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Full Length Research Paper

Herbicide Exposure to Maize Farmers in Northern Thailand: Knowledge, Attitude, and Practices

Denpong Wongwichit[1,a], Wattasit Siriwong[2,4,b,*], Mark G. Robson[2,3,4,c]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand
[2]School of Environmental and Biological Sciences, Rutgers University, New Brunswick, NJ, USA
[3]UMDNJ-School of Public Health, Piscataway, NJ, USA
[4]Thai Fogarty ITREOH Center, Chulalongkorn University, Bangkok, Thailand

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Herbicide products have been heavily used by maize farmers in Thailand. The knowledge, attitude, and practices of herbicide use and exposure were evaluated the association in maize farmers in Nanoi district, Nan province. The total response rate was 73.3%. The results were found that 79.9% was male and 70.8% was 35-53 years old. 36.1% reported health effects after spraying. Nevertheless, 48.6% of maize farmers had high knowledge level, 69.3% had positive attitudes, and 93.9% had good practices. Statistically significant associations ($p < 0.05$) were found between the knowledge and the attitudes ($r = 0.37$), the knowledge and the practices ($r=0.24$), and the attitude and the practices ($r=0.2$). However, the majority of maize farmers have high knowledge, positive attitude, good practices, but the maize farmers still had herbicides poisoning symptoms. Therefore, double check was necessarily conducted through the qualitative method. The important finding was that when the maize farmers applied herbicides, they did not use the personal protective equipments, because personal protective equipments could cause discomfort. Moreover, some maize farmers improperly used personal protective equipments. These results were directly opposite to the results that obtained by face to face interview. Therefore, the risk communication and the implementation of personal protective equipments are necessary to provide for encouraging their health effect concern and decreasing their risk of herbicide exposure.

Keywords: Knowledge, attitude, practices, herbicides exposure, Thailand.

INTRODUCTION

Thailand has imported pesticides, e.g. herbicide, insecticide, and fungicide, into the country since the expansion of the country's agricultural system from domestic to industrial production and mono-cropping agriculture in1950s (Siriwong et al., 2009). The amount of imported chemicals has increased dramatically from 20,790 to 116,322 tons during 1994 to 2007 (Office of Agricultural Economics, 2009). Agrochemicals, such as fertilizers and pesticides, have become a major part of farming in Thailand allowing for increased crop production and income. Although pesticides are easy to buy from the market, easy to use, decrease the need for a large labor force, and allow for quick yield, many adverse health effects and environmental impacts have resulted from pesticide use. Pesticides not only destroy targeted weeds and pests, but they also contaminate soil, water, and air thereby damage the surrounding ecosystem and other living organisms necessary for maintaining ecological balance, for example, insects, birds, worms, fish, etc (Siriwong et al., 2007, 2008, 2009). In humans and animals, pesticides target the endocrine system and can also cause cancer, infertility, and mutations. Pesticide residues can remain in the environment and cause long-lasting effects to humans and the environment long after discontinuation of its use (IPM Thailand, 2002). According to the Bureau of Epidemiology, Ministry of Public Health Thailand, the morbidity rate of pesticide poisoning was between 5.02 – 9.28 per 100,000 population in 2004 (Bureau of Epidemiology, 2004). This information indicated considerably large magnitude of adverse health effect due to pesticide exposure.

This research was conducted among people working in maize farms in Nan, a province in the northern region of Thailand. The Nan provincial agricultural office conducted a survey in 2005 to investigate agrochemical use in the

Corresponding Author E-mail; wattasit.s@chula.ac.th; Phone : +66 2 218 8231; Fax : +66 2 255 6046

region along with health risks associated with pesticide exposure. The survey found that maize farmers in this area were known to use a large amount of paraquat (60.7%), especially in Nanoi, Wiang Sa, Muang, and Santisuk districts (Nan Provincial Agricultural Office, 2005). Moreover, the results of cholinesterase testing among farmers in all areas of Nan province conducted by health care providers in 2004 revealed that 13.52% of them had cholinesterase activity at the unsafe level, followed by 29.11%, 33.93%, and 23.44% having risky, safe, and normal level respectively (Nan Provincial Health Office., 2005). It demonstrated that farmers in Nan province were at risk of pesticide exposure.

Maize farms have existed in the Nanoi district for over 25 years. Farmers use herbicide to kill unwanted plants including many weeds for protecting crops, increasing crop yield, and increasing income (Namtok Sub-district Health Center, 2009). This posed a serious public health problem and environmental impact regarding extensive use of herbicides in the area. Unfortunately there has been no research done to demonstrate the present situation of herbicide use and exposure in maize farmers. Therefore, the purposes of this study were to provide the general and background information of maize farmer and to evaluate the knowledge, attitude, and practices (KAP) associated with herbicide used and exposure among maize farmers in Namtok sub-district, Nanoi district, Nan province, Thailand.

MATERIALS AND METHODS

Both quantitative and qualitative methods were used in this study. The quantitative investigation was a cross-sectional study through face to face interview with questionnaire. The target population was the maize farmers in Namtok subdistrict, Nanoi district, Nan province. Of 603 households in the Namtok subdistrict, 555 of them owned maize farm and had family members working on the maize farms (Namtok Sub-district Administrative office., 2008). One subject from each household was chosen based on direct exposure to herbicides through loading, mixing, and spraying. A questionnaire, which was adopted from relevant studies, was administered to the subjects by a member of the research team. To evaluate the clarity of the questionnaire, the questionnaire was pre-tested on thirty maize farmers with similar occupations and living conditions in the Santa sub-district one month before the study began yielding the reliability score of 0.79. The questionnaire was then modified according to their feedbacks.

The questionnaire was divided into five sections. Section one was to collect data on general background. Section two collected data on weeds, pests, and pesticides. Section three evaluated the farmer's knowledge and health effect of herbicide use andexposure and prevalence of Personal Protective Equipments (PPEs) using. Section 4 comprised of 14 Likert-scale type of questions to assess attitude towards herbicide use (Likert, 1932). Section 5 comprised of 21 questions to address herbicide use practice. Those questions were divided into positive and negative statements using 3-level ordinal scale.

All data were coded, entered, and analyzed by using the licensed SPSS/PC software version 17. Descriptive statistics were used to describe the general background data. Pearson correlation was used to determine the significance of the association, and interactions among knowledge, attitude, and practices towards herbicide use.

After collecting quantitative data, the qualitative method was conducted in the community by using focus group discussion, in-depth interviews, and participatory observation. These methods were useful to confirm the results which obtained from the quantitative one and to explain the phenomena which could not be explained by the quantitative method.

RESULTS

Of the 555 households that owned a maize farm, 407 participated in the survey. The average age of the subjects was 44 years. Eighty percent were male; 89% were married; and 70% were the head of the household. Sixty percent of the subjects graduated from primary school and 31% earned an income in the range of 200,001-300,000 (6,060-9,090 US$) baht/ household/year. Approximately 61% of maize farmer owned less than 40 rais (15.87 acres) of land. The types of work that subjects carried were as follows: land reclamation (15%), sowing (15%), fertilizer application (17%), pesticide spraying (16%), harvesting (17%), milling and packing (13%), and distribution and sale (6%) (Table 1).

The problems of maize production were insect (95.0%), weed (90.2%), and blight (80.1%). Popular chemicals used during maize growing were paraquat (60.9%) and glyphosate (39.1%). Herbicide application practices were spraying by themselves (78.9%) and employing other workers to spray (21.1%). Sixty-four percent of the subjects never experienced symptoms during or after herbicide application. Subjects who experienced few symptoms (30%) often had headaches, fatigue, dizziness, loss of appetite with nausea, stomach cramps, tearing, and throat irritation. Moderate symptoms (7%) included nausea, vomiting, blurred vision associated with excessive tearing, shivering, cramps, hyperventilation, nervousness, contracted pupils, excessive sweating, and salivation. When subjects experienced symptoms from herbicide application, the health center was the most commonly-used place to seek for treatment and the radio was the main source for herbicide information. When asked "Have you ever screened for cholinesterase since last year", 75% of maize farmers answered "no".

Table 1. Social and demographic characteristics of maize farmers (n = 407)

Characteristic	No.	%
Land Owner		
≤ 40 rai	249	61.2
41 – 80 rai	150	36.9
≥ 81 rai	8	2.0
Farm-related Problem*		
Weed and pest outbreaks	322	18.6
Lack of water	260	15.0
Degenerated soil	323	18.6
Decrease in agricultural product process	374	21.6
High price of fertilizers and pesticides	376	21.7
Lack of knowledge of culture	79	4.6
Activities related of maize production*		
Land reclamation	338	15.2
Sowing	350	15.8
Applying fertilizer	372	16.8
Spraying herbicides	357	16.1
Harvesting crops	374	16.9
Milling and packing crops	297	13.4
Distribution and sale	131	5.9

*Question had multiple choices, ** 1 acre = 2.471 rai

Table 2. Distribution of herbicide knowledge, attitude, and practice level

List of content	No.	%	Pearson correlation (p<0.05)
Knowledge level			Knowledge & Attitude (r = 0.37)
Low (≤ 59%)	22	5.4	
Moderate (60% - 80%)	187	45.9	
High (≥ 80%)	198	48.6	
Attitude level			Attitude & Practice (r = 0.20)
Positive Attitude(52-70)	316	69.3	
Neutral Attitude(33-50)	90	30.5	
Negative Attitude(14-32)	1	0.3	
Practice level			Knowledge & Practice (r = 0.24)
Good practice	382	93.9	
Fair practice	25	6.1	

Knowledge, Attitude, and Practice of herbicide use and exposure

Almost half of farmers participated in the study (48.6%) had high level of knowledge, followed by 45.9% and 5.4% of them having moderate and low level of knowledge, respectively. Most of farmers (69.3%) had positive attitude towards herbicide use and exposure, followed by 30.5% and only 0.3% of them having neutral and negative attitude, respectively. For the practice aspect, it was shown that almost all of study participants had good level of practice with only 6.1% having fair level of practice. There were positive, statistically significant associations determined among knowledge and attitude, knowledge and practice, and attitude and practice ($p<0.05$) (Table 2). The results from the qualitative method, by the participatory observation, revealed that in the real situation when the maize farmers applied herbicide to the maize field such as mixing, loading and spraying, they did not use the personal protective equipment such as no glove, no mask, and no goggle all the time. Moreover, some maize farmers used PPEs improperly such as using

a wool hat instead of mask and goggle. That was because they thought it was sufficient protection. These results were contrary to the results that obtained from face to face interview, especially in the practice part. We also found the reason why some farmers did not used PPEs at all and some used PPEs improperly from the focus group and in-depth interview. It was because they did not feel comfortable using PPEs while they were applying herbicide, for example, not comfortable to pick or hold the equipment while wearing gloves during mixing, loading, and spraying herbicide; not comfortable to breathe and to see while they wearing mask and goggle during spraying in the maize filed. In addition, good quality PPEs were expensive and were difficult to buy.

DISCUSSION AND RECOMMENDATIONS

The majority of maize farmers had moderate and high knowledge level due to many reasons. Some plausible answers are, for example, new communication and information technology helps people to be more accessible to the necessary information about herbicide, increase in literacy of the farmers to read and gain knowledge about herbicide from the product label. Almost 70% of maize farmers had positive attitude towards herbicide use and exposure. They had good level of appropriate practice on herbicide use and exposure. Moreover, the associations among knowledge, attitude, and practice were significant. Results similar to ours have already been reported in other areas, both in Thailand and abroad. In Rayong province, a study to evaluate knowledge, attitude, and practice among durian growers reported high levels of knowledge, positive attitude and practice of pesticide use and exposure. There was also significant association between knowledge and attitude (Rampai, 1996). In Chiang Mai, an assessment of KAP was done among Hmong vegetable grower (Teradate and Prasert, 1998). They reported that 47.1 % of vegetable grower had moderate level of knowledge in pesticide application, 76.0% had moderate level of attitude towards pesticide application and 63.6 % had high level of practice of pesticide application. Similarly, there were significant associations among knowledge, attitude, and practice. In Ubonratchathani Province, the assessment of the level of knowledge, attitude and practice of using PPEs in chilli-growing farmers in Hua Rua sub-district, Muang district was conducted by using the standardized questionnaire with face to face interviewing among 330 chilli-growing farmers (Saowanee N, 2009). The results showed that approximately 53% of participants were male and 39.6% of them aged between 31-40 years old. 71.2% of them finished primary school education. Most of them owned the land plots where they worked. The association among knowledge, attitude, and practice were alsostatistically significant. For the dissimilar results, in Vietnam, a study on knowledge, attitude and practice on using PPEs among rattan craftsmen was conducted by a cross-sectional study through face to face interviews (Truong., 2008). They reported low levels of knowledge, positive attitude and practice of using PPEs. There was, however, a significant association between knowledge and attitude.

This study found that the majority of maize farmers had high level of knowledge, positive attitude, good practices with significant associations among knowledge, attitude, and practice. A few maize farmers, however, still had moderate degree of signs and symptoms of herbicide poisoning. Therefore, the cross checking needed to be conducted through the qualitative methods including in-depth interview, focus group discussion and participatory observation. The important results in the real situation were that when the maize farmers applied herbicides such as mixing, loading and spraying, in the maize field, almost all of them did not use the PPEs. The reason for not wearing gloves, mask and goggle given to interviewers was that PPEs caused discomfort, particularly while working in hot weather which occurred frequently in this region. Additionally, we also found some maize farmers who used PPEs improperly such as using a wool hat which was more like a rubber hat instead of mask and goggle. That was because they thought it was enough to protect. These results were opposite to the results that obtained from face to face interview, especially in the practice part. Therefore, the educational programs and legislation to promote the safer use of herbicide, application of PPEs and risk communication are necessary to continuously decrease their risk of herbicides exposure and increase awareness of health effects.

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