Environment & Ecology 29 (3) : 1104—1108, 2011
 ISSN 0970-0420

Assessment of Farmer's Knowledge about Safe Usage of Pesticide

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Abstract

Humans are exposed to pesticides, found in environmental media (soil, water, air and food) by different routes of exposure such as inhalation, ingestion and dermal contact. Being the principle polluters and victims of pollution, farmers are at the top of this risk. Knowledge of agrochemical use is a key to understanding how to take sensible precautions against health hazards. With the aim to assess the knowledge about safe use of pesticides, a cross-sectional study was conducted in five villages of district Gurdaspur. Study tool used was questionnaire containing 20 items; 185 farmers responded to the questionnaire. The analysis of data revealed mean knowledge score for the farmers was 12.80. Results revealed that significant negative correlation was established between knowledge score and age of respondents. Similarly positive correlation was found between knowledge score and education status. Knowledge about safe use of pesticides significantly depends upon training received by farmers and poisoning history of farmers. Specific seminars and practical training of the farmers regarding pesticide usage and its health impacts is needed to bring about changes in the agricultural practices in India.

Key words : Environmental cost, Health cost, Pesticide knowledge, Pesticide safety.

Ever since the dawn of civilization, one of the main tasks in which human beings have been engaged is securing relief from hunger. Green revolution of 1960 has given reasonable hope for the country being self sufficient in the production of adequate food for feeding its teeming human population (1). Green revolution was impossible without the introduction of pesticides. All over the world, the use of pesticides is considered to be the most attractive method of controlling pests as it involves less labor and makes possible a higher output per hectare of land. Out of the total consumption of pesticides in India, 80% are in the form of insecticides, 15% are herbicides, 1.46% are fungicides and less than 3% are others (1). Punjab (6,972 MT) is the second highest consumer of pesticides in India (2). Lack of knowledge about the right use of pesticide not only results in negative public perception but it also has adverse impact on Nation's economy and agricultural growth. However, exposure to pesticides both occupationally and environmentally causes a range of human health problems. Being the principle polluters and victims of pollution, farmers are at the top of this risk. The World Health Organization (WHO) and the United Nations Environment Program estimate pesticide poisoning rates of 2—3 per minute, the majority in developing countries (3, 4). It is estimated that nearly 10,000 deaths occur annually due to use of chemical pesticide worldwide, with about three-fourths of these occurring in developing countries (5). A vast majority of the population in India (56.7%) are engaged in agriculture and are therefore exposed to the pesticides used in agriculture (1, 6). Pesticides being used in agricultural tracts are released into the environment and come into human contact directly or indirectly. Humans are exposed to pesticides, found in environmental media (soil, water, air and food), by different routes of exposure such as inhalation, ingestion and dermal contact. Exposure to pesticides results in acute and chronic health problems. These range from temporary acute effects like irritation of eyes, excessive salivation to chronic diseases like cancer (7). Exposure to even small doses of these dangerous pollutants during fetal stage can cause losses to human life (8). Knowledge of agrochemical use is a key to understanding how to take sensible precautions against health exposure (9). Health problems can be prevented if pesticides are used safely and basic precautions are taken. A wise use of pesticides can contribute to a more sustainable agricultural production and can

Table 1. Demographic characteristics of sample.

Characteristics	Number	Percentage
Age		
15—25	17	9.2
26—35	39	21.1
36—45	57	30.8
46—55	49	26.5
55—65	23	12.4
Educational Level		
Illiterate	44	23.8
Primary	50	27.0
Middle	15	8.1
High	34	18.4
Senior secondary	16	8.6
Graduate	26	14.1
Farm Size		
Small (<2 ha)	72	38.9
Medium (2—10 ha)	84	45.4
Large (>10 ha)	29	15.7
Training		
Yes	35	18.9
No	150	81.1
Pesticide Poisoning History		
Yes	12	6.5
No	173	93.5

Table 2. Mean score of respondents by various demographic characteristics.

Characteristics	Mean s
Age	
	12.23
15—25	13.84
26—35	13.07
36—45	12.28
46—55	11.91
55—65	12.80
Educational Level	
Illiterate	11.61
Primary	12.34
Middle	12.40
High	14.02
Senior secondary	13.31
Graduate	14.04
Farm Size	
Small (<2 ha)	12.33
Medium (2—10 ha)	13.07
Large (>10 ha)	13.51
Training	
Yes	15.17
No	12.25
Pesticide Poisoning History	
Yes	15.66
No	12.60

avoid a lot of the possible negative side effects. Good health and productive agriculture are important in the economy of any nation especially in the fight against poverty. There is a dearth of studies related to these issues in India. These studies emphasized that the health and environmental exposure of pesticides can be partially avoided by adequate information regarding health effects and pesticide safety measures. A clear understanding of farmer's knowledge about safety issues is central to inform policy makers to develop environmental and health cost reduction strategy. Therefore, we undertook a study among the farmers of Punjab to look into the various aspects of pesticide usage in agriculture and its impact on environment and human health. This study is designed to assess farmer's basic knowledge of pesticide use and safety issues, so that policymakers can easily make out challenges and gaps and then focus on the capacity building efforts accordingly.

Methods

Study of Population

Study area was District Gurdaspur in Punjab, India. The technique of stratified random sampling was used to obtain cross-sectional data for this study. Five villages were selected randomly, one village from each of five Tehsils of district Gurdaspur, Punjab. Total sample size was 185 farmers, 37 from each village. All participants were interviewed; aim and any uncertainty was explained and questionnaires were distributed.

Survey Instrument

Based on a comprehensive review of the literature, 20 true/false/cannot say type questions were designed. Of these 20 statements, 12 were worded positively and eight were worded negatively. The questionnaire was adapted to the local language i.e.

Table 3. Correlation : Knowledge score age. *, Correlation is significant at the 0.05 level (2-tailed).

		Score	Age
Score	Pearson correlation	1	-0.161*
	Sig (2-tailed)		0.029
	N	185	185
Age	Pearson correlation	-0.161*	1
	Sig (2-tailed)	0.029	
	N	185	185

Table 4. Correlation : Knowledge score and education status. **, Correlation is significant at the 0.01 level (2-tailed).

		Score	Education
Score	Pearson correlation	1	0.343**
	Sig (2-tailed)		0.000
	N	185	185
Education	Pearson correlation	0.343**	1
	Sig (2-tailed)	0.000	
	N	185	185

Punjabi and designed in a simple way to make it easy for the selected farmers to read and complete. The questionnaire was tested for content validity. A pilot study was done to test the various areas of the questionnaire. It was written in two pages including the cover page that contains purpose of study and researchers' name. Questionnaire was in two sections : The demographic profile and statements regarding pesticide safety. In the first section demographic information about age, education, land holding, training, and history of pesticide encounter was obtained. The second section was presented in a series of statements on a three point scale of (yes, no and cannot say). Questionnaires were hand distributed to farmers.

Analysis

After analyzing the responses, a score of 1 was given for the correct answer and 0 for other answers (wrong, missing or "cannot say" answers). Each blank space was considered a missing value. The maximum score that any respondent could obtain, if all the responses were correct, was 20. The knowledge portions of the data were scored and assessed as percentage scores. Data were analyzed using the Statistical Package for Social Science (SPSS) software version 16. Descriptive statistics were used to run for frequencies, mean, median and standard deviation. The Pearson Product-moment correlation coefficient was used to describe the relationship between two variables in a linear fashion. Chi-square analysis was used to statistically analyze bivariates of nominal versus interval data. A P value of <0.05 was considered significant.

Table 5. Chi-square tests : Knowledge score training status. (a) 13 cells (54.2%) have expected count less than 5. The minimum expected count is 0.19.

	Value	df	Asymp sig (2-sided)
Pearson Chi-square	63.816a	11	0.000
Likelihood ratio	59.612	11	0.000
Linear-by-linear Association	36.717	1	0.000
N of valid cases	185		

Table 6. Chi-square tests : Knowledge score poisoning history. (a) 14 cells (58.3%) have expected count less than 5. The minimum expected count is 0.06.

	Value	df	Asymp sig (2-sided)
Pearson Chi-square	34.408a	11	0.000
Likelihood ratio	28.753	11	0.002
Linear-by-linear Association	315.962	1	0.000
N of valid cases	185		

Results and Discussion

Profile

All the farmers surveyed, were male, because men are normally involved in pesticide application. Age of respondents ranged from 18 to 65 years. Most of the farmers (30.8 and 26.5%) were in the age groups of 36—45 and 46—55 respectively. Maximum respondents (27%) have primary education. 23.8% of the respondents were illiterate, whereas 18.4% has completed high school; 14.1% of respondents were graduates; 20% farmers got training on safe use of pesticide; 45.4% of respondents own medium farms (2—10 ha) while 38.9% and 15.7% of respondents have small (<2 ha) and large farms (>10 ha) respectively; 6.5% of farmers faced pesticide poisoning sometimes in their life. Socio-demographic profile of sample is given in Table 1.

Table 7. Correlation : Knowledge score and farm size. *, Correlation is significant at the 0.05 level (2-tailed).

		Score	Land
Score	Pearson correlation	1	0.174*
	Sig (2-tailed)		0.018
	N	185	185
Land	Pearson correlation	0.174*	1
	Sig (2-tailed)	0.018	
	N	185	185

Table 8. Knowledge test items with more than 80% correct responses.

Items	Percent of correct responses (N)
If farmer has wound, he should not go for spray	95.6 (177)
Pesticides pose few health risks to children	91.8 (170)
It is better to spray in morning	90.2 (167)
If products enter body, severe health problems can occur including death	85.4 (158)
Face must be covered by cotton cloth or mask	81.6 (151)

Table 9. Knowledge test items with less than 50% correct responses.

Items	Percent of correct responses (N)
Wearing goggles in field is merely show off	32.4 (60)
It is okay to re-enter the field within few hours of spray	36.2 (87)
It is okay to use pesticide containers for domestic purpose	39.4 (73)
It is good to spray in shorts, short sleeve	42.7 (79)
It is okay to blow or suck by mouth to blocked nozzle of spraying equipment	44.8 (83)
Chemicals (pesticides) used in fodder can enter milk	48.1 (89)

Scores

The knowledge score that was obtained by the respondents ranged between 6 and 17 with a mean of 12.80, median 13 and standard deviation of 2.565. Mean score of respondents of age group 26—35 was highest (13.84) while of age group 56—65 was lowest (11.91). Regarding impact of education, on average, a farmer having primary education has 0.73 higher scores, compared to illiterate farmers. Respondent having high education has 1.68 higher scores compared to respondent having primary education. While graduates performed much better by getting 2.43 higher score compared to uneducated farmers and 0.01 higher score than farmers having high education. Farmers who got training in some form, despite less in number performed much better by scoring 2.92 higher than others. Respondents having large farms scored 0.44 higher than respondents having medium farms and 1.18 higher than respondents having small farm. The farmers who faced pesticide poisoning in their life scored 3.06 higher than others. Mean scores by various demographic characteristics are given in Table 2.

Relationship Between the Farmers' Age and Their Pesticide Safety Knowledge

Correlation for knowledge score and age was found as (e= -0.161, P= < 05, where P = 0.029) (Table 3). The P-value is less than the alpha value i.e. $P < .05$. Therefore, we can reject the null hypothesis showing that there is significant relationship between farmers' age and knowledge. Significant negative correlation between age and score indicates that knowledge level decreases with age.

Relationship Between the Farmers' Qualification and Their Pesticide Safety Knowledge

Significant positive correlation was found between education level and knowledge score ($r = 0.343$, $P < .05$, where $P = 0.00$). This suggests that knowledge level increases with increase in education level (Table 4).

Association Between Knowledge Score and Training got by Farmers

Chi-square test was applied to find out the association between knowledge score and training status. From the output in Table 5, it can be concluded that farmers' knowledge depends significantly on training status ($\chi^2 = 63.816$, $P < 0.05$, where $P = 0.00$). Furthermore, the minimum expected cell frequencies is 19 which is greater than 5; which means one of the main assumptions of chi-square has not been violated.

Association Between Knowledge Score and Pesticide Poisoning History

Table 6 reveals that there is significant association between knowledge score and pesticide poisoning history of farmers ($\chi^2 = 34.408$, $P < 0.05$, where $P =$

0.00). This shows that farmers' knowledge score depends upon pesticide poisoning encountered by farmer. Furthermore, the minimum expected cell frequencies for training status is 6 which is greater than 5; which means one of the main assumptions of chi-square has not been violated.

Relationship Between the Farm Size and Their Pesticide Safety Knowledge

Significant positive correlation was found between farm size and knowledge score ($r = 0.174$, $P < 0.05$, where $P = 0.18$). This suggests that knowledge level increases with increase in land holding (Table 7).

Most Correct and Least Correct Responses

The most common form of knowledge was the avoidance to spray if farmer has wound (95.6%) followed by health risk to children from pesticides (91.8%); 90.2% farmers prefer spraying pesticide in morning. Table 8 highlights the most correct responses. Six knowledge statements had a response rate lower than 50%; 67.6% of respondents consider no need of goggles while spraying pesticides; 63.8% of respondents consider that there is no harm in visiting field after sometimes of spraying pesticide. Knowledge statements with less than 50% correct answers are given in Table 9.

Conclusion

The results reveal that educated and trained farmers in our sample performed significantly better. Knowledge about safe usage of pesticides also depends upon age, farm size and poisoning history. However, the study did not take into consideration of more complex aspects of the work safety environment. Misuse of pesticide is often the result of ignorance which can only be dealt with education and training. Specific seminars and practical training of the farmers regarding pesticide usage and its health impacts is needed to bring about changes in the agricultural practices in India. Health education programs should be implemented to update the farmers with knowledge about the prevailing health problems. Farmers' information and knowledge about pesticides are central in providing a sound base for environmental and health cost reduction strategy.

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