AN INTERVENTION STUDY TO IMPROVE SAFE BEHAVIOUR OF PESTICIDE HANDLING AMONG TOBACCO PLANTERS IN BACHOK, KELANTAN.

By

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ABBREVIATIONS

AChe	- Acetylcholinesterase
DDT	- Dichlorodiphenyltrichloroethane
IPM	- Integrated Pest Management
KAP	- Knowledge, Attitude and Practice
LC_{50}	- lethal concentration 50
LD50	- Lethal dose 50
LTN	- Lembaga Tembakau Negara
MARDI	- Malaysian Agricultural Research and Development Institute
PPE	- Personal Protective Equipment
PPSP	- Pusat Pengajian Sains Perubatan
RM	- Ringgit Malaysia
SD	- standard deviation.
USM	- Universiti Sains Malaysia
WHO	- World Health Organization

DEFINITION OF TERMS

Bomoh	- traditional healer
Carcinogenicity	- ability to produce cancer or to assist carcinogenic chemicals
Cure	- process of drying tobacco leaf
Kangkung	- a type of vegetable grown in swampy area
Knapsack	- metal container carried in back or shoulder with hand operated air pressure pump for distribution
Mutagenicity	- ability to cause genetic changes
Oncogenicity	- ability to induce tumor growth (not necessarily cancer)
Pesticide	- any substance used to deter or destroy pest which may damage agricultural investments, including rodents and insects (Charles Ogburn, 1992)
Pesticide handling	- action taken when managing pesticide (mixing, spraying and disposing empty pesticide container)
Teratogenicity	- ability to cause birth defects
Wakaf	- a covered platform used as meeting place or resting

ABSTRAK

Di Malaysia, 6.7% pekerja pertanian mengalami keracunan pestisid setiap tahun secara tidak sengaja. Beberapa kajian telah dibuat untuk memahami penyebab-penyebab keracunan pestisid di kalangan pekerja-pekerja pertanian ini. Kajian intervensi komuniti ini telah dijalankan di antara bulan Julai 2000 dan Jun 2001 untuk menilai satu pakej pendidikan kesihatan bertujuan untuk meningkatkan tingkahlaku yang selamat dalam pengendalian pestisid di kalangan penanam tembakau di daerah Bachok, Kelantan. Sejumlah 85 orang (kawasan intervensi) dan 71 orang (kawasan kawalan) sampel telah dipilih dari Tawang dan Telong (kadar respons sebanyak 95.3% dan 98.6% masing-masing). Satu soalselidik berstruktur dan boleh dipercayai yang dikendalikan oleh penemuduga telah diberikan kepada semua penanam tembakau di dalam kedua-dua kumpulan sebelum dan selepas intervensi untuk menilai pengetahuan, sikap dan amalan mengenai tingkahlaku yang selamat dalam pengendalian pestisid. Pakej pendidikan kesihatan adalah terdiri daripada seminar mengenai cara-cara pengendalian pestisid yang selamat menggunakan carta selak, poster, risalah, gambar dan pameran peralatan perlindungan diri. Model pengukuran berulang ANOVA telah digunakan untuk menilai keberkesanan intervensi. Perbezaan yang bermakna didapati sebelum intervensi pada skor min pengetahuan dan sikap di antara kumpulan intervensi dan kawalan di mana skor min untuk pengetahuan adalah 15.68 ± 4.22 & 17.46 ± 2.81 ($p = 0.002$) dan skor min untuk sikap adalah 20.06 ± 4.32 & 22.66 ± 1.63

($p = 0.001$) masing-masing. Jangkaan min batas skor-skor yang diperolehi dalam kumpulan intervensi sebelum dan selepas intervensi dijalankan adalah masing-masing 15.60 & 18.27 untuk pengetahuan, 19.98 & 23.26 untuk sikap dan 18.06 & 19.53 untuk amalan selepas pengawalan dilakukan ke atas tempoh lama bekerja. Peningkatan skor-skor di dalam kumpulan intervensi didapati lebih tinggi secara bermakna berbanding dengan kumpulan kawalan ($p < 0.001$). Hasil keputusan kajian ini menunjukkan bahawa pakej pendidikan kesihatan yang telah dibuat adalah sesuai untuk meningkatkan pengetahuan, sikap, amalan dan tingkahlaku selamat dalam pengendalian pestisid di kalangan penanam tembakau di Bachok, Kelantan.

ABSTRACT

An interventive study to improve safe behaviour of pesticide handling in tobacco planters in Bachok, Kelantan.

In Malaysia, 6.7% of agricultural workers were annually poisoned accidentally by pesticides. Few surveys have been done to understand the causes of pesticide poisoning among agricultural workers. This community intervention study was done between July 2000 and June 2001 to evaluate an education package aimed at improving safe behaviour of pesticide handling in tobacco planters in Bachok, Kelantan. A sample of 85 (intervention group) and 71 (control group) tobacco planters were randomly recruited from Tawang and Telong (response rate of 95.2% and 98.6% respectively). A structured and reliable interview-guided questionnaire was administered to both groups of planters before and after intervention to assess their knowledge, attitude and practice on safe behaviour of pesticide handling. The education package comprises of a seminar on safe methods of pesticide handling using flip charts, posters, pamphlets, photographs and display of personal protective equipment. Repeated measure ANOVA model was applied to evaluate the effectiveness of intervention. There were significant differences noted in the pre-intervention knowledge and attitude between intervention and control group where the mean score of knowledge were 15.68 ± 4.22 & 17.46 ± 2.81 ($p = 0.002$) and the mean score of attitude were 20.06 ± 4.32 & 22.66 ± 1.63 ($p = 0.001$) respectively. The estimated marginal means of scores in the intervention group for pre- and post-intervention were 15.60 & 18.27 for knowledge, 19.98 & 23.26 for attitude and 18.06 & 19.53 for practice respectively after controlling

for duration of occupation. The improvement of the scores in the intervention group was significantly higher than those in controls ($p < 0.001$). The result suggests that the education package is appropriate in improving the KAP and safe behaviour of pesticide handling among tobacco planters in Bachok, Kelantan.

1. INTRODUCTION

Pesticides are mainly used to improve the quality of agricultural products including tobacco and in developed countries, strict conditions are imposed on the use of pesticides and pesticide sprayers are more educated (Cornwall *et al.*, 1993). In Malaysia generally, there were no proper training and guidance for pesticide handlings (Jeyaratnam *et al.*, 1987). Farming were done in small scales involving many people and planting grounds were those surrounding their houses (Heong *et al.*, 1987).

In 1959, tobacco was introduced to Peninsular Malaysia as a cash crop and has contributed considerably to the economy of the country. In 1973, Lembaga Tembakau Negara (LTN) was established and is now the main governing body for control of the tobacco industry in Malaysia. LTN deals directly with companies producing tobacco products, regulates quotas and aims to control pesticide use by tobacco growers. The local administration of LTN policy and financial assistance was carried out by regional LTN officers, each responsible for a number of tobacco curers within a geographical area. These curers in turn work with the tobacco growers (Cornwall *et al.*, 1993).

There were about 25 million cases of occupational pesticide poisoning for the 830 million agricultural workers in the developing world. However, the bulk of these episodes of poisoning were not recorded, as they were considered minor and often self-limiting. Furthermore, most of the affected farmers do not seek medical attention but totally depend on traditional ways of curing poisoning (Jeyaratnam, 1990).

Agricultural workers in Malaysia have been exposed to pesticides since long ago as their activities involve pesticide handling including purchasing, mixing,

spraying, storing and disposing the empty pesticide containers (Heong *et al.*, 1987). Hence, they were at high risk of pesticide poisoning.

Another study done in Malaysia showed that even though farmers were provided with personal protective equipment (PPE), most of the time they were not wearing it due to some reasons (Ramasamy and Nursiah, 1988). A known reason was discomfort while using the PPE - for example, heavy boots and gloves that limit movement and reduce sensitivity and those which prevent heat from escaping from the body like hats, masks and long sleeves (Andrews, 2000). Others were due to lack of knowledge on pesticide toxicity and safe handlings (Rojas *et al.*, 1999). The lack of appropriate safety measures may result from the fact that, although PPE was available, it may be inappropriate for use in the elevated temperatures (Rojas *et al.*, 1999). This hazard was exacerbated by the higher human energy expenditure and respiratory exchange associated with carrying and operating a knapsack sprayer, compared with tractor-mounted equipment (Rojas *et al.*, 1999). Some of the farmers even smoke or eat during mixing or spraying of pesticides (Cornwall *et al.*, 1993).

Some of the farmers used traditional methods which they believed would prevent poisoning like eating canned sardines (in tomato sauce), drinking coconut water or "kangkung water". This belief has been practised for decades (Kyi, 2000).

In Bachok, Kelantan a quarter of farmers with symptoms of poisoning had sought formal medical advice, the remainder relying on traditional cures (Heong *et al.*, 1987). In Malaysia, most workers did not report poisoning to health authorities, self-treating with coconut water, herbs and tamarind instead (Ramasamy & Nursiah, 1988). Some would go for treatment at health clinics, private general practitioners or hospitals' outpatient clinics. Others would sought treatment from bomohs (traditional healers),

while some might not even bother to seek treatment at all, as long as they can work in the field the very next day (Jeyaratnam, 1990).

A call for study in pesticide use in Malaysia is timely since very few surveys have been undertaken to study the problem of acute pesticide poisoning among agricultural workers. It has been reported that 6.7% and 7.3% of agricultural workers and pesticide users were poisoned per year respectively in Malaysia based on questionnaires and analysis of hospital records. The causes of poisoning for hospital admission as found in hospital records were 67.9% for suicide, 14.3% for accidental and occupational and 17.9% for non-occupational reason (Jeyaratnam *et al.*, 1987).

Pesticide exposure and poisoning is in fact a major problem especially in Malaysian tobacco industries. Very few studies have been undertaken to highlight this problem. There were few studies done to assess the knowledge, attitude and practice of pesticide use among tobacco farmers in Malaysia (Cornwall *et al.*, 1993). Very few health education programmes related to pesticide handling were given to farmers and most of them were informal without evaluation (Kyi, 2000). This prompted the author to assess the knowledge, attitude and practice of pesticide use of tobacco planters and to evaluate the effectiveness of an educational package on safe pesticide handling.

1.1 Background of Study Area

Kelantan state is located in the northeast corner of peninsular Malaysia, bordering Thailand in the north and Terengganu state in the south with a coastal perimeter of 32 kilometers against the South China Sea. The climate is tropical with 5-monsoon seasons late in the year and temperature ranging from 22^0C to 30^0C year round (Land & District Office, Bachok, Kelantan, 1999).

Bachok is one of ten districts in Kelantan situated in the coastal area against South China Sea with Kota Bharu district in the northeast and Pasir Puteh district in the south (Land & District Office, Bachok, Kelantan, 1999).

Bachok comprises an area of 264.64 kilometer square and has eight subdistricts namely Bekelam, Gunong, Mahligai, Melawi, Perupok, Tawang, Telong and Tanjung Pauh. The population according to the 1991 census was 100,400 with annual increment of 2.3%. Ninety eight percent of the population are Malay Muslims while the remainder were Chinese and Siamese Buddhists (Land & District Office, Bachok, Kelantan, 1999).

The land is low lying and sandy at the coastal areas and Bris soil (sandy soil) in the inner. With a large proportion of Bris soil, this condition only permits a few crops to grow (Heong *et al.*, 1987). The main activities of the people are fishing and farming (tobacco, rice and coconut) which account for 76.8%; others are government servants and those who are doing small businesses and industries (brick and charcoal making) (Land & District Office, Bachok, Kelantan, 1999).

The natural water table is high and domestic wells are common sources of water for farmers in Bachok whereas only 48.3% have clear pipe water supplies. Electricity is available in over 90% of houses. Medical facilities in the district comprise 1 Health Office, 6 Health Clinics, 21 Rural Health Clinics and 5 Private Clinics (Hamizah, 2000). There are 33 primary schools and 15 secondary schools in the district (Land & District Office, Bachok, Kelantan, 1999).

Tobacco was introduced to Malaysia in the 1920's and in 1959 it was introduced as a cash crop (Cornwall *et al.*, 1993). Since then, it has contributed considerably to the economy of the country. LTN is now the main governing body for the control of the tobacco industry in Malaysia (Lembaga Tembakau Negara, 1999).

LTN controls the growing and marketing of tobacco and sets growing standards such as seed materials, fertilizer rates, agronomic practices and pest control measures. It also controls the price of tobacco leaves, support the cost of fertilizers and chemicals and provides training and extension services to the farmers (Cornwall *et al.*, 1993).

Registered with LTN are tobacco curers who buy green leaves from the farmers, cure them and subsequently market them to the tobacco companies (Cornwall *et al.*, 1993). LTN also provides advice, planting materials and other inputs such as pesticides to the farmers (Heong *et al.*, 1987).

Climatic conditions limit tobacco growing, although it grows quickly, with one crop per year at the end of the monsoon season (December – April) (Cornwall *et al.*, 1993). There are 4396 tobacco planters registered in 1997 that contributed to 19.1% of the total registered tobacco planters in Malaysia (Lembaga Tembakau Negara, 1999).

1.2 Literature Review

1.2.1 Tobacco Growing, Pesticide Use and Pesticide Poisoning Internationally

In 1985, an estimated 4 million hectares or 0.3% of arable land world-wide were under tobacco cultivation. Tobacco accounted for 1% of total agricultural output. Tobacco contributed 10.2% of government revenue world-wide in 1983. Tobacco growing in developing countries has a health cost both directly, through the long-term health effects on tobacco users and secondary problems to those involved in cultivation, and indirectly by loss of food production (Cornwall *et al.*, 1993).

Tobacco growing is subsidized in many countries by both governmental and private agencies. Subsidies are for fertilizers, pesticides and capital. Purchase of the crop by tobacco companies may be incumbent by the use of a type and quantity of pesticide determined and sold at a fixed price by the company while profit for the government and tobacco companies greatly exceeds that for farmers (Cornwall *et al.*, 1993).

Pesticide poisoning can present as an acute or chronic manifestation. Acute manifestations were usually due to brief exposure and in large doses. These will present with signs and symptoms of acute poisoning and such cases were usually referred to the nearest health facilities for urgent treatment (Delilkan *et al.*, 1984). Majority of the farmers with chronic low dose exposure were usually asymptomatic. Some will have occasional non-specific constitutional symptoms such as headache, low grade fever, skin irritation or eczema, chronic conjunctivitis and some may present with "occupational asthma" (Jeyaratnam, 1990).

Currently, there is a growing concern about toxic effects of pesticides on humans and domestic animals in developing countries (Rojas *et al.*, 1999). In most cases, however, only acute episodes were consigned to medical records, but many more individuals may be at risk of developing important chronic effects such as cancer, reproductive and immunological effects (Rojas *et al.*, 1999).

Apart from hospital registers, it was believed that the difficulty in obtaining real data in developing countries stems from:

a) lack of accurate characterization of poisoning circumstances,

b) large numbers of combinations of pesticides used,

c) presence of confounding factors,

d) incomplete identification of the toxic agent, and

e) lack of a laboratory confirmation of a clinical diagnosis,

making comparison difficult. In rural hospitals, pesticide toxicity was commonly misdiagnosed; therefore, morbidity and mortality data may be underestimated in these facilities (Rojas *et al.*, 1999).

Education and training of farm workers in handling pesticides in an appropriate way and the use of PPE were needed to reduce their exposure and hence the long term risks to their health (Rojas *et al.*, 1999). Only some efforts have been made so far to educate and train farmers on safe methods of pesticide handling (Andrews, 2000).

Poisoning associated with pesticides can occur despite extensive control measures due to misuse or failure to abide by the control measures (such as regulations or instructions on label) to account for changing pattern of pesticide use (Andrews, 2000). Problems were also likely to occur in countries where pesticides were heavily

used and have less developed control measures (O'Malley, 1997). It was seen that the technological transfer of pesticides to developing countries has occurred without coupling modern techniques of pesticide safety, regulation and establishment of occupational health surveillance as practised by the developed countries (Albertson & Cross, 1993).

1.2.2 Pesticide Use in the Tobacco Industry in Bachok

Sandy or Bris soil is suitable for growing tobacco. Plants are grown from seeds, and seedlings are planted out at eight to ten weeks. A fungicide may be applied to the seedlings (Cornwall *et al.*, 1993). Hand hoeing still remains the main method for weed control in Malaysia. The crop is prone to infestation with pests, particularly *chlorida assulta*, the tobacco-bud worm. Other major pests common in Malaysia include the "armyworm" (*spodoptera litura*), the "webworm" (*pasara submarginalis*), the "cutworm" (*agrotis ypsilon*) and the aphid (*myzus persicae*) (Heong *et al.*, 1987).

Basically there are three stages of tobacco planting where the planters commonly use pesticides. The first is before seedling when planters usually use fungicides to avoid fungal infection of the seeds. The second is during planting season when the tobacco plants are susceptible to pest attack. The pesticides used include insecticides, fungicides, herbicides and nematocides. Most of the time, the planters depend on their perceptions of any pest attack, especially the worms before they decide the frequency of spraying. The third is to retard the flowering of tobacco when they commonly use contact poison. This is done to encourage the leaves to grow bigger and wider.

The types of pesticide used and the frequency of application depend on the farmers' perception, objectives and feasible options (Heong, *et al.*, 1987). Throughout the tobacco planting season, the farmers are compelled to use and are exposed to various chemicals including tobacco fertilizers, sucker control chemicals, insecticides, herbicides, soil fumigants, fungicides and nematocides. These chemicals are used at various stages of tobacco growing. Since the returns of tobacco growing are potentially more lucrative, farmers tend to be more prepared to invest in pest control (Cornwall *et al.*, 1993). When spraying, a tobacco planter typically directs spray on to plants in front of him/her and then walks through the sprayed plants (Heong *et al.*, 1987). With little or no protection, body contamination by pesticides is very common (Cornwall *et al.*, 1993). About a third of the planters have suffered the effects of pesticide poisoning but only a quarter have sought medical attention (Heong, *et al.*, 1987).

1.2.3 Health Effects resulting from Pesticide Use in Tobacco Cultivation

Among the problems identified particularly affecting those involved in tobacco cultivation and pesticide use are:

i) allergy resulting in eczema and occupational asthma in susceptible individuals.

ii) toxicity resulting from pesticide use.

The latter has been described previously in Malaysian agricultural workers by Heong *et al.* (1987), Jeyaratnam *et al.* (1987) and Ramasamy and Nursiah (1988). Thirty six percent of agricultural workers surveyed by Ramasamy and Nursiah (1988) had symptoms of poisoning.

A study in Bachok, Kelantan involving 178 tobacco planters done in 1984, found one third to have had symptoms of pesticide poisoning (Heong *et al.*, 1987). Giddiness was the most common symptom (81%), followed by nausea (12%) (Heong *et al.*, 1987). Skin irritation occurred in 5% of workers and 2% had history of fainting (Heong *et al.*, 1987). However a study in Cameron Highland by Jeyaratnam *et al.* (1987) found only 7% of the farmers to have considered themselves poisoned by pesticides.

In Bachok, Kelantan, a quarter of the tobacco planters with symptoms of poisoning had sought formal medical advice, the remainder relying on traditional method of medications (Heong *et al.*, 1987). A study in Peninsular Malaysia by Ramasamy and Nursiah (1988) found most workers who did not report poisoning to health authorities but self-treating with coconut water, traditional herbs and tamarind instead.

1.2.4 Occupational Health and Pesticide Use

The WHO (1985) recommended that workers dealing with the storage, mixing and application of pesticides take adequate safety precautions to protect themselves and the environment from contamination (Appendix I). Poisoning occurs to workers due to inadequate knowledge about the safe handling of pesticides, leaking or malfunctioning of spray equipments and the inadequate provision of suitable protective clothing (WHO, 1985) as well as a lack of legislation to enable safety standards to be enforced (Jeyaratnam *et al.*, 1987).

1.2.4.1 Protective Clothing

Ideal clothing, cheap, cool, flexible and fully protective (Appendix I) is not available. Plastic apron have been recommended after finding that polyester pants blocked only two thirds of pesticide penetration (Cornwall *et al.*, 1993). However in a hotter climate the absorbent, easily washed cotton fabrics are most suitable and more likely to be acceptable than synthetics (WHO, 1990). The fact is that, although personal protective equipment is available, it may be inappropriate for use in the elevated temperatures (Rojas *et al.*, 1999).

In Malaysia, Ramasamy and Nursiah (1988) found that the most common combination of clothing claimed to be worn by 37% of pesticide users, was a long sleeve shirt, long trousers, shoes and hat. Thirty eight percent said they used a cloth to cover the nose and mouth (Ramasamy and Nursiah , 1988). In Bachok (1984) 60% of tobacco planters reported using mouth or nose protection during spraying (Heong *et al.*, 1987). A study done in Santa Lucia in 1992 found that 13% of farm workers said they wore respirators, 17% wore rubber gloves, 22% wore rubber boots, and only 15% wore other protective clothings despite a knowledge of the danger of pesticide (Cornwall *et al.*, 1993).

1.2.4.2 Wind

Wind drift and direction may increase pesticide contamination (Cornwall *et al.*, 1993). Ideally, spraying should not be done when wind speed is greater than 6km/h (2 knots) and when hand sprayers are used, the farmer should walk with their back to the wind (Cornwall *et al.*, 1993).

1.2.4.3 Personal Hygiene

Washing the skin with soap and water after spraying is an important factor in decreasing contamination (WHO, 1985). Pesticide are usually formulated with other products which may increase dermal absorption and absorption is facilitated by a hot humid climate (WHO, 1990). In a study done in Santa Lucia in 1992, it was found that 74% of farmers surveyed washed the entire body and change clothes at the end of a day using pesticides (Cornwall *et al.*, 1993). In Bachok, only 2% of tobacco planters sampled did not wash after spraying (Heong *et al.*, 1987).

1.2.4.4 Equipment

The largest area of contamination for manual sprayers is around the abdomen (Cornwall *et al.*, 1993). Contamination occurring whilst using normally functioning equipment is minimal compared to that which occurs with leaking and damaged equipment (Jeyaratnam, 1985). In Bachok, Kelantan 11% of tobacco planters (all using knapsack sprayers) had problems with their knapsack sprayers, 72% of which were leaking (Cornwall *et al.*, 1993). Fifty seven percents of all knapsacks were 2-3 years old, only 3% were older than five years (Heong *et al.*, 1987).

Jeyaratnam (1985) found that agricultural workers in developing countries to be aware of risks associated with leaking knapsacks, skin contamination and spraying in windy condition. However knapsacks are expensive to repair and buy, facilities for washing contaminated skin and clothes rarely existed, and there was always pressure on the farmers to complete spraying on schedule (Heong K.L. *et al.*, 1987).

1.2.4.5 Route of Contamination

The hands have the greatest potential for contamination during mixing, and are then exposed to concentrations of pesticide much higher than during the remainder of the procedure (Cornwall *et al.*, 1993). Despite perception by workers that the respiratory route of absorption is most important (Jeyaratnam *et al.*, 1987), particularly for compounds with a strong smell, dermal absorption is the most important route of absorption for worker spraying outdoors (Cornwall *et al.*, 1993).

1.2.4.6 Training

World Health Organization (1990) recommends education and training in the safe use of pesticides. In the Cameron Highlands, Malaysia the majority of pesticide users surveyed had no safety education (Jeyaratnam *et al.*, 1987). Ramasamy and Nursiah (1988) found 25% of 964 Malaysian agricultural workers had not been informed of the dangers of pesticide use. In Bachok, instructions on pesticide use were obtained from the labels on the bottle packaging (57%), from official sources (34%), and from farmers, friends and relatives experience (14%) (Heong *et al.*, 1987).

1.2.4.7 Storage of Pesticide and Disposal of Empty Pesticide Containers

World Health Organization standards are given for the storage and labeling of pesticides and disposal of containers in Appendix I. In Bachok, 90% of tobacco planters kept chemicals in a "designated store" (undefined), generally near their houses (Heong *et al.*, 1987). In a study done in Zimbabwe in 1987 found that 25% of farmers burned or buried used containers while 38% felt used containers were safe to be used for other domestic or farm purposes (Cornwall *et al.*, 1993).

1.2.4.8 Labeling

Labeling should be in a language understood by those who will handle the pesticide (WHO, 1990). International codes or danger signs may not always be understood (Ramasamy and Nursiah, 1988). Lack of literacy and confusing instructions have been found to cause problems (Cornwall *et al.*, 1993). A study in Santa Lucia in 1992 shows that 54% of agricultural workers did not always understand labels (Cornwall *et al.*, 1993).

1.2.5 Recommended Pesticides

The given examples following the definition below are those chemicals recommended for use by the LTN as of 1999/2000:

Insecticides - compounds that are used to kill insects and related species (Acephate, Bacillus thuringiensis, Cypermethrin, Alpha-cypermethrin)

Herbicides - compounds that are used to kill weeds (Metalachlor, Sethoxydim).

Fungicides - compounds that are used to kill fungi and moulds (Chlorothalonil, Maneb, Mancozeb + Carbendazine).

Nematocides - compounds that are used to kill nematodes (Phenamiphos, Carbofuran).

Fumigants - gases that are used to sterilize products (Dazomet).

Poison to retard flowering - Fatty alcohol (contact poison), Pendimethalin, Butralin.

1.2.6 Recognizing Signs and Symptoms of Poisoning

Persons who are frequently involved with pesticides should become familiar with these important steps:

1. Recognize the signs and symptoms of pesticide poisoning for those pesticides they commonly use or to which they may be exposed.
2. If a pesticide poisoning is suspected, get immediate help from a local hospital, physician, or the nearest poison control center.
3. In a pesticide emergency, identify the pesticide to which the victim was exposed. Provide this information to medical authorities.
4. Have a copy of the pesticide label present when medical attention is begun. The label provides information that will be useful in assisting a pesticide poisoning victim.
5. Know emergency measures to be taken until help arrives or the victim can be taken to the hospital. Both first aid and medical treatment procedures are usually listed on the product label.

1.2.6.1 Recognizing Common Pesticide Poisonings

All pesticides in a given chemical group generally affect the human body in the same way; however, severity of the effects vary depending on the formulation, concentration, toxicity and route of exposure of the pesticide (Redekop, 1992). It is important, therefore, to know both the type of pesticide used and the signs and symptoms associated with poisoning from it (Appendix XIII & XIV). These symptoms may be mistaken for those of flu, heat stroke or heat exhaustion, or upset stomach (Redekop, 1992).

1.2.7 Developing an Intervention Program

An intervention program is needed to improve awareness on the danger of pesticide poisoning especially a chronic low-dose exposure which are usually overlooked. The intervention program should be targeted to the population at risk. Based on the review of previous studies, it was concluded that the following elements contributed to the effectiveness of any interventions: a behavioural focus, incorporation of instructional strategies that are based on appropriate theory, adequate dose (such as amount of education required to stimulate positive behavioural change), peer involvement, self-assessment and feedback, environmental interventions to complement behavioural lessons, and community involvement. In general, however, the studies that were not effective provided fewer hours of education compared with the more efficacious studies (Hoelscher *et al.*, 2002).

Environmental components play an important part in the success of any intervention programs especially when dealing with people working in the fields such as farmers (Rojas, 1999). Climate change, current weather and availability of facilities, all will influence the outcome of the programs (Kyi, 2000).

Appropriate Strategies with consideration of the sociocultural background of the target population during program development is essential to ensure success of any intervention program. The program developed should be easy to understand and culturally acceptable (Hoelscher *et al.*, 2002).

Hoelscher and colleagues, (2002) suggested the following steps for the development of education program:

i) Needs assessment, as a first step, should be given enough time. A needs assessment of the population can be accomplished through literature review, review of data collected previously, or baseline data collected specifically for the proposed project. Data for the project can be drawn from a variety of sources and can be in the form of quantitative data or data which include focus groups and structured interviews. Although a data collection specific to the intervention will yield the most relevant information, in many cases this was not feasible because of cost and time limitations. In that case, the interventionists need to rely on data previously collected such as information from national surveys or similar studies. Involvement of target population was important during the needs assessment. They might be asked to make suggestions for dealing with issues related and their preferred methods of education delivery.

ii) Goals and Objectives Setting

Once a thorough needs assessment had been done, the overall goals and objectives for the study must be selected.

iii) Development of Education Materials

This was done after taking into consideration the sociocultural background of the target population and analysis of baseline data obtained in the needs assessment. The feasibility of the program, the most preferred tools and the method of program delivery were also incorporated in the development process.

iv) Pretesting and Evaluating Education Materials

After materials were developed, it should be tested and evaluated to ensure validity and measure its effectiveness. Community involvement in the program evaluation might be needed because they can give opinions, suggestions and make preferences of the tools they like. Pretesting or piloting of the materials can be done in the target population or in a similar setting.

1.3 OBJECTIVES

1.3.1 General objective

To study on safe pesticide handling in tobacco planters.

1.3.2 Specific objectives

i) To assess the knowledge of, attitude towards and practice of safe pesticide handling among tobacco planters.

ii) To evaluate an education package on safe pesticide handling.

iii) To identify the area of knowledge, attitude and practice improved by intervention program.

1.4 STUDY HYPOTHESIS

i) The health education package improves knowledge of, attitude towards and practice of safe pesticide handling in tobacco planters.

1.5 CONCEPTUAL FRAMEWORK

Factors contributing towards pesticide exposure are:

a) Lack of knowledge on pesticide toxicity and safe handling.

b) Lack of regular training program.

c) Lack of information, supervision and control from appropriate authorities.

d) Low education status.

e) Improper attitude on pesticide handling.

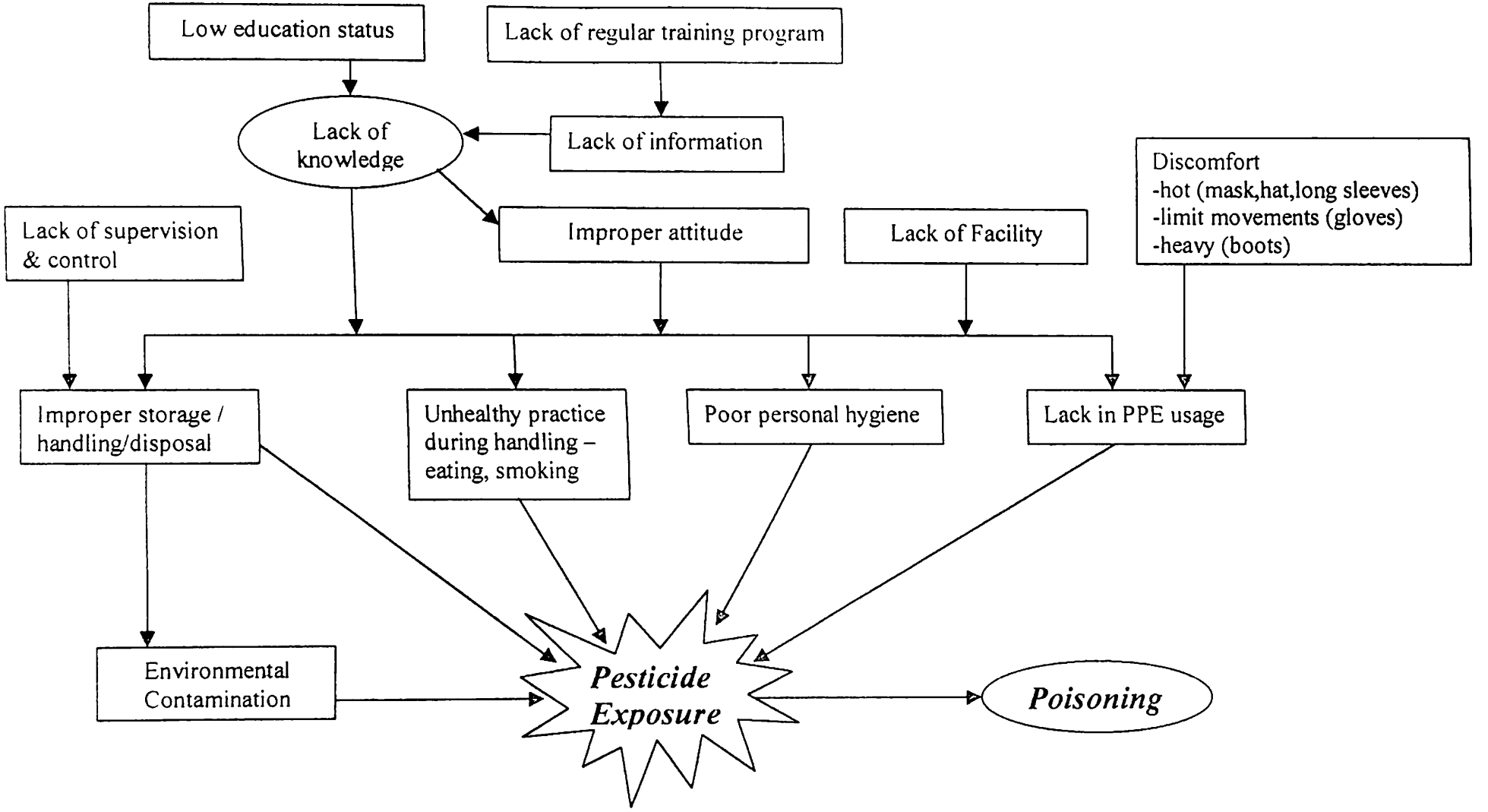
f) Absence or improper use of personal protection (wide-brimmed hat, goggles, oro-nasal mask, rubber/plastic gloves, rubber boots, long-sleeved shirt and long pant).

g) Poor personal hygiene (hand washing, bathing/showering with soap).

h) Unhealthy practice during pesticide handling such as smoking and eating.

The relationship between the abovementioned factors is summarized in Figure 1.

Figure 1: CONCEPTUAL FRAMEWORK



2. MATERIAL AND METHODS

2.1 Study Design

A community-intervention study was conducted among tobacco planters in Bachok district, Kelantan from July 2000 to June 2001.Two subdistricts (mukims), Tawang and Telong were chosen, one for intervention and the other for control (Appendix 0).

2.2 Population and Sample

Source population of the study were all tobacco planters in Mukim Tawang and Telong, Bachok. The reference population is all tobacco planters in Kelantan. Simple randomization was used to assign the subdistricts into intervention and control group.

A list of registered tobacco planters with LTN, updated in the year 2000, was obtained. It included 256 tobacco planters in Tawang and 235 in Telong. Inclusion criteria for both intervention and control group were age above 15 years, participation in tobacco planting activities and involvement in pesticide handling. Those with any psychotic / mental illnesses were excluded from the study.

Subjects were chosen using simple random sampling (SRS). All tobacco planters from the list were numbered. By using the table of random numbers, subjects were randomly selected to fulfill the calculated sample size.

Using the power of study of 0.95, alpha of 0.05, detectable difference in population means of score of 5, within group standard deviation of 6 and equal size for

two groups and considering drop-out rate at 20%, the calculated minimum sample size was 48 planters per group (using PS software) (Dupont and Plummer Jr.,1997). Sample size calculation was based on comparison of two means (mean of attitude score increase, post- minus pre-intervention attitude score in intervention and control group). Attitude score was used for calculating the sample size as it has the widest range of score (0 – 24) and expected to have the biggest standard deviation.

2.3 Data Collection

2.3.1 Method of Data Collection

The purposes and importance of the study were explained to all subjects. Their consent (written informed consent as in Appendix II) to take part in the study were obtained. A survey was done using interviewer assisted questionnaire (details of the questionnaire is explained in 2.3.2).

The intervention was then implemented before the tobacco-growing season (November to March). After two months of intervention, a post-intervention survey was done using the same set of questionnaire.

2.3.2 Questionnaire

The questionnaire was constructed to assess Knowledge, Attitude and Practice of pesticide handling. It comprises four sections (Appendix III & IV).

Section one concerns the socio-economic background of the subjects and consists of 13 questions. Section two, three and four assess the knowledge, attitude and practice of pesticide handling, and consists of 6, 14 and 9 questions respectively.

The drafted questionnaire was sent to 4 experts (a Public Health Lecturer from the Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia; a Senior Health Officer from the Ministry of Health; a Senior Assistant Agronomy Officer from the Department of Agriculture and The Director of Agronomy Division, LTN, Kelantan) to seek their opinion and suggestion on content validity. The content was subsequently modified according to the recommendations of the four content experts.

Regarding the scoring of research questions, a positive response will be given 'one' mark. A negative or non-response to a question will be given 'zero' mark. Total marks in each section will be taken as sum scores for knowledge, attitude and practice accordingly.

The questionnaire was piloted in a study consisting of 30 tobacco planters in the nearby subdistrict (Melawi). Factor analysis to assess the construct validity of the questionnaire was done. Reliability analysis was done to assess item-total correlation and internal consistency (Cronbach Alpha). According to these analyses and considering the importance of the questions in the theoretical aspects, some questions (items) were omitted. The selected questions were obtained as in Table 1.