultry	• Identification of locally available feed supplements to replace imports • Need for safe and cost-effective feed supplements • Need to improve digestibility and utilization of local feeds • Need for feed supplements based on natural products to improve production • Need for healthy and safe livestock, poultry and aquaculture products

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			• Demand for value added products
		Development of Malaysian Ayam Kampung	• Demand for 'Ayam Kampung' in niche market • Malaysian kampung chicken with specific characteristics and production system has not been established
		Mechanized silage production and handling for animal feed	• Need to improve efficiency in forage based feed production • High price of imported machinery
		Disease detection and surveillance	• Early detection and control of major livestock diseases
		Bio-diagnostics and vaccines of major livestock diseases	• Inadequate suitable biologicals
11.	Fishery	Development of new and improved value added products from fish and fishery resources for import substitution and export	• High import bill for imported processed fish and fishery products • Lack of technology for production of new and improved value added products • Lack of know-how on utilization of small pelagic in production of fishery products to overcome glut problems • Lack of know-how on the packaging techniques for safe preservation of new fishery products • Lack of technology for new aquaculture species • Lack of technology for production of aquaculture products for domestic and export market • Lack of technology to minimize waste from fish processing industry • To increase export of fish and fishery products from 30 to 70%

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			• Safety of fish and fishery products • Lack of appropriate technology for extension of shelf life of fish products by SMEs
		Development of potential species e.g. *belangkas, Ikan haruan tasik, lintah*	• Potential use as pharmaceuticals
		Selection and improvement of propagation material for *Eucheuma* seaweed cultivation in Malaysian waters.	• Cost effective *Eucheuma* seaweed cultivation and production techniques. • Seaweed products development for SME in Malaysia.
12.	Biodiversity and New Resources for Agriculture	Highly nutritious ulam, traditional vegetable and underutilized fruit species, varieties or accessions for commercial planting with emphasis on antioxidant, vitamins and selected minerals	• Malaysia is one of the 12 megadiversity countries of the world but only a small percentage of its biodiversity are utilized. • Malnutrition among Malaysian is still prevalent in some parts of the country • Narrow range of commercially potential crops available to the growers for both domestic and export purposes. • Lack of health food products from locally grown crops. • Inadequate information system on genetic resources • Lack of production technology for many of the potential species

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		Biological control through biopesticides and bio-agents	• Heavy usage of chemicals • Plant based bio-pesticide • Contamination of products • Environmental pollution • Destruction of biodiversity • Development of resistant strains • Depletion of natural control agents • Inadequate information system
		Development of cost effective bio-fertilizer and bio-pesticides for tropical agriculture	• High cost of chemical fertilizers • Cost effective bio-fertilizers • Contamination and deterioration of soils due to long-term application of agricultural inputs (chemical fertilizers, pesticide and weedicide) • Increased consumer preference for organic and safer food produce • Fixation of phosphorus in soils
			• Lack of commercial success in bio-fertilizer production • Sustainable agriculture production system • Fertilizer for organic agriculture production system • Specific plant response to biofertilizer • Biofertilizer response to extreme soil abiotic factors • Bio-control of pests and diseases

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		Integrated organic farming	• Increased demand for safe and health food product • Increased awareness for clean environment. • Low quantity and variety of organic produce • High price of organic products • Low yields of organic farming • Bulkiness and low nutrient content of solid organic fertilizers • Unstable and low nutrient content of liquid organic fertilizers • High incidence of pest and disease attack. • High labour requirement • High cost and low efficiency of agronomic inputs • High rate of soil degradation, due to nutrient depletion • Lack of pure organic seeds and breeds
13.	Agro-Environment	Understanding and managing climate variability for yield maximization and stabilization.	• GHG emissions from padi and livestock activities • Changes of GHG emissions from land use conversion of peat ecosystem. • Increase international pressures for wise use, reduction of CO_2 emission and maintaining carbon reserve of tropical peatland • Crops response under extreme climatic events • Dynamic of crop pests, diseases and soil microbes under various climate variability scenarios • Agriculture mitigation strategies under climate change scenarios
		Land resources and environment management for crop production at different agro-ecological zones	• Increase awareness for sustainable eco-friendly agriculture development • Lack of data for accurate identification and characterisation of land resources and environment in spatial domain. • Requirement for integrated database for land resources and environment and

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			meteorology datasets • Site specific agriculture development (one district one product) • Tool for agriculture planning and management and monitoring system • Early warning system • Mechanism to integrate the multi-scales dataset for agricultural development. • Geo-spatial modeling • Highland ecosystems managements • Crop production potentials • Highland ecosystems managements • Web-based decision support system for agricultural planning • Mobile laboratory for quick assessment of soil and environment qualities • Decreasing quality and availability of irrigation water
14.	Agro-Biotechnology	Functional genomics to enhance productivity, quality and disease resistance in selected tropical fruits and ornamental crops	• Seasonality, long juvenile period, limited variability and short life-span in several horticultural and ornamental crop. • Low productivity of agricultural crops due to pest and disease problems. • Current research on conventional breeding and transgenic crops have been rather sluggish in producing stable transgenic lines for desired characters such as for diseases resistance, colour, fragrance, extended shelf life etc. • Lack of information and basic understanding on the vast networking of genes, proteins and metabolites that exist in plants • Lack of integrated approach in monitoring metabolic and physiological processes occurring in plants

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		Functional genomics to improve phyto-nutrient levels in selected tropical fruits	• Degenerative disease such as cardiovascular diseases, diabetes, obesity, cancer, and respiratory conditions, is in the rise which can be avoided by changing lifestyle, including consuming more fruits and vegetables (WHO fact sheets). • Malaysia, vast wealth in terms of phyto-chemicals than can be harnessed for our health care. • Lack of dietary phyto-chemical data in Malaysian fruits • Lack of information on the associated health benefits of phyto-nutrients in Malaysian tropical fruits varieties • Lack of information and basic understanding on the vast networking of genes, proteins and metabolites that control production of phyto-nutrients • Lack of integrated approach in monitoring metabolic and physiological processes that control production of phyto-nutrients in fruits
		Development of transgenic Eksotika papaya resistant to PRSV or with extended shelf-life of fruits	• Papaya is one of the important horticultural crops in Malaysia with an export value of about RM 12.0 mill pa. • Further expansion of papaya industry in the country is restricted by two main constrains namely: i. infestation of papaya ringspot (PRSV) disease ii. short- shelf life of the fruits which limits its export potential to distant markets. • Improving the papaya Eksotika fruits quality and extending their shelf life will also significantly reduce the post harvest losses in the fresh fruit industry. • Quarantine measures and routine applications of insecticide are ineffective in reducing the incidence and damage caused by the papaya ringspot virus (PRSV). • Development of a transgenic papaya resistant to PRSV or fruit with longer shelf-life offers the best solutions

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		Bio-processing of value-added products from selected fruits and plants	• Under exploitation of Malaysian biodiversity resources as potential materials for new food and feed ingredients • Lack of utilization of agro-based materials for the production of value added products • High dependence on imported functional products, enzyme and ingredients in the manufacturing of food and feed products • Lack of technology to produce high quality agro-based products • High production cost and lack of product competitiveness
		Development of biosensor technologies for safety, quality and halal assurance (rapid detection of major contaminants affecting quality of agriculture produce and non-halal ingredients/procedure)	• Need to improve the current technology to support the existing conventional technology which is expensive, not user-friendly, time-consuming, tedious and with high maintenance cost • Need for Malaysia to produce its own biosensor technology instead of importing the products from overseas • Lack of proper control and monitoring of antibiotics usage in the poultry industry have resulted in poultry products such as egg and meat being contaminated with unwanted and illegal antibiotics • Lack of proper control and monitoring of chemicals products such as pesticides and other toxic chemicals used in agro industry has resulted in unsafe foods and environmental pollutions • Increased awareness and demand among consumers for quality and safe product • Lack of reliable and cost-effective detection methods of food contaminants • Lack of effective detection tools to ensure compliance of our agro-based products with international guidelines such as Codex, MRLs

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		Nano-sensor for pathogen detection and nano-particles for production and quality improvement of agriculture produce	• Nanotechnology has been identified as a key emerging technology that has potential to generate new and improved sources of economic growth. • Lack of high- quality products at a very low cost and at very fast pace. • Lack of near real time pathogen detection and location reporting detection system • Lack of study on plant delivery system especially in nutrients balance such as calcium in plants need to be established. • Lack of early warning and detection system for specific plant diseases • Control of plant outbreak using nanotechnology approach need to be established • Prerequisite for Malaysia to ensure that our agriculture produce is of high quality and complies with the guidelines food quality such as Codex, MRL and the Food Act
15.	Novel Food Products	Development of nutraceuticals, functional ingredients and health food products from local sources	• New local sources being exploited for the production of nutraceuticals, functional and health foods • Viable and feasible technology for the production processes • Value-adding to existing products so that it contains nutraceuticals and functional characteristics and provide health benefits. • New problems due to the possible hazards and risks associated to the novel ingredients or novel processing method that can affect human health. • Data required to determine the safe use of these types of ingredients, and provides advice on the development of risk assessment strategies consistent with due diligence under existing food regulations. • Need to collect data and information for safety and efficacy assessment through the research for scientific validation. • Improvements in the methods of detection and determination of natural toxicants, contaminations, food additives in new and existing nutraceuticals, functional and health food products

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16	Food processing	Development of multi-hurdle processing technology	• Extension of shelf life of popular local food
		Development of agro-waste for new and improved packaging material for food	• Alternative resources to produce bio plastics • Alternative resources to improve barrier properties of packaging material through incorporated of nano size particle from agro waste • Requirement of adequate thermal stability, minimum interference with melt properties and disturbance of product quality. • Inadequate information on the formulations and processing of plastics incorporated with agro waste • Lack of information on local raw materials as source for potential food packaging components • Viable technology for the production of biodegradable materials or new packaging materials • Value adding to existing food packaging materials/containers
		Safety and quality of locally produced packaging materials	• Increased awareness and demand for safe and quality packaging materials for the public. • Used of non virgin resin in the production of locally produced packaging material for food. • The interactions between foods and packaging materials can be detrimental to quality and/or safety. • The migration aspects of plastic additives or packaging materials into food could endanger human health • Unacceptable change in the food compositions • Deterioration in the organo-leptic characteristics of the food

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17.	Farm and food mechanization	Farm mechanization and machinery systems	• Specialized farm machineries for selected crops to increase efficiency • Mechanization system for slope land
		Mechanization of traditional food products	• Small scale, labour intensive; traditionally processed • Low level of machinery used • Inconsistence finished quality products • High processing waste • Short shelf life, low quality and poor product presentation
		Precision agriculture	• Poor management of farm inputs • Increase farm productivity within limited land and resources • Better prediction of crop yield • High losses of agriculture produce due to diseases and post harvest losses • Effective and efficient technique for early detection of crop disease and deficiency • Effective determination of quality of agro-produce
18.	Consumer research	Consumer taste and preferences, sensory evaluation and market testing	• Market driven R & D on product development, packaging design & product presentation • Consumer acceptance of new product. • Identification of future needs and wants for product development