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An Overview of the IPM Techniques for Saving the Agricultural Biodiversity in Malaysia

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ABSTRACT

Agriculture is one of the most important and single largest sectors of Malaysian economy. It is predominantly an agrarian economy. It has been considered as the backbone of the economy. Around 75% of the total population directly or indirectly depends on agriculture and near about 84% of the total population lives in rural areas almost depend on agriculture for livelihood. In order to facilitate agricultural production, pesticides are used. It is chemically produced and used as poisonous for killing the insects in agriculture. It is used all over the world restrictedly. It has short term and long term impacts on agricultural environment including ecology in any country in the world. Hundreds of crust species has been extinguished due to excessive uses of pesticides. The world Health Organization (WHO) issued figure showing that pesticides poison 25 million people every year and that more than 220,000 die from exposure to these chemicals and they are worried due to over-use or wrong use of pesticides. In problem lies in the fact that, if hazardous pesticides and chemicals like parathion or DDT for that matter – are allowed to pollute the environment with abandon, the health of us all is at risk as they have the potential to cause irreparable harm. In order to address these impacts, there are some agricultural laws and policies in Malaysia. But there are many problems in these laws including British colonial in nature. In the meantime, the integrated pest management (IPM) has been using since 1970s as an alternative modern technique in addressing these agricultural problems for sustainable agricultural environment in Malaysia. But there are some constraints such as limited resources, lack of trainings, unawareness, lack of monitoring etc.; in this regard. This study however, intends to examine potentialities and constraints on the IPM techniques as applied in Malaysia consisting of at least 25 respondents of different criteria such as agricultural professionals, farmers, business people, lecturers, students, researchers, industry people et; based on the primary and secondary sources in Bangi at UKM, Selangor Darul Ehsan, Malaysia.

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1. Background:

Green revolution was made in 1960s as an initiative of modernizing agriculture and maximizing agricultural growth through which the processes of the monoculture, high yielding varieties and hybrids seeds began over the traditional varieties. That is why, some important measures such as modernizing agricultural technology, introduction of high-yielding varieties of crops, intensification of crops, introduction of chemical fertilizer, etc., have been made to achieve the target. With it, the Bio-diversity has been facing numerous problems including chemical fertilizers and pesticides. Some external outputs such as the declining of the traditional varieties were identified.

Agriculture has been considered as one of the oldest and important sectors in any economy in the world including Malaysia. It is the foundation of the modern economy. Agriculture combines crops, forestry, fisheries and livestock to the country's GDP. Majority of the population have been living in the rural areas and relying mainly on agriculture for their survival. It also plays a pivotal role in alleviation of poverty and sustainable economic development (Helal Uddin Ahmed, 1997).

It is already proved that this sector is very much implicated with many problems due to the heavy uses of pesticides all over the world particularly in the Asian regions including Malaysia. Illegal pesticides are increasing in this country. Resources for training are limited and more resources are needed to train the farmers and the plant protectionists at all levels including correct diagnosis of key pests and diseases. Shortage of labor

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experienced in various sectors in Malaysian agriculture could hamper the IPM. However, the adoption and implementation rate which is currently low among the farmers and growers, need to be improved to realize the full impact of these IPM programs. In Malaysia, the IPM had its beginning in the 1960s when several entomologists became increasingly concerned on the negative consequences of excessive use and misuse of pesticides in the plantations.

The world Health Organization is quite worried about it. There are many effects on the agricultural biodiversity as various types of fishes, plants, species are extinguished. As a result, the balance of bio-diversity has been affected. Besides, these chemicals after mix with the water in the ponds, paddy, field, haor & boar, drainage, canals, river and pollute it seriously. Consequently, the living beings of that area are alarmingly hampered and it makes various diseases. A pesticide not only destroys the harmful but also useful pesticides, which plays bad negative impact on the bio-diversity.

But with regard to the IPM is not a single pest control method but rather, series of pest management evaluations, decisions and control. It is an effective and environmentally sound approach to pest management that relies in a combination of common-sense practices. It is a pest control method used to pest damage by the most economic means and with the least possible hazard to people, property and the environment. It can be used both agricultural and non-agricultural matters such as home, garden and work place. It applies to several methods and modes such as setting action thresholds, monitoring and identifying pests, prevention and control. In fact, it involves the judicious selection and integration of all available methods for control of pests and diseases implemented in a cost effective manner with consideration of environmental protection. Six main methods such as cultural, host plant resistance, biological control, physical, chemical and regulatory control that may integrate in the IPM.

2. Literature Review:

In order to draw a conceptual frame work of this study, the relevant published and unpublished literatures have been discussed below:

In the South Asian countries including Bangladesh, pesticides are heavily used and the agriculture became polluted. Impact of modern technology on local variety (no longer of porangi paddy) is also enormous. Foreign (Indian) pesticides are indiscriminately used and the foreign seeds are not adjusted to the local climate.

It is also noted that most of the laws are scattered in nature and its penal provisions are quite inadequate to the present socio economic changes of the country. These laws are also quite British colonial in nature. For example, the Canals Act, 1864; the Irrigation Act, 1876; the Agricultural and Sanitary Improvement Act, 1920; the Tanks Improvement Act, 1939, 1983; the Destructive Insects and Pest Act, 1914.; the Agricultural Pests Ordinance, 1962; in the Agriculture Pesticides Ordinance, 1971; the Seeds Ordinance, 1977; the Agricultural Development Corporation Ordinance, 1961 etc.; are one of them. These Acts are applied in the Indian Subcontinent including Bangladesh. In Malaysia, there are some important agricultural development acts such as the Pesticides Act, 1974; the Plant Quarantine Act, 1976; the Local Government Act, 1976; the Town and Country Planning Act, 1976; the New Varieties Protection Act 2004 etc.

For example, the New Varieties Protection Act, 2004 was passed to provide legislation for the protection of propagation of new varieties of plant, and recognition and safeguarding the contribution made by the farmers, local community and indigenous people on the creation of new plant variety; to encourage investment and development in the propagation of new plant variety within the private and public sector; and to provide legislation on matters related to it. This Act was enforced on January 1st 2007 and commences on October 28th 2008.

They are implementing the enforcement of Pesticide Act, 1974 in order to ensure that pesticides which are imported distributed and sold in our country are of quality and will not cause harm to consumers, livestock, food crops and the environment. Additionally, they are implementing and enforcing the Plant Quarantine Act, 1976 in order to prohibit the entrance of deadly foreign pathogen into our country and also to facilitate the export of our country's products so that they comply with the quarantine regulations imposed by the importing country. They recently also implementing the Implement the Custom Order (Export Restriction) 1988 and CITES regulation (International Trade Convention for Endangered Animal Species and Wild Plants) in order to ensure that agriculture resource and plasma generation are not threaten with extinction.

Implement the enforcement of New Variety Plant Protection Act 2004 (Act 634) to protect the intellectual rights of local varieties for superior plant breeds such as oil palm, rubber, cocoa, coconut and flowers

In order to protect the environment, India, Sri Lanka, Bangladesh etc.; have passed several environmental laws such as the Bangladesh Environment Conservation Act, 1995, the 'Bangladesh Environment Conservation Rules, 1997, the 'Environment Court Act, 2000, the Environment Policy and Environment Action Plan 1992 etc. But unfortunately, these legal frameworks and issues have not been properly implemented due to lack of good governance in these regions.

Taylor AK, Esdaille K. discussed integrated pest management (IPM) policies that are being implemented in states and school districts across the country. The content and regulation of these policies vary. The need for

standardization of such policies and a federal IPM law is the only way to ensure that children in America's schools are adequately protected from exposure to hazardous pesticides used to control pests.

Developing and implementing an Integrated Pest Management Program in Schools and Day Care Centres Structural Pest Control, October 2009: In its foreword, it is stated that in the past five decades, the research and development work done by governmental agencies, universities, and chemical manufacturers has greatly increased the knowledge of the biology and habits of pests. As this body of knowledge grew, our ability to control pests increased dramatically. Today, this expansion of our knowledge allows us to control pests more effectively with less reliance on pesticides.

Research Questions:

We are planning to conduct several questions based on the objectives of this study as follows:

1. How can the IPM be effective for saving and ensuring the biodiversity in Agriculture in Malaysia?
2. What are prospects and constraints towards the IPM techniques in Malaysia?
3. How could we train up our relevant stakeholders including farmers?

3. Objectives:

The main objective of this is to deal with the Integrated Pest Management Techniques relating to environmental protection in Malaysia. Moreover, this study will embark:

- 1) To examine the effects of pesticides on biodiversity in agriculture in Malaysia
- 2) To identify the problems of implementation with regard to the IPM related laws and policy in Malaysia

RESULTS AND DISCUSSION

The uses and impacts of the Integrated Pest Management (IPM) techniques are being used most of the countries in this world as it is affordable and environmentally friend with the agriculture environment.

Some relevant issues on the IPM benefits have been discussed as follows:

Integrated Pest Management (IPM) is the use of holistic and compatible methods of pest and disease control to reduce economic injury. IPM reduces overdependence on pesticides and it is a sustainable process for agricultural environment. It may also contribute to sound crop health management programmes through its methods. It may also address challenges of food security.

The traditional pests such as harmful insects, fungal, viral, and bacterial pathogens, nematodes, rodents and weeds are considered as one of the major constraints to agricultural production, productivity, and improved performance in agricultural systems. They cause chronic qualitative and quantitative losses of up to 40% of the attainable yield in major food and cash crops that may have some effects on the climate change, trade globalization, environmental protection, and poverty alleviation.

By preventing reducing pre- and post-harvest losses caused by pests is a significant contribution towards improved food security and safety, and better market access. The IPM addresses crop losses. It also increases substantial food production linking them to the other sciences that may an impact on crop health as a whole.

Pests can spread disease, consume vegetables and plants and destroy homes. Thus, various pest control methods have been employed to deal with them. There are two main types of pest control such as natural and chemical. Natural pest control employs organic or biological materials to reduce infestation.

On the other hand, chemical pest control employs potent chemical pesticides to reduce or eliminate pests. We can use either of the methods, or utilize both pest control methods to manage infestation problems. However, both methods present advantages and disadvantages.

Pest Control Methods:

Some important methods for control of pests and diseases as implemented in a cost effective manner with consideration of environmental protection" as follows:

There are six methods such as (i) Cultural, (ii) Host Plant Resistance, (iii) Biological control, (iv) Physical control, (v) Chemical control and (vi) Regulatory

Cultural Method:

Good, practical and safe agricultural practices help farmers to reduce pests and diseases. Sanitation and cleanliness is one of them. By pruning, bagging and removal of infected plants, we can control the pests.

Natural pest control:

Natural pest control methods are used to reduce infestation without harming humans, crops and other organisms. It also utilizes other organisms such as plants or insects to control pests in an agricultural environment. It has little or no harmful effect on humans and agriculture etc.

Host Plant Resistance:

Plant resistance to insects is one of several cultural control methods. Cultural control methods involve use of agronomic practices to reduce insect pest abundance and damage below that which would have occurred if the practice had not been used.

In IPM, plant resistance to insects refers to the use of resistant crop varieties to suppress insect pest damage. Plant resistance is intended to be used in conjunction with other direct control tactics.

Biological Control:

Pests and pathogens may be controlled by using beneficial natural enemies and bioagents as well as using other living organisms like Barn Owls etc. The beneficial natural enemies are the Predators, Parasitoids, Microbial bioagents; Fungi, bacteria, mycorrhiza etc.

Biological Control of Rats: IPM for rat control in rice involves the integration of diverse methods such as field sanitation, simultaneous planting, chemical baiting, physical barriers and more recently the use of barn owls. The barn owl biological control approach is not only found to be the most effective and suitable, but also reduces or eliminates the use of chemical baits with no adverse effect to the environment.

Physical control:

Physical Pest Control is a method of getting rid of insects and small rodents by removing, attacking, or setting up barriers that will prevent further destruction of one's plants. These methods are used primarily for crop growing, but some methods can be applied to homes as well.

Physical control refers to mechanical or hand controls where the pest is actually attacked and destroyed. Physical controls are used mostly in weed control. Tillage, fire, removal by hand, grazing and mowing is all used to destroy weeds and prevent reproduction. Some insects may also be destroyed by tillage, which destroys their eggs or overwinter stages of growth. Weeds are not controlled through a single operation.

Chemical pest control methods:

We can control pest using pesticides, insecticide, fungicide and herbicide and rodenticides etc. Chemical pest control methods are used in an agricultural setting and within the household for a very long time by using pesticides that instantly eliminate pests upon application. It can either be applied systematically or to the entire crops as in the case of aerial spraying. Chemical pesticides have harmful and residual effects on both human and animals living within the area while it is largely used on crops and within the household.

Regulatory pest control:

The objective of regulatory pest control is to prevent spread of pests and diseases through the application of suppression, control, and eradication measures such as pesticides laws and policies. The objective is achieved through limiting movement of commodities and materials, and through the treatment of commodities, materials, and the environment to prevent the establishment of pests and diseases where they have not been previously established. For example, the Federal Noxious Weed Act (1974), this Act "provides for the control and eradication of noxious weeds and the regulation of the movement in interstate or foreign commerce of noxious weeds and potential carriers thereof, and for other purposes.

IPM Challenges in Malaysia:

Some authors including Zainal Abidin at UPM argued that there is no reduction in the use of pesticides in Malaysian agriculture. He also pointed out that there is a lack of resources to implement the IPM techniques. More resources are needed to train farmers and plant protectionists at all levels including correct diagnosis of key pests and diseases and practical methods to determine economic threshold levels of pests for effective IPM. It is also said that shortage of experienced labours in various sectors in Malaysian agriculture that may hamper IPM. It is also said that effective IPM is supported by correct diagnosis, constant monitoring of pest and disease incidences and right timing of control. It is noted that inadequate research supports on the IPM Research and Development by Government and private sectors in Malaysia.

IPM and Agricultural Policy in Malaysia:

IPM is very much concerned with the protection of crops (industrial and food crops) from threat such as pests and diseases through the crop protection programme and quarantine services. It also helps to determine the production of crops that are safe for consumption and control environmental pollution and to regulate the agriculture resources and the country's plasma-generated materials from being transferred out of the country and from threat of extinction. The IPM may provide consultation services and technical support in a package format to entrepreneurs, private organizations and agriculture development agencies for the purposes of

developing agricultural programmes for the sector. The IPM may conduct training at the agriculture Institute/Training Centre in order to fulfil the requirement for skilled workforce within the agriculture sector and to monitor the quality of the country's agriculture resource/seedlings etc. Her agricultural laws are also concerned with the theme of the IPM. The IPM is also very concerned with the mission and vision. IPM may enhance their mission and vision of their agricultural sectors as the theme of IPM is quite relevant to the principles and policies as follows:

Vision- Towards the creation of a competitive agriculture industry producing quality products which are safe and environmental friendly, and export-oriented

Mission- To provide quality and efficient services to agricultural entrepreneurs through the application of advance technologies and agricultural regulatory services to boost production capability and ensure the safety of the country's agriculture sector

Main Services- Provision of agriculture development services through sufficient production of food source that are of quality and safe for consumption. Enforcement of Acts is essential for safeguarding the safety, quality and protecting the country's agriculture industry from the threat of pests and foreign diseases and facilitating international trade.

Moreover, the Department of Agriculture is committed to provide services to the operators of agriculture through adoption of the latest technologies in addition to the implementation of regulatory service activities. In line with this commitment, the Department of Agriculture has designated two core services. The first is technical extension services to target groups and clients to improve productivity especially food crops sub-sector and the second is to enforce relevant agriculture acts.

5. Methodology:

This research work is based on the primary and secondary sources related integrated pest management techniques relating to environmental protection using survey methods.

The primary sources include all relevant agricultural laws and policies, the survey and interview, case study, focus group discussion, observation etc.

The secondary sources deals with all relevant published and unpublished research materials such as articles, journals, books, proceedings, chapters in book, online publications and resources from the Science Direct, Google scholars, Google, different universities in Malaysia such as the UPM, UM, USM, UKM, IIUM law library and the concerned Ministries and Departments etc.

This study will also closely deal with all relevant data and publications from the principles of the international law including the international environmental policy and principles, the polluter pays principles, the principles of prevention and the precautionary principles, the best practice means, Rio summit, 1992; Stockholm, 1972; Johannesburg, 2002; the United Nations Commission on Sustainable Development (CSD) etc. Moreover, the relevant case laws on the constitutional courts, international courts, the European Court of Justice, the European Courts of Human Rights, along with other relevant case laws will be considered.

In Malaysia, the relevant laws and policies such as the Environment Quality Act 1974; the Waste and Public Cleansing Management Act 2007, the 9th Malaysian Plan and policies, the National policy, the National Vision Policy, the National Development Policy, the Millennium Development Goals, the Malaysian Vision 2020, the National Strategic Plan for solid waste management, the Local Government Act, 1976 and its rules and policies; the Streets, Drainage and Buildings Act, 1974 etc.; Will be analysed and discussed systematically.

This research will deal with the duties and responsibilities to the FAO as one of the member participating countries in the Food and Agricultural Organization (FAO) inter-country programme for integrated pest control on rice. This study will also discuss with some other inter-governmental responsibilities including World Bank, IFAD etc.

This study critically discuss the role of the Crop Protection Branch of the Department of Agriculture which is responsible for implementing and coordinating the activities assisted by various agricultural agencies. On the other hand, the Malaysian Agricultural Research And Development Institute actively provides the back-up research. The relevant Ministry of Agriculture and Fisheries along with other institutes will take into account for undertaking this research. The progress achieved since 1980 is encouraging particularly in pest surveillance and training. There has been positive impact towards consciousness among the farmers in integrated pest management (IPM) leading to more judicious use of pesticides. The successful implementation of IPM programme on rice would undoubtedly bring many advantages and benefits towards more effective and efficient pest management among rice farmers.

6. Recommendations and Conclusion:

Biodiversity is fundamental issue for sound environment. It has been facing numerous problems with the pesticides all over the world including Malaysia. In order to cope with these problems, the IPM has been considered as one of the important tools for saving the biodiversity in agriculture. The Government has been encouraging the IPM as it is inexpensive and fruitful to the agriculture environment. The relevant Government

department for agriculture should be enhanced and trained with the IPM and they should be foreign training specially from the USA. It would be also compliance with the international environmental laws and policies as undertaken by the Stockholm conference, Rio de Janeiro, Johannesburg conference etc. There are some challenges in Malaysia such as lack of resources lack of training, shortage of experienced labours in various sectors in Malaysian agriculture that may hamper IPM. It is also said that effective IPM is supported by correct diagnosis, constant monitoring of pest and disease incidences and right timing of control. It is noted that inadequate research supports on the IPM Research and Development by Government and private sectors in Malaysia. We need to overcome these problems as Malaysia is an agro-based country although the Government is active in this regard.

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