TRAINING NEEDS OF FRUIT GROWERS REGARDING PESTICIDE USE FOR SUSTAINABLE ENVIRONMENTAL HEALTH IN PUNJAB

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The purpose of this study was to assess the training needs of the respondents with evaluation of their knowledge and skill towards different aspects of pesticides use in fruit pest protection. Their level of knowledge and skill about various aspects of pesticide use was indicated by the responses they gave during interview. The level of knowledge and skill about different aspects of pesticide use was determined to find out the gap between respondents' possessed levels and the desired standard levels. Improving this gap of knowledge and skill with provision of proper training in various assessed aspects of pesticides will provide a base to have safe pesticide practices for a healthy environment. The level of education (qualification), holding land size and spraying experience of the respondents had a significant role for better recognition (knowledge) in different aspects of pesticide use. It was revealed that good level of knowledge in different aspects of pesticide use led towards a better response in gaining the perfect skill. It was only the well skilled person who could lead ideal practices in the use of pesticides. The perfect skills could only be achieved by an appropriate training programme implementation. So the training needs assessment was the basic step towards ideal practices in pesticide use for a sustainable environmental health.

Keywords: Orchards, pesticide use, hygiene and sanitation, protective accessories, training needs, fruit growers.

INTRODUCTION

The Punjab province of Pakistan is the land of 5-rivers, population-wise the largest, and once known as the granary of east. The Punjab is called the lifeline of Pakistan. All the major rivers of the country namely Indus, Jhelum, Chanab, Ravi, & Sutluj flow through this province (Wikipedia, 2005). The Punjab province is playing a leading role in agricultural production. It contributes about 68% to annual food grain production in the country. The agriculture sector absorbs 42.1 % of the total workforce and it contributes 34 % in national economy of Pakistan. Pollution levels in the Punjab's most populated cities are among the highest in the world and climbing; causing serious health issues (Govt. of Pakistan, 2006).

Pakistan is one of those countries in Pacific Asia, which produces and exports the best quality of fruits (Wasim, 2005). Pesticides of various kinds have been widely used on fruit and fruit orchards in the Punjab for the last 30 years. These pesticides were usually organophosphates, carbamates and to much extent organochlorides (Abegaz, 1985). Some pesticides that were restricted and banned in industrialized countries were used in many third-world countries (Wessling, *et al.,* 1997). The health hazards associated with pesticide handling were little understood by the fruit growers in the Pakistan. The communities living around the fruit farms might also be unaware of the pesticidal health hazards. However, it was known that extensive use of pesticides on fruits had adverse effects on health (Lakew and Mekonnen, 1998; Wolf, *et al.,* 1999), and gradually contaminates the soil, water and surrounding environment (WHO, 1984; Clarke, Levy and Spurgeon, 1997). Fruit growers' knowledge towards the health hazard of pesticides had not been well assessed in the Punjab. There was a great concern that fruit farm workers and owners should be aware of the adverse effects of pesticide use if not handled properly. In this paper, an effort is made to assess the actual needs of fruit growers which is the gap between existing level and desired standards (Compton, 1984). The data are presented regarding the perceived level of present knowledge and skill of fruit growers on different aspects of pesticides use in the Punjab and a training programme based on the assessed needs will be suggested to minimize the hazards of health and environment.

MATERIALS AND METHODS

The study was conducted in Punjab Province which has 14 top fruit growing districts out of 35 districts (PHDEB, 2005). These districts are divided into three production zones viz. Southern Zone, Central Zone and Northern Zone (PARC, 2004). The Southern Zone was famous for mangoes production; consist of

fruit producing districts Multan, Muzafargarh, Bahawalpur, RahimYar Khan, Dera Ghazi Khan. The Central Zone was important for guava production and consists of districts Toba Tek Singh, Faisalabad, Sheikhupura, Kasur and Northern Zone was prominent for citrus production and consists of districts Gujranwala, Sargodha, Mianwali, Khushab, and Chakwal (PHDEB, 2005). The fruit growers were spread in three fruit production zones of the Punjab province and due to prevailing limitations, this study was conducted in three randomly selected districts i.e., one district from each fruit growing zones of the Punjab. The randomly selected three districts were Multan from Southern Zone, Sheikhupura from Central Zone and Sargodha from Northern Zone.

The population of this study comprises all fruit growers in the Punjab Province of Pakistan. According to an estimate (Govt. of Pakistan, 2004) there were 0.141 million fruit growers in the Punjab. The sample size from this population was determined by using Fitzgibbon (1987) technique. The sample size consisted of randomly selected (using multistage random sampling technique) 384 fruit growers. Face to face personal interview were conducted to acquire the data regarding the study.

The aim of the study was explained to the fruit growers who had consented to take part in the study. The researcher developed the interview schedule by adopting statements from the similar studies whereas some statement of the interview schedule were developed by the researcher using insights gained from the review of the literature, key informant interviews and discussion with the faculty at the University of Agriculture, Faisalabad.

The statistical techniques used to achieve the objective of the study included frequency distribution and percentages among the important variables. Respondent's level of knowledge and skill were measured on different aspects of pesticide use, using Likert scale (1= V.Poor; 2= Poor; 3= Satisfactory; 4= Good; 5= Excellent) and were reported as mean ( ) and standard deviation (SD).

RESULTS AND DISCUSSION

The data regarding the demographic characteristic of the respondents are presented in the table 1. It can be concluded from the data in this table that the age of the fruit growers ranged from 21 to 60 years and majority of them (68.2 %) were in the age of 31 to 50 years. There were 37.0 % illiterate respondents and 22.9 % educated up to primary level. Majority of the respondents (82.3 %) were married and 61.7 % of them were living with a family size of 6-10 members. The income source of 79.4 % respondents was farming and 71.0 % were cigarette and Huqqa smokers. There were only 10.2 % of the fruit growers having land size above 25 acres or having fruit production experience more than 10 years were only 18.5 %. There were 50 % growers who worked as tenants and 23.7 % were having spraying experience of above 5 years. The respondents having fruit orchards with only one kind of trees pattern were 30.7 %, whereas 39.9 % were having mixed pattern of fruit plants and 29.4 % were having orchards of fruits mixed with other crops.

Table 1. The demographic characteristics of the respondents

Demographic features	n (%)
Age (Years)	
21-30	83 (21.6)
31-40	146 (38.0)
41-50	116 (30.2)
51-60	39 (10.2)
Qualification	
Illiterate	142 (37.0)
Primary	88 (22.9)
Matric	67 (17.4)
Intermediate	48 (12.5)
Graduate and above	39 (10.2)
Marital status	
Single	45 (11.7)
Married	316 (82.3)
Widowed	23 (6.0)
Family size (Person)	
	71 (18.5)

1-5 6-10 11-15	237 (61.7) 76 (19.8)
Source of income Farming Farming + Employment Farming + Private business	 305 (79.4) 48 (12.5) 31 (8.1)
Smoking habit Smokers Non smokers	 276 (71.0) 108 (28.1)
Size of land holding (acres) <12.5 12.5-25 > 25	 160 (41.7) 130 (33.9) 94 (10.2)
Fruit production experience (in years) < 5 5-10 >10	 160 (41.7) 144 (37.5) 71 (18.5)
Experience as a sprayer (in years) <1 1-5 >5	 136 (35.4) 157 (40.9) 91 (23.7)
Status of farm ownership Owners Owner-cum-tenant Tenant	 64 (16.7) 128 (33.3) 192 (50.0)
Planted fruit trees pattern Only one kind Mixed fruit plants Fruit cum other crops	 118 (30.7) 153 (39.9) 113 (29.4)

The respondents were asked to rank their knowledge regarding various aspects of pesticides on Likert scale (1= V.Poor; 2= Poor; 3= Satisfactory; 4= Good; 5= Excellent). The data concerning the knowledge level of the respondents regarding pesticide and their use have been presented in table 2.

The data given in table 2 depicts that the mean level of knowledge regarding various aspects of pesticides ranged from a minimum ( ) of 2.40 to a maximum ( ) of 2.95 which concludes that on an average the

Table 2. Means, standard deviations and rank order of the knowledge level of the respondents regarding pesticide use

Aspects of pesticide use	V. Poor n (%)	Poor n (%)	Satisfactory n (%)	Good n (%)	Excellent n (%)		SD.	Rank order
Pesticide granules applicator	0(0.0)	178(46.4)	95(24.7)	64(16.7)	47(12.2)	2.95	1.06	1
Spraying machine nozzles	95(24.7)	94(24.5)	108(28.1)	50(13.0)	37(9.6)	2.58	1.26	2
Recognition of fruit pests	103(26.8)	98(25.5)	92(24.0)	55(14.3)	36(9.4)	2.54	1.28	3
Pesticides as environmental pollutant	110(28.6)	105(27.3)	68(17.7)	60(15.6)	41(10.7)	2.52	1.33	4
Measures to be taken in case of poisoning	102(26.6)	112(29.2)	82(21.4)	52(13.5)	36(9.4)	2.50	1.27	5
Use of personal protection accessories	113 (29.4)	100(26.0)	78(20.3)	56(14.6)	37(9.6)	2.49	1.31	6
Pesticides entry in human body	112 (29.2)	106(27.6)	74(19.3)	52(13.5)	40(10.4)	2.48	1.32	7
Pest control methods	111(28.9)	94(24.5)	100(26.0)	47(20.2)	32(8.3)	2.47	1.26	8
Safety measures in pesticide transportation	114(29.7)	93(24.2)	105(27.3)	30(7.8)	42(10.9)	2.46	1.29	9
Pesticide spraying machines	117(30.5)	102(26.6)	80(20.8)	45(11.7)	40(10.4)	2.45	1.31	10
Reuse of remaining pesticides	116 (30.2)	104(27.1)	80(20.8)	48(12.5)	36(9.4)	2.44	1.29	11
Pesticide label instructions	120 (31.3)	104(27.1)	74(19.3)	48(12.5)	38(9.9)	2.43	1.31	12

respondents' knowledge regarding pesticide was rated between poor to satisfactory level. The aspects of pesticides regarding which respondents had lowest level of knowledge (from 2.40 to 2.45) were the disposal of empty pesticide containers, pesticides residue existence, pesticide label instructions, reuse of remaining pesticide material, and pesticide spraying machines. The respondents' knowledge (from 2.46 to 2.49) was found below satisfactory level regarding the safety measures required in pesticide transportation, pest control methods, pesticides entry in human body and use of personal protection accessories (PPA). The aspects of pesticides regarding which respondents possessed highest level of knowledge (from 2.50 to 2.95) were measures to be taken in case of pesticide poisoning, pesticides as environmental pollutant, recognition of fruit pests, nozzles of spraying machine, and pesticide granules applicator.

The knowledge of the respondents regarding specific pest awareness and pest control methods enables farmers to choose an effective treatment and also the choice of limiting their exposure to potentially harmful control methods. The results of the study indicates that the majority of respondents had not the good knowledge level of specific fruit pests as well as pests control methods which was the main reasons not adopting the normal dose of pesticides. The similar results were reported by Imran (1991) that lack of awareness to recognize specific pest was the most important reason to use pesticides carelessly. The similar findings were reported by Hurting, *et al*., (2003) that for specific pest control there was need to improve the knowledge of pest control methods. Hussain (1990) reported that only small numbers of respondents had knowledge of specific pests and diseases to use the recommended chemicals for pest control.

The results of the study regarding respondents' knowledge for pesticide applicators were also supported by report of FAO (1996) which revealed that in Pakistan about 50% of applied pesticides were wasted due to inappropriate knowledge of application and poor spraying machinery. The similar problems were

revealed by Stallen and Lumkes (1990) in their report that poor knowledge of pesticide spraying machines resulting in a waste of pesticides and unnecessary environmental contamination.

The results of study depicts that respondents have the knowledge below satisfactory level regarding pesticide label instructions which is an important measure for safe use of pesticides. Its importance was also revealed by Miller (2004) that labeling pesticides with systems that could be read by the applicator would be an important step in the development of pesticide application advantages. The statement regarding instructions and directions on the label must be read before use was also favored by Smith, Browning and Cartwright, (2005) that all possible precautionary measures must be observed with materials labeled for restricted use.

Use of personal protection accessories (PPA) during pesticide spray has a significant role to protect the sprayers from pesticidal hazards and results of the study reveals that respondents have poor level of knowledge in this aspect of pesticide use. The importance of respondents' knowledge was also supported by Perry, (1995) that personal protection accessories (PPA) include clothing protect farmers from exposure when working with pesticides. PPA consists of equipments used to protect hands, body, respiratory system, head, feet and eyes. The knowledge of using PPA during pesticide handling could significantly reduce pesticide contact with the skin, eyes, mouth and absorption through the lungs. The knowledge of using PPA not only important for dealing with acute toxic pesticides but they were also important when dealing with some products identify as potentially causing chronic health problems. Mekonnen and Agonafir, (2002) also described the similar findings regarding the knowledge of PPA use. The results of the study revealed that the knowledge of using PPA should be improved for better protection from pesticide hazards.

The knowledge about pesticide entry in human body during spray is found poor level and the lack of awareness may cause serious health problems to the sprayers. The similar findings were reported by Dulout (1985) that poisoning occurred through inhalation of pesticide contaminated air and through ingestion. Van der Hoek (1998) also reported that most non-occupational poisonings occurred through ingestion of contaminated food and water. The symptoms of pesticide poisoning were also reported by PIPs, (1998) that pesticide entry in the body caused poisonings with symptoms of cold, flu, sore throat, runny nose, aching limbs, and headache.

Table 3. Prioritizing the training needs based on respondent's level of knowledge regarding different aspects of pesticide use

Statements regarding various aspect of pesticide use	Training Needs	Prioritizing Rank
Disposal of empty pesticide containers	2.60	1
Pesticides residue existence	2.58	2
Pesticide label instructions	2.57	3
Reuse of remaining pesticides	2.56	4
Pesticide spraying machines	2.55	5
Safety measures in pesticide transportation	2.54	6
Pest control methods	2.53	7
Pesticides entry in human body	2.52	8
Use of personal protection accessories (PPA)	2.51	9
Measures taken in case of pesticide poisoning	2.50	10
Pesticides as environmental pollutant	2.48	11
Recognition of fruit pests	2.46	12
Spraying machine nozzles	2.42	13
Pesticide granules applicator	2.05	14

The training needs regarding level of knowledge in different aspects of pesticide application is prioritized in a ranking order. In this table the training needs are assessed by determining the gap between the desired

level of knowledge (5 = excellent level) and presently possessed level of knowledge ( ). Regarding various aspects of pesticides the respective level of training needs is calculated and ranked in table 3.
The self perceived skill levels of the respondents regarding pesticide application was determined on a Likert scale (1= V.Poor; 2= Poor; 3= Satisfactory; 4= Good; 5= Excellent). The data concerning the skill level of the respondents regarding various aspects of pesticide have been presented in table 4.
The data given in table 4, reveals that the mean level of skill regarding various aspects of pesticide use ranged from a minimum of 2.40 to a maximum of 2.51. It concludes that on an average the respondents' skill regarding pesticide was rated between poor to satisfactory level. The aspects of pesticides regarding

Table 4. Means, standard deviations and rank order of the skill level of the respondents regarding pesticide use

Assessment of the skill	V. Poor n (%)	Poor n (%)	Average n (%)	Good n (%)	Excellent n (%)		SD	Rank order
Wearing of personal protection accessories	109(28.4)	100(26.0)	87(22.7)	47(12.2)	41(10.7)	2.51	1.31	1
Calibration of spraying machine	104(27.1)	103(26.8)	93(24.2)	48(12.5)	36(9.4)	2.50	1.27	2
Mixing, loading and handling the pesticides	106(27.6)	124(32.3)	80(20.8)	33(8.6)	41(10.7)	2.42	1.27	3
Calculation of the dose of pesticide	114(29.7)	110(28.6)	82(21.4)	47(12.2)	31(8.1)	2.40	1.25	4

which respondents had lowest level (from 2.40 to 2.42) of skill were the calculation of the dose for a given formulation of a pesticide, and mixing, loading and handling the pesticides whereas the satisfactory level of skill (from 2.50 to 2.51) was determined for calibration of spraying machines and wearing of personal protection accessories (PPA).
The results of the study reveals poor level of skill in the respondents for calculation of dose for a given pesticide formulation and the skill of dose calculation play very important role in safe pesticide practices.
The importance of pesticide dose calculation skill was also reported by Rahman (2004) that changes in application could be related to the dose applied, but might also concern the skill and ways in which a treatment was delivered in terms of parameters such as spray trajectory angle and droplet size distribution.
The results of the study shows the level of skill for mixing, loading and handling the pesticide into a spraying machine was measured below satisfactory in the respondents. The importance of skill for pesticide mixing, loading and handling the pesticide into a spraying machine was described by Murray and Taylor (2000) that skill regarding personal protection during application, safe disposal and storage practices, and mixing of different chemicals need perfection for good practices of pesticide use.
The skill level for wearing the personal protection accessories (PPA) play an effective role in protection of pesticidal health hazards. The results of the study regarding skill of PPA wearing are similar with Yassin, *et al.,* (2002) that most farm workers were aware of the protective measures to be used during applying pesticides.
The training needs regarding level of skill for different aspects of pesticide application is prioritized in a ranking order. The training needs are assessed by determining the gap between the desired level of skill (level 5 = excellent) and presently possessed level of skill ( ). Regarding various aspects of pesticides the level of training needs for skill is calculated and ranked in table 5.

CONCLUSIONS

It is concluded that majority of the fruit growers were middle aged, literate, married, smokers, having farm size of <12.5 acres and most of them had spraying experience less than 5 years. On the Likert scale 1-5 the respondents had mean levels of knowledge regarding various aspects of pesticides ranging from 2.40

based on respondents' level of skill regarding different aspects of

sticide use	Training Needs	Priority Rank
	2.60	1
es	2.58	2
e	2.50	3
s(PPA)	2.49	4

Training needs of fruit growers

to 2.95. Their mean levels of skill regarding pesticide application ranged from 2.40 to 2.51 on the same scale.

It can be concluded that there is a very frustrating state of affair concerning the current position of fruit growers' knowledge and skills related to pesticide handling and application. To avoid the pesticidal health hazards, fruit growers need training in all aspects (knowledge and skill) identified in the study instruments. It is therefore, recommended that the Govt. of the Punjab should plan and conduct training sessions of fruit growers regarding safe use of pesticides. The training session may be conducted in collaboration with the local governments and agricultural colleges/universities.

REFERENCES

Abegaz, G. 1985. The rate of chemical use in development and their impact on the environment. SINET Ethiop J Sci; 6.

Clarke, E.E.K., L.S. Levy and A. Spurgeon. 1997. The problems associated with pesticide use by irrigation workers in Ghana. Occup Med; 47: 301–308.

Compton, J.L. 1984. Extension Programme Development In Swanson (Ed.) Agricultural Extension: A Reference Manual. FAO. Rome, Italy.

Dulout, F.N. 1985. Sister-Chromotide Exchange and Chromosomal Aberrations in a Population Exposed to Pesticides. Mutation Research 143: 237-244.

FAO (Food and Agriculture Organization). 1996. of the United Nations Rome, FAO pesticide management–FAO/OECD pesticide risk reduction survey, in analysis of government responses to the second questionnaire on the state of implementation of the international Code of Conduct on the Distribution and Use of Pesticides.

Fitzggibbon, C. Taylor and L.L. Morris. 1987. How to design a programme evaluation. Newbury Park, C. A: Sage.

Govt. of Pakistan. 2004. Agricultural Census, Agricultural Census Organization. Ministry of Economics Affairs and Statistics. Available at: http://www.stapak.gov.pk/aco/statistics

Govt. of Pakistan. 2006. Economic Survey Report, Finance Division, Economic Advisor's Wing, Islamabad.

Hurtig, A.K., M.S. Sebastian, A. Soto, A. Shingre, D. Zambrano and W. Guerrero. 2003. Pesticide use among farmers in the Amazon Basin of Ecuador. Archives of Environmental Health Apr. (4): 223-228.

Hussain, A. 1990. A study of the extent of adoption of insect/pest and disease control measures in cotton crop in Tehsil Dera Ghazi Khan. M.Sc.(Hons.) Thesis, Dept. of Agri. Extension, University of Agriculture, Faisalabad.

Imran, M.Z. 1991. To determine the effectiveness of various pesticide agencies in the adoption of recommended plant protection measures by the cotton growers of Tehsil Depalpur, District Okara. M.Sc.(Hons.) Thesis, Dept. of Agri. Extension, University of Agriculture, Faisalabad.

Javed, M.T. 1989. A study of productivity differential between large and small farmers in cotton crop. A case study of Bhawalpur District. M.Sc.(Hons.) Thesis, Dept. of Agri. Economics, University of Agriculture, Faisalabad.

Lakew, K. and Y. Mekonnen. 1998. The health status of Northern Omo state farm workers exposed to chloropyrifos and profenifol. Ethiop Med J; 36: 175–184.

Mekonnen, Y. and T. Agonafir. 2002. Pesticide sprayers' knowledge, attitude and practice of pesticide use on agricultural farms of Ethiopia Department of Biology, Faculty of Science, Addis Ababa University, Addis Ababa, Occup. Med. 52(6): 311–315. Society of Occupational Medicine. UK.

Miller, P.C. 2004. Patch spraying: future role of electronics in limiting pesticide use Pest Management Science: 59(5): 566–574 Society of Chemical Industry Publisher John Wiley & Sons, Ltd.

Murray, D.L. and P.L. Taylor. 2000. Claim no easy victories: evaluating the pesticide try's Global Safe Use campaign. World Development, 28: 1735-49.

PARC (Pakistan Agricultural Research Council). 2004. Report; Sub group on cropping pattern of working group on agriculture. PARC, Islamabad.

Perry, R. 1995. Sensor Controlled Orchard Sprayers; Proceedings of the National Conference on Pesticide Application Technology August 1995, Guelph/Canada, pp. 164-171

PHDEB (Pakistan Horticulture Development & Export Board). 2005. Fruit Events Overview: Available at: http://www.phdeb.org/sec_overview/php

PIPs (Pesticide Information Profiles). 1998. ExToxNet. Available at: http://extoxnet.orst.edu/faqs/dietcancer/web4/four.html

Rahman, S. 2004. Farm-level pesticide use in Bangladesh: Determinants and awareness: Agriculture, Ecosystems and Environment: 95(1): 241–252. Available at: http://www.ingentaconnect.com /content/els/01678809

Smith, L., H.W. Browning and B. Cartwright. 2005. Concepts of Pest Management Texas Citrus, Texas Agricultural Extension Service, the Texas A&M University System. Available at: http://www.ento.vt.edu/Fruitfiles/PtdUsage2.html

Stallen, M.P.K. and L.M. Lumkes. 1990. Improving Spraying Techniques for Vegetables in Indonesia; scope and strategy; LEHRI/ATA-395 No. 22, Lembang/Indonesia

Van der Hoek, W. 1998. Pesticide Poisoning: A Major Health Problem in Sri Lanka. Journal of Social Science and Medicine 46 (4-5): 495-504.

Wasim, A. 2005. Fruit export from Pakistan. A report by FAO. Available at: http://www.pakissan.com/ english/agri.overview/fao.report.shtml.

Wessling, C., R. McConnell, T. Partanen and C. Hogstedt. 1997. Agricultural pesticide use in developing countries: health effects and research needs. Int J Health Serv; 27: 273–308.

WHO. 1984. Guidelines for DrinkingWater Quality. Geneva:World Health Organization; vol. 1: 68–76.

Wikipedia, 2005. Available at: http://www.answers. com/library/wikipedia:jsessionid

Wolf, T.M., K.S. Gallander, R.A. Downer, F.R. Hall, R.W. Fraley and M.P. Pompeo. 1999. Contribution of aerosols generated during mixing and loading of pesticides to operator inhalation exposure. Toxicol Lett; 105: 31–38.

Yassin, M.M., T.A. Abu Mourad and J.M. Safi. 2002. Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip Occupational and Environmental Medicine Jun 59 (6): 387-393.