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FARMERS' KNOWLEDGE REGARDING SAFE HANDLING AND APPLICATION OF PESTICIDES IN RICE CROP

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ABSTRACT

Rice is one of the leading food crops in Pakistan and we conducted this study to explore farmers' knowledge regarding the safe handling and application of pesticides on rice crops in rice growing district Shiekhupura of Punjab province. A total of 381 randomly selected rice growers were interviewed using a structured, validated and reliable interview schedule administered face-to-face. Collected data were analysed using Statistical Package for Social Sciences (SPSS). Results revealed that 58.5% of respondents were aged between 36 and 50 years, 25.2% o had completed middle-level education,40.4% had more than 25 acres of land, 60.9% were owners of their land and 50.6% had farming experience of 6-10 years. Around 45% reported not considering wind direction while spraying and 66% used mud/soil to clean their hands post-pesticide application. Around 73,2, 66.1 and 73.2% reported the use of goggles, 66.7% trousers/ suits, 66.1% face masks, 65.4% used boots and 6.6% used overalls for their safety. This study indicates an average level of knowledge and use of Personnel protective equipment (PPEs) against pesticides. However, there is still room to create awareness among those who are not utilizing the PPEs. Along with the dissemination of advisory services through group meetings, and the dissemination of information related to the safe use of pesticides the potential of social media platform and mainstream media can be used.

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INTRODUCTION

Agriculture is the backbone of the Pakistan economy; it contributes 22.9% to the Gross Domestic Product (GDP) and provides 37.4% national labour force. Despite this, it remains a backward sector of the national economy. For the economic growth and alleviation of poverty, higher production in agriculture is essential. However, the performance of the agriculture sector has fallen short of the desired level due to the stagnant productivity of all major crops like rice, sugarcane, wheat, and maize (Government of Pakistan, 2023). Rice (Oryza sativa L.) is the most valuable food and cash crop. Pakistan is the fourth-largest producer of rice. It produces an average of six million tonnes every year and supplies 30% of rice in the world. The rice growers are relying on rice crop farming for their income generation and improving their livelihood. It is grown mainly in the Punjab and Sindh provinces. The major rice-growing districts of the Punjab province are Sheikhupura, Jhang, Hafizabad, Gujranwala, Sialkot, and Okara. In Sindh province, Jacobabad, Larkana, Dadu, Thatta, Badin, and Shikarpur are the major rice-producing districts (Government of Pakistan, 2012). Similarly, Pakistan is the leading consumer of pesticides, and it has been estimated that small farmers

uses almost 60% of their annual income in purchasing pesticides.

Rice farmers were using excessive pesticides which create serious concerns, including disastrous health, environmental and economic consequences. Some researchers concluded that excessive and improper use of pesticides in under-developed countries is associated with no training and education on pesticide usage and information on related hazards (Wilson and Tisdell, 2001; Khan *et al*., 2015). Therefore, pesticides are regarded as "global killers." Although some researchers reported that farmers' perceptions about the risk of pesticides were not related to concentrated pesticide usage (Khan *et al*., 2015; Damalas *et al*., 2006), perceptions about pesticide use were influenced by pesticide risk (Dasgupta *et al*., 2007; Liu and Huang, 2013; Damalas and Hashemi, 2010; Hashemi et al., 2012). Every year, thousands of human casualties occur in Pakistan due to pesticide poisoning. Extensive use of pesticides in agriculture severely affects human health, the environment, and agricultural sustainability (Gupta *et al*., 2012). The knowledge of farmers regarding the proper application of pesticides is vital for the efficient management of crops. Improper handling and careless application of pesticides can lead to accidental poisoning and result in both immediate and long-term health issues (Van Den Berg *et al*., 2011; Kumari *et al*., 2019).

Misuse and overdose of pesticides by rice growers for insect and pest management in rice result in harmful effects on the environment, human health, and agricultural sustainability (Dasgupta *et al*., 2007). The rice farmers spend a significant amount of money on pesticides to maximize production and make a sustainable rural livelihood. They are, meanwhile, unable to avoid adverse effects due to erroneous knowledge regarding the safe use of pesticides. These negative impacts can be reduced by training rice farmers and ensuring that they understand how to store, apply, and dispose of pesticides (Karunamoorthi *et al*., 2012).

Farmers often lack access to protective clothing and may have limited knowledge about its proper use (Diomedi and Nauges, 2016). There is widespread availability of Personal Protective Equipment (PPE) designed specifically to significantly minimize the risks linked to various hazardous farm activities (Carpenter *et al*., 2002). In Pakistan, farmers protect their crops by the use of chemical methods without the knowledge of the harmful consequences of that particular pesticide used (Abbas et al., 2014) but in other developed countries farmers with a higher degree of education have better pesticide knowledge and use pesticides safely (Gaber and Abdel- Latif, 2012). Pesticide overuse is also positively associated with the lack of extension support (Sarker and Itohara, 2009). Overuse of pesticides due to lack of knowledge develops resistance against those pesticides and the beneficial insect population is decreased and other health issues are initiated. Therefore, the present study has been designed to investigate farmers' knowledge regarding safe handling and application of pesticides in rice crop.

MATERIALS AND METHODS

Study area

Pakistan is categorized into four ecological zones. Basmati rice dominates in Zone II, encompassing traditional rice cultivation in Punjab. In Zone I, including Swat, rice is grown at high altitudes. Zone III, located in Sindh, also cultivates basmati rice, while Zone IV, in Baluchistan, is known for both varieties (basmati and non-basmati rice). Zone II is situated between the Ravi and Chenab rivers in Punjab and is characterized by a sub-tropical climate ideal for fine-grain fragrant varieties. The major rice-producing districts of Punjab are situated in Zone II. Therefore, the District Sheikhupura is considered one of the significant rice-growing districts of the Punjab province, with a total cultivated area of 601,000 acres and a total production of 483,040 tonnes. District Sheikhupura comprises five tehsils, namely Sheikhupura, Ferozwalla, Muridke, Sharaqpur, and Safdarabad.

Sampling procedure

The website surveysystem.com was used to conduct a study with a sample size of 381 chosen from the study area's population (44453), ensuring a 95% confidence level and confidence interval of 5.

A proportionate sampling was employed to select respondents from different tehsils for the selection of sample size (Table 1). A total of 96 from Sheikhupura 77 from Ferozwalla, 86 from Muridke, 52 from Sharaqpur and 70 from Safdarabad were chosen. All respondents were then randomly selected from each selected tehsil. The formula used for the proportionate sampling is as follows**:**

$$\text{N for subgroup} = \frac{\text{Subgroup population}}{\text{Total population}} \text{ X sample size}$$

Table 1. Proportionate sample size from respective tehsils.

Name of tehsil	Population	Sample size
Sheikhupura	11240	96
Muridke	9010	77
Ferozwalla	10021	86
Sharaqpur	6083	52
Safdarabad	8099	70
Total	44453	381

Instrumentation, data collection and analysis

Respondents were homogenous and to avoid bias interview schedule was used as data collect which was translated into *urdu* language before final data collection. The interview schedule had closed-ended questions whereas the Likert scale was used to determine the responses (1-3 Scale: poor=1, somewhat=2, Excellent=3). Data were collected by conducting face-to-face interviews with rice growers. The pre-testing of data was done to check the validity and reliability of the interview schedule on 50 respondents other than sampled respondents of the study. Cronbachs' Alpha value appeared 0.827 which ensured the reliability of instrument. The collected data were analyzed using Statistical Package for Social Sciences (SPSS) to draw conclusions and make recommendations. The descriptive statistical analysis was applied on the collected data.

RESULTS AND DISCUSSION

Demographic characteristics of rice growers

This section refers to the socio-economic profile of the respondents who participated in this study as respondents. This section included information regarding age, education, size, experience and tenancy status. The information in this regard is given in Table 2.

Table 2. Distribution of respondents by demographic characteristics (n= 381)

Demographic Character	F	Percentage
Age (years)		
Young (up to 35)	62	16.3
Middle (>35-50)	223	58.5
Old age (>50)	96	25.2
Educational Level		
Illiterate	139	36.5
Primary-Middle	96	25.2
Matriculation	75	19.7
Above Matriculation	71	18.6
Size of land holding		
Small (up to 12.5)	79	20.7
Medium (>12.5-25)	148	38.8
Large (> 25)	154	40.4
Farming experience (in years)		
1-5	40	10.5
6-10	193	50.5
11-15	90	23.6
>15	58	15.2
Tenancy status		
Owner	232	60.9
Owner-cum-tenant	111	29.1
Tenant	38	10.0

Table 2 reveals that more than half (58.5%) of respondents were aged between >35-50 years followed by 25.2% of the respondents who were over 50 years old. Among respondents, 16.3% were under 35 years old. As far as education was concerned, 36.5% of the respondents were illiterate. Whereas, one-fourth of

respondents (25.2%) were educated between primary-middle levels. Around one-fifth (19.7%) of respondents were matriculated and 18.6% were above matriculated. Regarding the landholding size of rice farmers in the study area, 40% of respondents had large (>25 acres) land holdings. Whereas, 38.8% of respondents had land size between 12.5 and 25 acres followed by 20.7% of the respondents having land size less than 12.5 acres. This implies that land sizes were varied in the study area. This is relevant to Rijal et al. (2018) who reported that land size usually fluctuates due to family divisions from one generation to another (Rijal, *et al.,* 2018). As far as the experience of rice farming was concerned, half of the respondents (50.5%) had experience of 6 to 10 years. While 23.6% of the farmers had experienced between 11 to 15 years. Out of the total respondents, 15.2% had the experience of more than 15 years. The tenancy status of the farmers shows that a majority (60.9%) of respondents were owners followed by 29.1% owner-cum-tenants and 10.0% tenants.

Table 3. Knowledge of farmer's/spray man to apply pesticide spray in the rice crop (n= 381).

Condition under which pesticides were applied	F (%)	Mean + S.D	Rank order
Along the wind	317(83.2)	1.93±0.69	1
Across the wind	168(44.1)	1.94±0.83	2
Do not consider wind direction	173(45.4)	1.79±0.73	3

(Scale: Yes, No, poor=1, somewhat=2, Excellent=3)

During pesticide spraying, the direction of spraying and movement is considered to be important as it prevents direct contact from pesticide while spraying. Therefore, the data presented in Table 3 reveals that the knowledge level of rice farmers about the mode of pesticide application either along the wind, across the wind or not considering the wind direction was noteworthy. The results obtained from the collected data, 83.2% of rice growers apply pesticides by keeping in mind the direction of the wind i.e. along the wind having a mean value of 1.93, followed by farmers (44.1%) that apply pesticides across the wind and was ranked as 2nd having mean value of 1.94. Keeping in view the results analyzed from collected data 45.4% of rice growers do not consider wind direction while applying the pesticide or weedicides.

Table 4. Ranking of the respondents concerning to their knowledge level about hand washing practice (n= 381).

Hand washing practice	f(%)	Mean+S.D	Rank
With soap	280(73.5)	2.00±0.748	1
Simple water	258(67.7)	1.94±0.792	2
With mud/soil	250(65.6)	1.82±0.785	3

(Scale: Yes, No, poor=1, somewhat=2, Excellent=3)

The need for safety measures after pesticide spraying is necessary, therefore, the data given in Table 4 reveals that the respondent's knowledge level about hand washing with soap acquired a percentage of 73.5 with a mean value of 2.00 and ranked as 1st order. The respondents had also a somewhat level of knowledge about hand washing with simple water having a percentage of 67.7 and ranked as 2nd order with a mean value of 1.94. The respondents had less than somewhat level of knowledge about washing practice with mud or soil having parentage of 65.6% and ranked as 3rd with a mean value of 1.82. Aryal *et al*. (2013) noted that the majority of respondents adhered to safety measures following pesticide spraying and yet only a small number were observed to properly not adopting these safety measures.

The data given in Table 5 illustrates the various practices employed when mixing pesticides with water among the respondents. The most prevalent method reported was the use of a wooden stick, observed in 68.0% of the cases, with a mean and standard deviation (M ± SD) of 2.09 ± 0.73, ranking first in usage. Following closely was the practice of utilizing a sprayer lancer, which accounted for 61.2% of respondents with a mean of 1.99 ± 0.74. This was ranked second. Pouring water with a mug or jar was another common method,

reported by 51.2% of participants, with a mean of 2.05 ± 0.77, ranking third.

Table 5. Ranking of the respondents concerning to their knowledge level about pesticides and water mixing practices.

Pesticides and water mixing practices	F (%)	Mean + S.D	Rank
Use a wooden stick	259(68.0)	2.09±0.73	1
Use sprayer lancer	233(61.2)	1.99±0.74	2
Pouring water from mug/jar	195(51.2)	2.05±0.77	3

(Scale: Yes, No, poor=1, somewhat=2, Excellent=3)

Table 6. Farmers knowledge about Personal Protective Equipment (PPE) when applying pesticides.

Personal Protective Equipment (PPE) when applying pesticides	Respondent's response	
	Yes	
	f	%
Boots/long shoes	249	65.4
Trouser suit/long Suit	254	66.7
Gloves	92	24.1
Goggles	279	73.2
Face mask	252	66.1
Wide-brimmed Cap/Hat	223	58.5
Use of handkerchief during application of pesticides and weedicides	228	59.8
Overalls	231	60.6
Use of respirator	204	53.5

Personal Protective Equipment (PPEs) such as masks, gloves, boots, helmets, and long-sleeved clothes are found to be used as protective equipment during pesticide preparation and spraying (Damalas *et al.,* 2019; Sapkota *et al*., 2020). However, the data given in Table 6 shows that the knowledge of the use of Personal Protective Equipment (PPE) of respondents was as follows. The majority (73.2%) of pesticide applicators know about goggles, 66.1% of respondents know about face masks, trouser suits/long suits (66.7%), long shoes /boots (65.4%) and overalls (60.6%), respectively. The respondents knew the use of handkerchiefs during the application of pesticides and weedicides in rice crops (59.8%), wide-brimmed Cap/Hat (58.5%) and use of respirator (53.5%), respectively. The respondents had the lowest knowledge about gloves which was more than one-fifth (24.1%). The findings of the study are more or less related to Yassin *et al*. (2002), who found that a large percentage of farm workers (>88%) were aware that wearing gloves, goggles, a wide-rimmed cap, special boots, and an oral-nasal mask could prevent pesticide entry into the human body. Farmers may not use safety measures if they have an economic burden or a time restraint to performing the work or they are uncomfortable due to the heat stress and dampness experienced in the field (Lee *et al.,* 2017). These results indicated a limited knowledge of farmers.

CONCLUSION

We conclude that farmers were using pesticides on the rice crop to combat the infestation of insects and pests. Respondents of the study were diverse in their ages, farm experience, land size and level of education. As far as their knowledge regarding the use of pesticides was concerned, it was perceived as average and more inclined towards the traditional approach. Rather than following the recommended sanitary measures, farmers were still using mud and soil to wash their hands and the use of Personnel Protective Equipment (PPEs) like glasses, bots, and overalls was not up to the mark. This indicates that there is still room to create awareness among those who are not utilizing the PPEs. Along with the dissemination of advisory services through group meetings, and the dissemination of information related to the safe use of pesticides the potential of social media platforms and mainstream media can be used. The public and private sector extension should disseminate information among farmers regarding the use of PPE.

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