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ASSESSMENT OF FARMERS KNOWLEDGE ON PESTICIDES AND TRAININGS ON PESTICIDE WASTE MANAGEMENT IN CENTRAL PUNJAB – PAKISTAN

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ABSTRACT

Current study was intended to assess the farmers' knowledge and reliance on sustainable use of pesticides. Reduction in pesticide usage is very a simple strategy but it requires systematic programs, management of multiple pests and the variety of tactics to control invasive species. Development of transgenic crops; use of natural enemies and other cultural practices help reducing pesticide usage. Randomly 205 farmers were selected to conduct the study. Data were collected by using a questionnaire during face to face interviews of some 195 farmers. The majority of the respondents did not receive any training on sustainable use of pesticides. The study revealed that training on pest counting helps in sustainable pesticide usage. About 66.7% farmers did not receive any training on alternative pest control methods that clearly indicates their dependency on use of pesticides (chemicals). However, a positive correlation was realized between total number of trainings received by the respondents and their profile (age, education and pesticide using experience). Sustainable usage of pesticides protects crops from harmful insects, pests and diseases; reduces health hazards, minimizes all types of pollutions (Air, soil, water) and farming costs. Policy makers and extension workers should create awareness among farmers on the alternative pest controlling methods and diffuse to meet the objective of the sustainable pesticide uses.

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This paper would capture attention of policy makers, working on sustainable agriculture development. A communication gap was realized among the farmers and the concerns department on alternative pest controlling methods. Diffusion of alternative pest controlling methods and sustainable use of pesticide could be enhanced by organizing educational and training sessions use in study area.

1 Introduction

Agriculture contributes roughly 19.8% towards gross domestic product (GDP) to the economy of Pakistan and provides livelihood to about 42.5% of the rural people (GoP, 2016). On the global level, about 1.8 billion people are associated with agriculture and use chemicals to protect their crops from diseases, insects and pests to ensure food security by realizing healthy crops (Grube et al., 2004). A large number of chemical compounds like fungicides, nematicides, insecticides, molluscicides, rodenticides, herbicides, and plant growth hormones are considered as the pesticides (Xiao et al., 2010). Many studies revealed that in recent years, the use of pesticides have increased by 9% or even more per hectare in most developing countries including Pakistan (Jin et al., 2010; Schreinemachers & Tipraqsa, 2012).

Now-a-days, concern has been growing that improper dispose of the pesticide waste can create serious threats to human and environment (Szadkowska-Stanczyk & Buczynska, 2005). Wastes of Pesticides include materials that is not to be used or will not be used and must be disposed-of. It also includes empty bottles, surplus solution, water used for cleaning equipment, and old pesticide products (Nesheim & Fishel, 2005). Empty containers may have enough unused quantity if they are not rinsed well and could cause serious problems in many situations (Braun et al., 1983; Ntow et al., 2006; Recena et al., 2006). It is possible to make the use of pesticides limited through the careful integration of available pest control techniques that discourage pest population development and keep pesticides and other interventions to the levels that are economically justified, safe for human health, and environment (FAO, 1994). The pest population can be suppressed by implying natural enemies that are eco-friendly and help in yield losses without damaging the environment (Ostman et al., 2003).

Factors like elimination of key pests, invasive species, rapid adoption and widespread planting of transgenic crops and the extensive use of pesticides have altered many agro-ecosystems (Fuchs, 2007; Spurgeon, 2007). A study was conducted under the national project with main objectives of sustainable profitable and environmentally sound production of cotton through the development promotion and practice of alternative pest controlling methods by farmers. The findings of study revealed that about 25% more yield and a net amount of RS 3705 (38.03% profit increase over growers plots) were realized in the plots receiving alternative pest controlling methods (Mallah & Korejo, 2007).

A large number of farmers (10,000) become intoxicated each year through the improper use of pesticides in cotton growing areas of Pakistan. Due to the low knowledge levels on the harmful effects of the exposure to the pesticide, farmers and farm-workers rarely adopt precautionary measures while applying pesticides (Ejaz et al., 2004; Khan, 2012). These negative effects of pesticides can be minimized by focusing more on alternative methods for sustainable crop production and by reducing the use of pesticides.

Farmers of the study are not well aware of alternative pest management approaches and fully relying on the pesticides for sustainable production as they believe that chemicals are the only solution to control insects-pests. In order to popularize the use of alternative methods to control insect-pests and discourage the use of pesticides, it is important to assess the knowledge levels of the farmers on the subject so that meaningful training programs in the discipline be chalked out. Before conducting the actual survey, it was realized in the informal discussions with the farmers that there is an urgent need of training programs in study area (Sahiwal). There is a need to discourage the extensive use of pesticide and help farmers adopting alternative methods by changing farmers' behavior towards chemicals and wipe-off misleading beliefs about employing the alternative methods to control pests. In the situation, it seems imperative to undertake studies to explore the farmer's knowledge and practices on safe guarding the crops and discouraging intensive usage of pesticide. This study would help extension department to develop extension, educational and capacity building programs for the farmers on reducing the use of pesticides.

2 Materials and Methods

2.1 The study area

The study was undertaken in Tehsil Sahiwal, District of Sahiwal, Pakistan. It lies between 30.66^{o}N latitude and 73.10^{o}E longitude, and is 500 ft. (150 m) above sea level (Figure A). District of

Sahiwal administratively divided in two municipalities called tehsil (Tehsil Sahiwal & Tehsil Chichawatni). Each Tehsil is further administratively divided into Union Councils (UCs). District of Sahiwal consists of 81 UCs and approximately 531 villages. In Tehsil Sahiwal, there are 52 UCs and 315 villages whereas 11 UCs fall in urban and 41 in the rural zones.

2.2 Methodology

Descriptive survey method was adopted to determine the effect of trainings on pesticides reduction on crops by the farmers based on proposed objectives. A descriptive survey method was used to collect data as it is known to be an appropriate method for obtaining peoples' perceptions on social issues and facts prevailing in a specific region or location.

Cluster sampling technique was used to obtain the data for this study. One village was selected from each UC through random sampling technique. Then finally five farmers were interviewed from each randomly selected village. To make the study sample, in total 205 farmers were selected from the 41 UCs and interviewed to collect the data for the study purposes. However ten incomplete questionnaires were not included in the study, making the sample size 195.

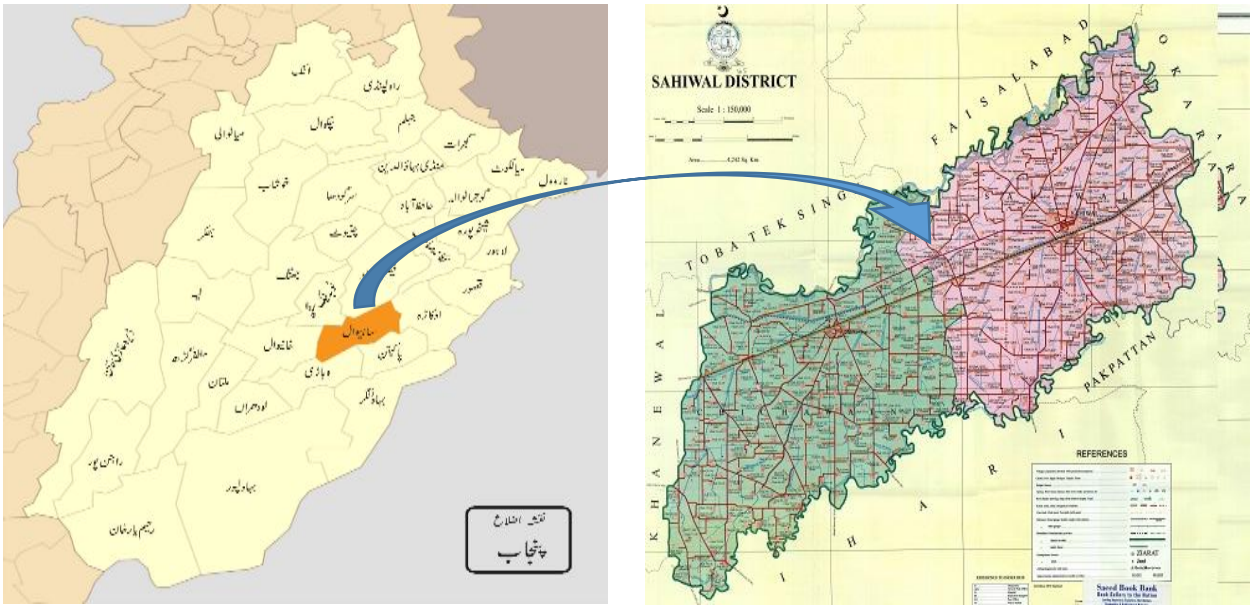
All the collected data were coded, entered into the computer and analyzed by using the Statistical Package for the Social Sciences (SPSS) program. Descriptive statistics such as frequencies, percentages for categorical variables, and Mean sand standard deviation (SD) were used. For dependent variable correlation was employed appropriately to test the significant differences or associations between independent and dependent variables.

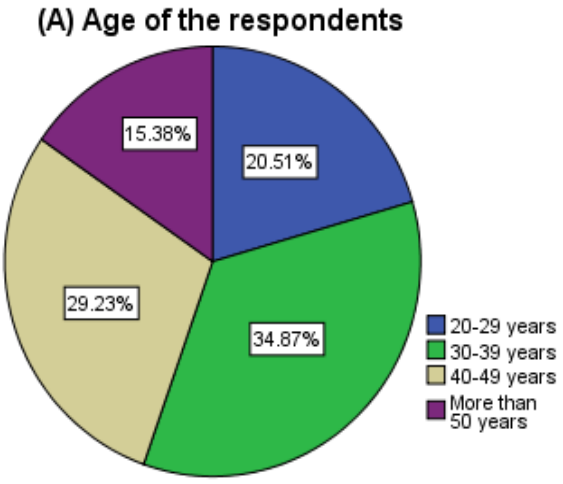
3 Results and Discussion

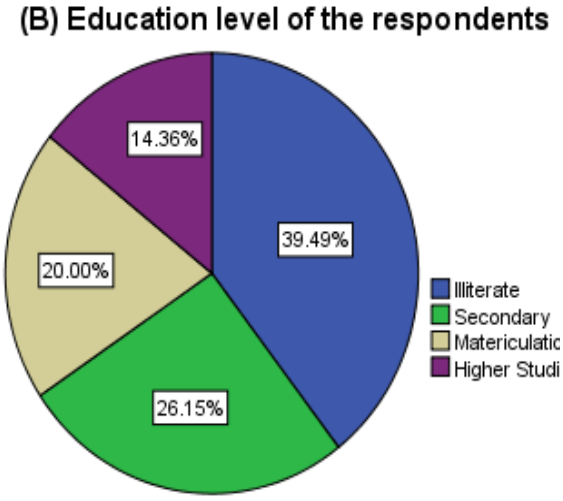
3.1 Socioeconomic profile of the respondents

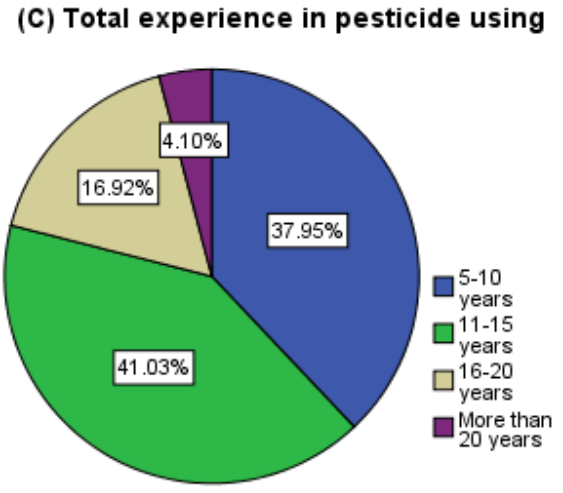
The profiles of the respondents are represented in figure A, B and C. The data have shown that majority of the respondents (34.87%) fall in middle age group (30-39 years) followed by age group (40-49 years) that were accounted 29.23%. Approximately 20.51% respondents associated with the agricultural activities were in the age group of 20-29 years and some 15.38% respondents were with age greater than 50 years. Muddassir et al. (2016) conducted research in Pakistan and reported the similar results about the age groups of the respondents. As for as education is concerned, majority of the respondents (39.49%) were illiterate and those who got secondary and matriculation level education were about 26.15% and 20%, respectively. Whereas, only 14.36% of the respondents engaged in agricultural activities had higher level of education.

As regards the pesticide using experience, present study revealed that majority of the respondents (41.03%) 11-15 years experience in using pesticide in agriculture, followed by 37.95% respondents who had 5-10 years' experience. The respondents that had (16-20 years) experience in using pesticides in agriculture accounted for 16.92% whereas, only 4.10% of the respondents had more than 20 years' experience of using pesticides in agriculture.









3.2 Training received by the respondents on sustainable pesticide uses, storage, disposal of empty containers, pest counting, and alternative pest controlling methods

Table 1 provides information on training received by respondents on pesticide, how it usage could be minimized by adopting different techniques like pest counting and alternative pest controlling. Pest counting is a systematic estimation of pest infestation on cultivated crops. Accurate estimation of pest infestation would be would help minimizing the use of pesticides. Pesticide application on a particular crop is only recommended,in case the pest population reaches to the threshold level. population reach to threshold level. Approximately, 82.1% of the respondents had not been trained on safe pesticide use, 9.2% received training once or twice, 4.6% three to four times, and 4.1% more than four times. Results are in line with Sankoh et al. (2016) who indicated that most farmers were poorly informed on safe pesticide use and about 71% of the farmers did not receive any type of training on pesticide use. This might be because of the low level of education of the farmers, which plays an important role in increasing knowledge as stated by Jensen et al. (2011).

The respondents who received training on the safe disposal of empty containers/bottles of the pesticides are shown in Table 1. Most of the respondents (79.5%) had no trainings, whereas, 12.3%, 5.1%, and 3.1% of respondents received 2, 4, and more than four training sessions, respectively. As Aslam et al. (2007) reported that Pakistani farmers had poor knowledge on the use of pesticides and hence, extensive training by the Extensionists regarding pesticide usage has helped to increase knowledge of the farmers. Similar findings were obtained in a survey conducted by Negatu et al. (2016) in Ethiopia on farmers' knowledge and attitudes of farm workers in three different farming systems namely large-scale closed greenhouse (LSGH), large-scale open (LSOF), and small-scale irrigated farms (SSIF). They found that most workers (85%) did not receive any training on the application of pesticides. Ibitayo (2006) reported in Egypt that almost all of the respondents (98%) did not attain any training on pesticide use and small segments of the farming community were aware that non-chemical pest control was possible, whereas in South Africa (16%) of the farmers received formal training about pesticide use (Naidoo et al., 2010).

As revealed in Table 1, more than half of the respondents (56.9%) received two training sessions on pest counting, indicating a lack of interest by the farmers. This might be because of their poor knowledge on the usefulness of training in pest counting. Approximately 21% of respondents attended 4 training sessions, 8.7% had more than four training sessions, and 13.3% respondents did not receive any training on pest counting. Research conducted by Pasiani et al. (2012) showed that health risks were minimized

with training sessions providing advice, and raising awareness on pesticide uses.

In another study conducted in United Kingdom on risk assessment regarding safe pesticide use among workers revealed that socio-economics greatly influenced the adoption of safety protection measures and this could be enhanced through proper training (Remoundou et al. 2014). In terms of Alternative pest controlling method trainings, most respondents (66.7%) were not aware of concepts, principles, and practices of alternative pest controlling methods. The farmers who received 2, 4, and more than four training sessions regarding alternative pest controlling methods were 23.1%, 7.2%, and 3.1%, respectively. A study in India indicated that creating awareness through educational programs and trainings on alternative pest control methods significantly reduced (up to 50%) poisoning among the farmers (Mancini et al., 2009).

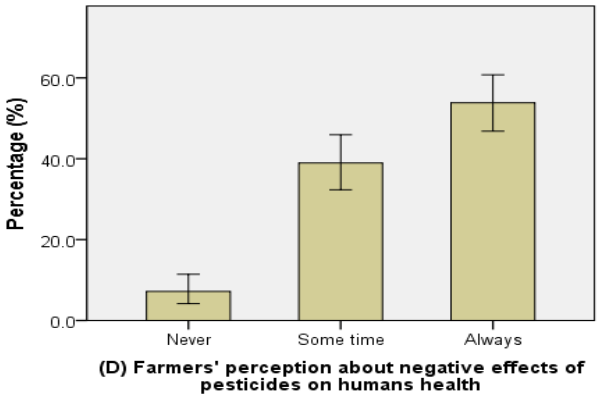
Table 1 Training received by farmers on sustainable pesticide usage

Types of Trainings received by farmers on sustainable pesticide usage	Number of trainings			
	1-2 (%)	3-4 (%)	More than 4 (%)	No training (%)
Safety measures regarding pesticides use	9.2	4.6	4.1	82.1
Pesticide storage	9.7	5.6	2.1	82.6
Safe disposal of empty container/bottles	12.3	5.1	3.1	79.5
Pest counting	56.9	21	8.7	13.3
Alternative pest controlling methods	23.1	7.2	3.1	66.7

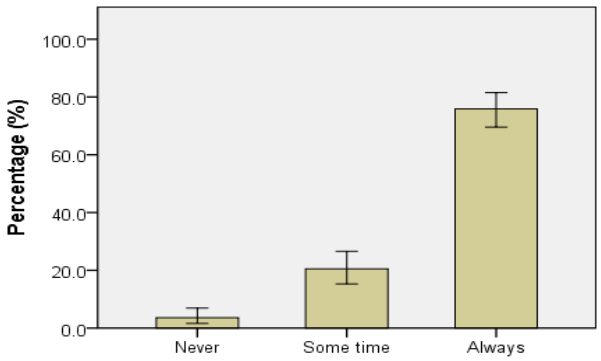
3.3 Respondents' knowledge level regarding improper use of pesticides

Mekonnen & Agonafir (2002) believe that knowledge and perceptions of farmers regarding risks associated with pesticides play a decisive role in adopting pesticide protection instruments (PPI). Knowledge gained through education results in the promotion and adoption of protective measures. Apart from knowledge, a farmer's confidence levels in applying safety measures are also important (Shetty et al. 2010; Jensen et al. 2011).

Farmers' responses to the questions; "improper use of pesticides can cause health issues" and "pesticides on ingestion can cause death to an animal and a human" are shown in figures (D) and (E). The level of knowledge of the farmers was represented on a three-pronged scale (Always = 3; Sometimes =2 and Never =1). Present study revealed that more than half of the respondents (53.8%) were quite knowledgeable and believed that the improper use of pesticides always leads to serious health issues. About 39% respondents believed that improper use of pesticides sometimes caused serious health issues and the rest of the respondents (7.2%) were of the opinion that pesticides did not cause any health issues if they were used improperly.



(D) Farmers' perception about negative effects of pesticides on humans health



(E) Farmers perception about death of animal and humans on pesticide ingestion

While responding to the question "Pesticides on ingestion can cause death to an animal and a human being" most of the respondents (75.9%) stated that pesticides on ingestion always caused death. Only 20.5% of respondents reported that it caused death sometimes, whereas only 3.6% respondents stated that inappropriate applications of pesticides did not cause deaths. Results of the present study are in line with the findings reported by Gaber & Abdul-Latif (2012). They also reported that majority

of the famers (82%) were aware of the negative effects of pesticides on health.

3.4 Correlation between respondents' profile and total trainings

As revealed in Table 2, a highly significant correlation was realized between the profiles of the respondents and the total trainings received by them on the sustainable usage of pesticides. Also age of the respondents (0.876**) significantly correlates with the trainings received by the respondents on alternative pest controlling methods. With the passage of time, the respondents' knowledge and awareness might be increased through trainings received on alternative pest controlling methods and pest counting that would be lead to minimize use of the pesticides.

Educational levels of the respondents significantly correlated (0.868**) with the trainings farmers do have on the usage of pesticides. Many researchers (Blanco-Muñoz & Lacasaña, 2011; Al Zadjali et al., 2015) maintain that the farmers with higher secondary education and trainings on alternative pest controlling methods and pesticide use significantly change their behaviors.

Pesticides using experience (0.820**) significantly correlates with trainings on pesticide usage. The farmers that possessed more experience in pesticides usage had more knowledge on alternative pest controlling methods and pesticide handling practices. Educational training programs based on pesticides usage can be possible way to mitigate expenditures incurred on pesticides (Ye et al., 2013). Blanco-Muñoz & Lacasaña (2011) is also of the view that trainings of farmers significantly exhibit the changes in their behaviors.

Table 2 Correlation between respondents' profile and total trainings

	Spearman correlation		P-Value
Total Trainings	Age	0.876**	0.000
	Education	0.868**	0.000
	Experience	0.820**	0.000

** Correlation is significant at the 0.01 level

Conclusions

Since most of the farmers of the area are illiterate and fall in the 30-39 years, therefore their knowledge on alternative pest control methods is very poor. They did not adopt alternative pest control methods to manage insect, pest and diseases however, they were well aware of the negative impacts of pesticides and their impact on human health. Only few farmers received trainings on sustainable pesticide use and waste handling.

A comprehensiveand well- planned program based on the benefits of alternative pest control methods needs be initiated that could be helpful in reducing extensive use of pesticides. There is also adire need to organize farmers and giving them trainings on the proper handling of pesticide- wastes to minimize their impacts on human health and environment in the central Punjab, district Sahiwal.

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Conflict of Interest

The authors declare that they have no conflict of interests.

References

Al Zadjali S, Morse S, Chenoweth J, Deadman M (2015) Personal safety issues related to the use of pesticides in agricultural production in the Al-Batinah region of Northern Oman. Science of the Total Environment 502: 457-461.

Aslam M, Ali T, Zafar MI, Ahmad M (2007) Training needs of fruit growers regarding pesticide use for sustainable environmental health in Punjab. Pakistan Journal of Agricultural Sciences 44: 511-518.

Blanco-Munoz J, Lacasana M (2011) Practices in pesticide handling and the use of personal protective equalternative pest controlling methodsent in Mexican agricultural workers. Journal of Agromedicine 16: 117-126.

Braun HE, Morrow DC, Ripley BD, Frank R (1983) Efficiency of water rinsing for the decontamination of used pesticide containers. Archives of Environmental Contamination and Toxicology 12: 257-263.

Ejaz S, Akram W, Lim CW, Lee JJ, Hussain I (2004) Endocrine disrupting pesticide: a leading cause of cancer among rural people in Pakistan. Experimental Oncology 26: 98-105.

Food and Agriculture Organization (FAO) (1994) Sustainable agriculture through integrated pest management. Twenty-Second Regional Conference for Asia and the Pacific, Manila.

Fuchs TW (2007) Diffusion of IPM programs in commercial agriculture: concepts and constraints. In: Koul O, Cuperus G (Eds), *Ecologically Based Pest Management*. CAB International, Oxford shire, Pp. 432–444.

Gaber S, Abdel-Latif SH (2012) Effect of education and health locus of control on safe use of pesticides: a cross sectional random study. Journal of Occupational Medicine and Toxicology 7: 3.

Grube A, Kiely T, Donaldson D (2004) Pesticides Industry Sales and Usage: 2000 and 2001 Market Estimates. EPA 733-R-04-001. Washington, DC: U.S. Environmental ProtectionAgency.Available:https://www.epa.gov/pesticides/pesticides-industry-sales-and-usage2006-and-2007-market-estimates.pdf [January 2011].

Ibitayo OO (2006) Egyptian farmers' attitudes and behaviors regarding agricultural pesticides: implications for pesticide risk communication. Risk Analysis 26: 989–95.

Jensen HK, Konradsen F, Jørs E, Petersen JH, Dalsgaard A (2011) Pesticide use and self-reported symptoms of acute pesticide poisoning among aquatic farmers in Phnom Penh, Cambodia. Journal of Toxicology, *Article ID 639814*, DOI: http://dx.doi.org/10.1155/2011/639814.

Jin F, Wang J, Shao H, Jin M (2010) Pesticide use and residue control in China. Journal of Pest Science 35: 138-142.

Khan M (2012) Adverse health experiences, risk perception and pesticide use behavior, Unpublished PhD Thesis. Islamabad: School of Economics Sciences, Federal Urdu University of Arts, Science and Technology; Retrieved from http://eprints.hec.gov.pk/8103/1/1608S.htm

Mallah GH, Korejo AK (2007) Establishment of integrated pest management (IPM) in cotton through farmer field school (FFS) in Sakrand, Sindh, Pakistan. Pakistan Journal of Botany 39 : 2693-2697.

Mancini F, Jiggins JL, Malley MO (2009) Reducing the incidence of acute pesticide poisoning by educating farmers on integrated pest management in south India. International Journal of Occupational and Environmental Health 15: 143-151.

Mekonnen Y, Agonafir T (2002) Pesticide sprayers' knowledge, attitude and practice of pesticide use on agricultural farms of Ethiopia. Occupational Medicine 52:311-315.

Muddassir M, Noor MA, Ahmed A, Aldosari F, Waqas MA, Zia MA, Mubushar M,. Zuhaibe AH, Jalip MW (2016) Awareness and adoption level of fish farmers regarding recommended fish farming practices in Hafizabad, Pakistan. Journal of the Saudi Society of Agricultural Sciences (in press) https://doi.org/10.1016/j.jssas.2016.12.004

Naidoo S, London L, Rother HA, Burdorf A, Naidoo RN, Kromhout H (2010) Pesticide safety training and practices in women working in small-scale agriculture in South Africa. Occupational and Environmental Medicine 67: 823–828. DOI: http://dx.doi.org/10.1136/oem.2010.055863.

Negatu B, Kromhout H, Mekonnen Y, Vermeulen R (2016) Use of Chemical Pesticides in Ethiopia: A Cross-Sectional Comparative Study on Knowledge Attitude and Practice of Farmers and Farm Workers in Three Farming Systems. Annual Occupation Hygiene 1–16.

Nesheim ON, Fishel FM (2005) Proper disposal of pesticide waste.FloridaCooperative Extension Service, University of Florida, Pp.1-18.

Ntow WJ, Gijzen HJ, Kelderman P, Drechsel P (2006) Farmer perceptions and pesticide use practices in vegetable production in Ghana. Pest Management Science 62: 356-365.

Ostman O, Ekbom B, Bengtsson J (2003) Yield increase attributable to aphid predation by ground-living polyphagous natural enemies in spring barley in Sweden. Ecological Economics 45: 149-158. doi:10.1016/S0921-8009(03)00007-7.

Government of Pakistan (GoP) (2016) Pakistan Economic Survey 2015-16. Pp. 23. http://www.finance.gov.pk/survey_1516.html

Pasiani JO, Torres P, Silva JR, Diniz BZ, Caldas ED (2012) Knowledge, attitudes, practices and bio-monitoring of farmers and residents exposed to pesticides in Brazil. International Journal of Environmental Research and Public Health 9 : 3051-68.

Recena MCP, Caldas ED, Pires DX, Pontes ERJ (2006) Pesticides exposure in Culturama, Brazil—knowledge, attitudes, and practices. Environmental Research, 102: 230-236.

Remoundou K, Brennan M, Hart A, Frewer LJ (2014) Pesticide Risk Perceptions, Knowledge, and Attitudes of Operators, Workers, and Residents: A Review of the Literature. Human and Ecological Risk Assessment 20:1113–1138.

Sankoh AI, Whittle R, Semple KT, Jones KC, Sweetman AJ (2016) An assessment of the impacts of pesticide use on the environment and health of rice farmers in Sierra Leone. Environment International 94: 458-466.

Schreinemachers P, Tipraqsa P (2012) Agricultural pesticides and land use intensification in high, middle and low income countries. Food Policy 37: 616-626.

Shetty PK, Murugan M, Hiremath MB, Sreeja KG (2010) Farmers' education and perception on pesticide use and crop economies in Indian agriculture. Journal of Exprimental Sciences 1:3-8.

Spurgeon DW (2007) Ecologically based integrated pest management in cotton. In: Koul O, Cuperus G (Eds), *Ecologically Based Pest Management*. CAB International, Oxford shire, Pp. 367–405.

Szadkowska-Stanczyk I, Buczynska A (2005) Identification of health hazards to rural population living near pesticide dump sites in Poland. International Journal of Occupational Medicine and Environmental Health 18:331-9.

Xiao YM, Wang JA, Wang MA, Liu JP, Yuan HZ, Qin ZH (2010) Study on the inclusion complexes of flumorph and dimethomorph with β-cyclodextrin to improve fungicide formulation. Journal of the Chemical Society of Pakistan 32: 363.

Ye M, Beach J, Martin JW, Senthilselvan A (2013) Occupational pesticide exposures and respiratory health. International Journal of Environmental Research and Public Health 10: 6442-6471.