Pest control methods in rice production

CHAPTER 1: Introduction

As a cereal crop, rice has become the staple food for most human population in Asia, including Malaysia. Rice is a commodity that paramount importance in people uses every day. Rice, Oryza sativa L., belongs to the Poacea family. In Malaysia, it is grown in the Peninsular and on Borneo Island. About 300 500 hectares in Malaysia Peninsular and 190 000 hectares in Borneo Islands are devoted to rice production (FAO, 2002).

Being a security crop, rice production in Malaysian is protected by the government. The national average rice production in the country is only 3. 0 tons per hectare. The local productions can fulfil only 60-65% of domestic requirements, thus the needs of importation of rice from foreign country. In 1999, about 600 000 metric ton of rice has imported by Malaysia from various countries (Consumer International, 2008). 40% of rice consumption in Malaysia is imported from countries such as Thailand, Vietnam, China and Pakistan. Malaysia has enhanced the production of rice in many ways to ensure food security and to meet the demand of population, but still there is many constraints involving rice industry.

Rice production faced many constraints and one of the constraints is the attacked by the pest. Pest is any organisms or microbes with the potential to reduce the yield or value of the rice crop are rice pest (or of rice seeds) (Jahn et al., 2007). Insects that can cause damage are insects, weeds, rats, birds and pathogens. Excessive use of pesticide and high rates of nitrogen fertilizer application can be a factors contributing to outbreaks of the pest.

The main pests of the rice include rice weevils, stemborer, panicle rice mite, rats (Leung et al., 2002), the rice gall midge (Jahn and Khiev 2004), the rice bug (Jahn et al., 2004), the brown planthopper (Preap et al., 2006), the rice leafroller (Murphy et al., 2006) and the weed Echinochloa crusgali (Pheng et al., 2001). At 2007, pests damage cost loses 1 148 hectare in Malaysia (ASEAN Food Security Information, 2008).

Rice Ragged Stunt, Sheath Blight and Tungro are the main diseases of the rice. Rice blast cause by the fungus Magnaporthe grisea, is the most significant disease affecting rice cultivation. In addition to causing direct damage to the plants, many rice insect pests also act as a vector of spiral disease of rice, such as Tungro virus (Dale, 1994; Thresh, 1989).

Pest control is at least as old as agriculture, as there has always been a need to keep crops free from pests. In order to maximize food production, it is advantageous to protect crops from competing species of plants, as well as from herbivores competing with humans.

Pest management is an important practice in order to reduce pest population and disease in rice field. Pest management practices include chemical control, biological control and insect pest management (IPM). Most of them using pesticide as chemical control either other animals or predators as biological control. IPM is one of strategies that can reduce the use of pesticide in crop production. Adoption of IPM can reduce the potential of pesticide contamination to environment and food chain.

Chemical control has been the most pest control methods, it has created many problems, such as reduce in beneficial insect and pesticide residues in

water, soil and plant itself. Pesticide residues can cause negative effect to the human health and environment. At least 40% of sample taken from wholesale market in Selayang such as spinach (bayam), kangkung, round cabbage and Chinese mustard were contaminated and all the celery and curry leaf tested positive for three groups of cancer causing pesticide (Asean Food Conference, 2007).

The objectives of this study are:

1. To confirm the current pest control methods used in KADA area.
2. To find out if there is a relationship of farmers' background to their pest control method.

CHAPTER 2: Literature Review

2. 0 Rice

The scientific name of rice is Oryza sativa, is a plant in Poacea family (USDA, 2006). In the developing country, rice become the most important cereal crop and it also became the staple food of over half of the world's population, grown over about 124 million hectares (Pathak, 1975) and produced in at least 95 countries (Coats, 2003). Classified primarily as a tropical and sub-tropical crop, it is grown in over 100 countries today, on every continent except Antarctica, extending from 50-53°N to 40°S and from sea level to an altitude of 3000 meters (Juliano, 1993; Pathak & Khan, 1994).

Rice is grown either by direct sowing – broadcast, drilled or by transplanting and under diverse water regimes: as an upland crop where is no standing water and rains are the sole source of moisture, or under lowland conditions whereby water, derived from the rain or irrigation system, is impounded in

the fields. On slopes, it is cultivated in terraces, and in valleys, or low-laying sites, floating rice may be grown in several feet of prolonged sunshine. The optimum temperature is about 30°C but, particularly during the flowering stage, temperature of about 20°C induces sterility (Pathak, 1975).

Cultivated rice is a semi-aquatic annual grass, although in the tropics it can survive as perennial, producing new tillers from nodes after harvest (rotton rice). A mature rice has a main stem and several tillers (or side branches), each productive tillers bearing a terminal flowering head or panicle. Plant height varies with the variety and environmental conditions, ranging from around 0. 4 m to more than 5 m in deepwater rice varieties. Roots of the rice plant develop from nodes. There are two major types of roots. Crown roots (including mat roots) developed below the soil surface. Roots that developed from nodes above the soil surface are usually referred as nodal roots. Rice can grow to 1-1. 8 m tall, occasionally more depending on the variety and soil fertility. The grass has long, slender leaves 50-100 cm long and 2-2. 5 cm broad. The small wind-pollinated flowers are produced in a branched arching to pendulous inflorescence 30-50 cm long. The edible seed is a grain (caryopsis) 5-12 mm long and 2-3 mm thick.

The growth period of the rice plants is three to six months (90 to 180 days), depending on the variety and the environment in which it is grown (IRRI, 2003a). The growth duration can be divided into many stages, but the most basic division is into three phases: the vegetative phase, reproductive phase, and ripening phase (Tanaka, 1965). The vegetative phase begins with germination and ends at panicle initiation, when the plant begins to partition assimilate to developing panicle. During the reproductive phase, the panicle

forms within the least sheath, is exserted, and undergoes anthesis (flowering). The ripening or grain-filling phases begins after anthesis and ends at maturation (Karen & Julia, 2003)

Thus, although rice is grown under diverse cultural conditions and over a wide geographical range, it is essentially a crop of warm, humid environments conducive to the survival and proliferation of insects. Of the more than 70 species recorded as pests of rice, about 20 have major significance. They infests all parts of the plant at all growth stages, vectors of virus disease, and are a major factors responsible for low rice yields particularly in tropical Asia (Pathak, 1975).

2. 1 Rice in Malaysia

Rice area accounts for about 11 percent of the total agricultural lands in Malaysia. Rice remains as the country’s most important crop in terms of cultivation, being the principal staple food for most of the populace. To maintain rice production and sufficiency, the government has designated eight granary areas as the permanent rice-producing areas in the country. These designated areas, of various sizes and productivity, include the Muda Agriculture Development Authority (MADA) Kedah, Kemubu Agriculture Development Authority (KADA) Kelantan, Barat Laut Selangor, Besut, Krian/Sg. Manik, Endau/Rompin, Seberang Prai, Seberang Perak and Kemasin/Semerak (Tan, 1987).

These areas currently cover only 36 percent of the total physical paddy land located mainly in Peninsular Malaysia, their combined area constitutes 57 percent of the total land area planted to rice and their combined production

amounts to 72 percent of the total national rice production. These granary areas were officially designated based on their being the traditionally most important rice-producing regions in the country. All areas are located in Peninsular Malaysia.

These eight major granary areas have been reserved solely for rice cultivation where new rice varieties and new technologies from research and development efforts can be adopted. The other rice areas excluded from the eight are free to choose what alternative crops to plant every season (Tunku Mahmud, 2006).

The designation of specific rice granary areas is an astute policy to protect the interest of the dwindling, but politically important, rice-producing Malay-dominated segment of the rural population within the overall context of national economic policies that thrust towards industrial crop production. As the priority areas for rice production supplying the needs of the rest of Malaysia, government programs, support and interventions in the rice sector are focused in these eight designated regions.

2. 3 Definition of Pest Control

Good Agriculture Practice (GAP) is the design to approach aims at applying available knowledge to addressing environmental, economic and social sustainability dimensions for on-farm production and post-production processes, resulting in safe and quality food and non-food agricultural products. Establishing the suitable procedures for IPM in pest management in rice cultivation is an important component of GAPs in order to reduce the usage of chemical substance and pesticide in crop production. . Pests are

harmful organisms and can cost the food industry billions of dollars each year (Marriott, 1991). The pests of primary concern are insects and rodents and they are responsible to spread disease through foods. Rodents and insects carry pathogenic bacteria both internally and on their bodies (FAO, 1997).

Pest control is the process of minimizing or removing a wide range of undesirable insects and other pests from spaces occupied by people. Pest control tactics that commonly used today can be divided into two categories: natural controls and artificial controls. Natural control can be any environmental factor that keeps a pest population below its economic injury level and for artificial controls, it employs products or processes of human origin to modify a pest's behaviour, distribution or physiology.

2. 3. 1 Chemical control

Chemical control involve of chemical substance that disrupt developmental processes (growth regulators), prevent reproduction (sterilants), cause direct mortality (toxicants) or modify insect behaviour (semi chemicals).

The most common method of chemical pest control is the use of pesticides. Pesticides are often classified according to the pest they are intended to control. For example, insecticides are used to control insects, herbicides to control plants, fungicides to control fungi, rodenticides to control rodents, avicides to control birds and bactericide to control bacteria.

2. 3. 2 Biological control

Biological control is the introduction of natural enemies into a new place where they did not originate or do not occur naturally. Biological control also defined as the reduction of pest populations by natural enemies and typically involves an active human role. Natural enemies or biological control agents, includes parasitoids, predators, pathogens, viruses, fungi, and bacteria.

Biological control is frequently incorporated into integrated pest management (IPM) programs. Integrated pest management (IPM) is an integrated approach of crop management to solve ecological problems when applied in agriculture. There are three methods used in this programme: observation, prevention and intervention. It is an ecological approach with a main goal of significantly reducing or eliminating the use of pesticides while at the same time managing pest populations at an acceptable level. The major objective of IPM is to control pests economically through environmentally sound techniques (Marriott, 1994).

2. 3. 3 Cultural control

Cultural control involves of the manipulation of the environment to make it less habitable for pest species. If there is any changes in the time of planting or harvesting, water and fertilizer applications, the spatial distribution of host plants (crop rotation, intercropping, or trap cropping), and management of ground cover or surrounding vegetation can cause significant effect on the survival and growth of pest populations.

2. 4 Integrated pest management in Malaysia

Integrated pest management (IPM) was first introduced into Malaysia in 1960s to combat the surging problem of pest resistance and resurgence in the seventies, however, the implementation of IPM principles and practices in Malaysia was gradual yet continual process. The IPM were introduced in rubber (Rao, 1969), cocoa (Wood, 1971), oil palm (Wood, 1971), rice (Lim, 1970; Jusoh rt al.., 1980) and coconut (Ho et al.., 1971).

The use of barn owl, Tyto alba (Scopoli) as a predator of rat, Rattus argentiventer in paddy field has been found to be a very successful biological control agent in Malaysia. Another alternative to control weedy rice and weeds are by using duck. Ducks are very effective because they will scooping up the grains and seeds of weeds. Duck also can be used to control the population of the golden apple snails in paddy area (Othman and Palasubramaniam, 2001). Further with the extracts from the duck can be used as organic fertilizer.

The use of biological control agent in paddy field has proven to be a success method. By using biological control agent, farmers can reduce their cost of production because less herbicide is needed in the early stage.

CHAPTER 3: METHODOLOGY

3. 0 Location

To achieve the objective of this study, a survey was conducted to gather the information on rice farmers' attitudes on pest control practices in Kelantan and Terengganu. This study was carried out at Kemubu Agriculture Development Authority (KADA), Kelantan and Integrated Agriculture Development Area (IADA KETARA), Besut, Terengganu. KADA covers 5

irrigation plans for 5 separate territories, namely Kota Bharu, Bachok, Pasir Puteh, Pasir Mas and Tumpat. While IADA KETARA consist of four block of irrigation areas.

Kemubu Agriculture Development Authority (KADA) was established in 1967. It covers 49 929 hectares of paddy area with 38 415 farmers. The current status of the net production in 2008 is 179 048 metric ton The Integrated Agriculture Development Area (IADA KETARA) was establish in 1992. It consist of 9 846 hectares of paddy area with 2 759 farmers. The net production in 2008 is 46 097 metric ton (DOA, 2010).

3. 2 Data Sources

3. 1. 1 Data Collection

There are many research techniques used for gather information on farmers pest management practise. However, the most common methods for data collection are personnel interviews, telephone interviews and self-administrated interview.

For this study, the data was obtained by conducting the survey using questionnaire and interview with Agriculture Officer. The survey was conducted from June to August 2010. The total number of farmers involve in this study was 239 respondents from both IADA KETARA and KADA Interview was also conducted on agriculture officers from Department of Agriculture in the district to gather information on the he extension source on pest control practices of farmers.

3. 1. 2 Questionnaire Design

Relevance and accuracy are two basic criteria to achieve the research's purpose. Hence, a good questionnaire is needed so that the interviewer can get quick, accurate and reliable answers from the respondents. Therefore the questionnaire has been design using simple and direct way to avoid complexity as well as loaded question. The questionnaire constructed was referred to other related study. It was prepared in Bahasa Malaysia. It was divided into 4 sections; Section A, Section B, Section C and Section D where it was about demographic profile and attitudes of respondent respectively.

3. 2 Data Analysis

The data were analyzed using Statistical Package for Social Science (SPSS®) software. Descriptive analysis was used to analyze raw data from survey forms, and then transform into statistical data such as table, chart and histogram. Data from descriptive analysis was used to see the value in term of percentage, mean and chart. The data were analyzed using Pearson's Chi-Square (X2) where appropriate.