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PESTICIDE USE PRACTICES AND RISK PERCEPTION AMONG FARMERS IN CHAKWAL DISTRICT, PAKISTAN

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Abstract

Pesticides are used to eradicate pests and are advantageous for increasing crop yields. They do, however, pose serious threats to human health and the environment. Farmers are especially at risk since they come into intimate touch with these pesticides. Assessing farmers' pesticide use habits, risk perception, and the effects of pesticides on the environment and human health are the objectives of this study. Using a purposive sample, farmers from five tehsils in District Chakwal were chosen for a questionnaire survey. SPSS version 21 was utilized for the analysis of the gathered data. It is evident from findings that farmers who frequently overuse pesticides, without wearing personal protective equipment have resulted in several health problems. Professional training from agriculture extension departments and NGOs on the proper use of pesticides is essential to prevent risks.

Keywords: Pesticide practice, risk perception, misuse of pesticide, Pakistan

INTRODUCTION

Pesticides are chemical compounds used to destroy or kill any pests. They are considered beneficial to maintain crop yield, but their misuse can cause disastrous effects on human life and the environment. Humans are affected by pesticides via direct or indirect exposure. Farmers are more vulnerable to this by having direct contact with pesticides.

In Pakistan, pesticides are commonly used to protect crops from various pests. Most used pesticides include DDT, heptachlor, permethrin, endrin, etc. (Ali *et al*., 2019). Farmers primarily rely on chemical pesticides to prevent pre-harvest losses caused by pests. However, the frequent application of chemicals has led to pesticide resistance in pests and the destruction of beneficial organisms. Moreover, such practices can adversely affect human health and the environment. Over the past two decades, pesticide use in Pakistan has been increased by 69% (Rashid et al., 2022).

The improper use of pesticides has led to significant health and environmental effects among farmers in Pakistan. Organophosphate pesticides have been associated with the ability to proliferate into the tissues, causing breast cancer (Calaf, 2021). Studies suggest that exposure to these chemicals can disrupt endocrine functions, leading to reproductive in both males and females (Munoz *et al*., 2021). Furthermore, chronic exposure has been linked to genetic damage, as evidenced by increased DNA damage in farmers. Farmers are especially vulnerable due to their direct contact with pesticides, resulting in prolonged exposure and higher concentrations of these chemicals which exacerbate health risks. Consequently, they face increased risks of lung damage, airway obstruction, and DNA disruptions. Moreover, the lung damage caused by pesticide inhalation can be more severe than that resulting from smoking (Mergia *et al.,* 2021). A

few case studies of the acute toxic effects of pesticides on humans and animals are compiled in the following. Mishra *et al*. (2022) evaluated the harmful effects of CPF on biochemical changes (acetylcholinesterase (Ache) activity and antioxidant markers) in the brain, histopathological changes in pseudo branchial neurosecretory cells (PNSCs) of a neuroendocrine system of the gill region, the optic tectum (OT), and the cerebellum, and related locomotory behavioral alterations in air-breathing catfish Heteropneustes fossilis.

The study's findings suggested that brief acute exposure to CPF may cause fish's locomotory and swimming performance to decline, their neurosecretory activity of PNSCs to become dysregulated, and their brain's biochemical activity to change. Using a silicone O-ring as a reservoir, Kwon *et al*. (2020) used a passive dosing format and assessed its suitability for determining PCP's effects on *Daphnia magna*. Research demonstrated a PCP partition coefficient of 2:1 between methanol and a test medium (log KMeOH: ISO). Similar EC50 values of 576 and 485 µg/L for 24 hours and 362 and 374 µg/L for 48 hours, respectively, were demonstrated by solvent spiking and passive dosing in the acute toxicity experiments. These values overlap with those of earlier research.

Despite these risks, there is a lack of studies focusing on the impacts of pesticides on farmers within District Chakwal, Pakistan. This study assesses farmers' perceptions regarding pesticide use and their application practices. It will also investigate the potential effects of pesticides on health and the environment. The findings are expected to raise awareness among farmers regarding pesticide toxicity and assist the agricultural extension department in formulating policies to address problems arising from misuse and overuse. The study is organized into the following sections. Section 2 describes the study area and survey design; section 3 presents the results and discussion; and the final section provides the conclusion.

MATERIALS AND METHODS

STUDY AREA

The study was conducted in District Chakwal, in the Punjab province of Pakistan. The district comprises five tehsils: Chakwal, Kallar Kahar, Choa Saiden Shah, Talagang, and Lawa covering a total area of 6524km^2. The climate of the region ranges from semi-arid to sub-humid. Approximately 81% of the population resides in rural areas, with the majority engaged in agricultural activities. Most people are associated with agriculture in this area (Figure 1).

SURVEY DESIGN

The survey questionnaire was designed to get the results of pre-survey interviews. The purpose of these interviews was to learn about the opinions of local farmers and other agricultural-related organizations on the knowledge, risk perception, and practices of the farmers. Purposive sampling was used to select participants who could provide relevant and informed insights (Palinkas *et al*., 2015). The selection criteria included: (1) a minimum of 5 years of farming experience, (2) active involvement in agricultural activities in District Chakwal, and (3) direct exposure to farming challenges such as changing weather patterns, pest attacks, or input availability. These criteria ensured that the selected farmers had adequate experience and awareness to share meaningful perceptions regarding climate change and adaptation practices.

Ten farmers from various villages in District Chakwal participated in a pilot study of the questionnaire before the primary data collection to make sure the questions were suitable, pertinent, and clear. The necessary changes were made, such as streamlining complicated vocabulary and modifying the question flow, after analyzing the responses. Two focus group discussions (FGDs) with six to eight participants validate the themes discussed in the questionnaire and obtain preliminary insights. The final questionnaire was well-aligned with the local context and farmer experiences, the feedback from these focus group discussions was also utilized to improve its structure and content. Several modifications were made after gaining opinions from different focus groups.

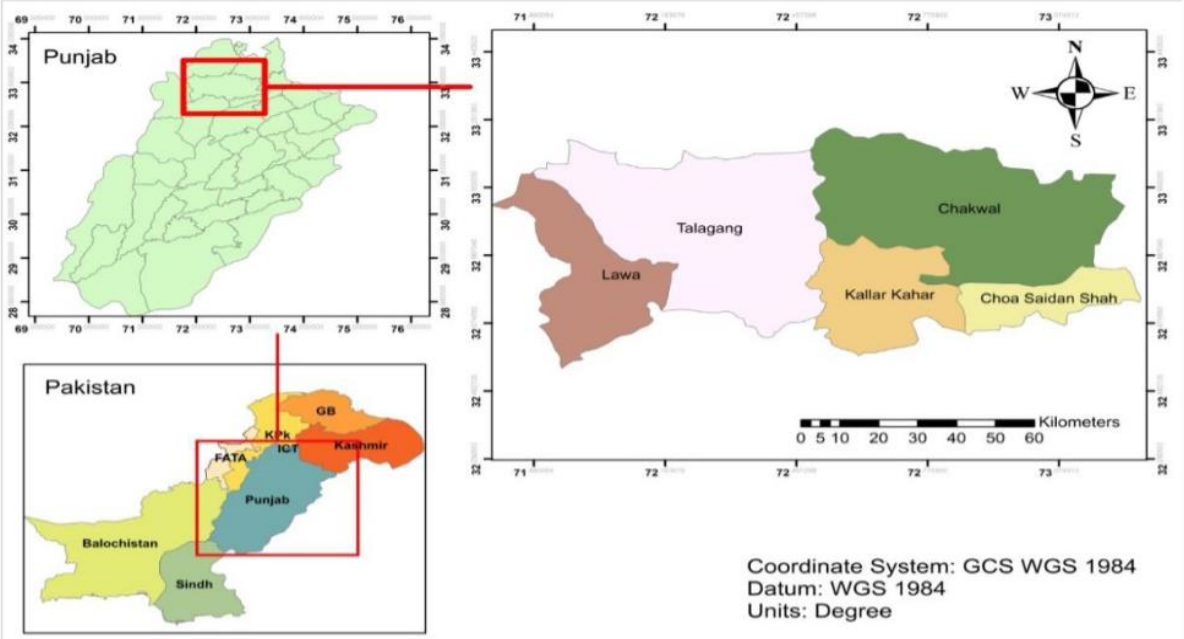

Figure 1: Study area (District Chakwal) Source: Amir et al. 2020

The Questionnaire consisted of three sections. Section 1 was used to learn about the socio-economic conditions of respondents including gender, age, income, farm size, farming experience, number of households, and health condition. Section 2 consisted of information about the knowledge and risk perception of farmers while section 3 comprised farmer's pesticide practices.

COLLECTION OF DATA

Data was collected from February to April 2023. Survey questions were translated into local languages to make it easy for farmers to understand. Face-to-face interviews were conducted as they are feasible to collect complex information.

Farmers were selected based on a purposive sampling method from five tehsils of District Chakwal. The size of the sample was 240. A total of 270 farmers were approached, and 240 farmers participated. 95% of the overall response rate was

recorded. Responses from the respondents were entered into an Excel sheet. SPSS 20.0 is used to analyze the results of the study. Descriptive statistics and chi-square tests are used to know the significance of the variables used in this study.

RESULTS AND DISCUSSION

SOCIO-ECONOMIC CHARACTERISTICS OF FARMERS

The number of participants involved in this study is 240, 157 (65.4%) are males and 83 (34.6%) are females. Males are more dominant in terms of farming in Chakwal than females (Figure 2).

53.3% of farmers belonged to the 35-49 age group. 15 (6.25%) are illiterate, 74 (30.80%) have done middle-level education, 126 (52.50%) passed the secondary level of education, and 25 (10.41%) have a higher level of education. Most of the farmers 156 (65%) have more than one hectare of farm size. The farming experience was less than ten years in most farmers.

RISK PERCEPTION OF PESTICIDE

Farmers were asked about the risk perception of pesticide use. Most farmers, 144(60%) farmers have a very high-risk perception of pesticide use. They considered it a risk to human health and the environment. 18 (7.5%) said there would be a moderate risk while 28 (11.7%) believed the use of pesticides to be a low risk as it won't affect human health or the environment (Figure 3).

Most farmers face different symptoms while using pesticides. Among the reported symptoms, eye irritation is the problem or symptom faced by most farmers, followed by headache, allergy, breathing problems, and dizziness. 70 (29.1%) farmers got eye irritation, 65 (27%) had headaches, 60 (25%) had allergies, 22 (9.16%) faced difficulty in breathing and 13 (5.14%) reported dizziness.

PESTICIDE USE PRACTICE AMONG FARMERS

Most farmers didn't know the frequency of pesticide use. 59.3% of farmers used to apply pesticides more than 10 times per season.

Storage and disposal of pesticides are important factors for the prevention of pesticide poisoning and pollution. In the study area, most farmers did not have proper storage sheds and methods of disposing of pesticide containers. 25% of farmers used pesticide containers for domestic purposes, 13.3% used them to sell these containers, 20.8% put them in garbage and 40.8% burned down these containers along with other waste (Figure 4).

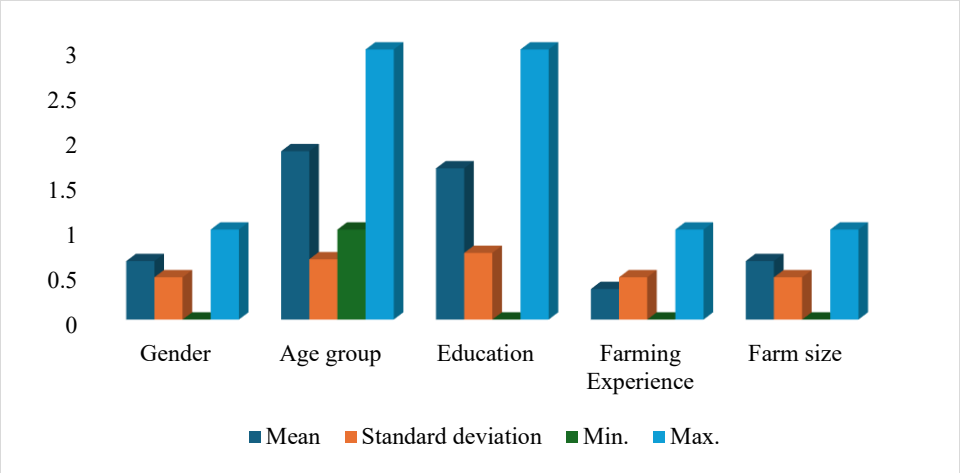

Figure 2: Socio-economic characteristics of respondents

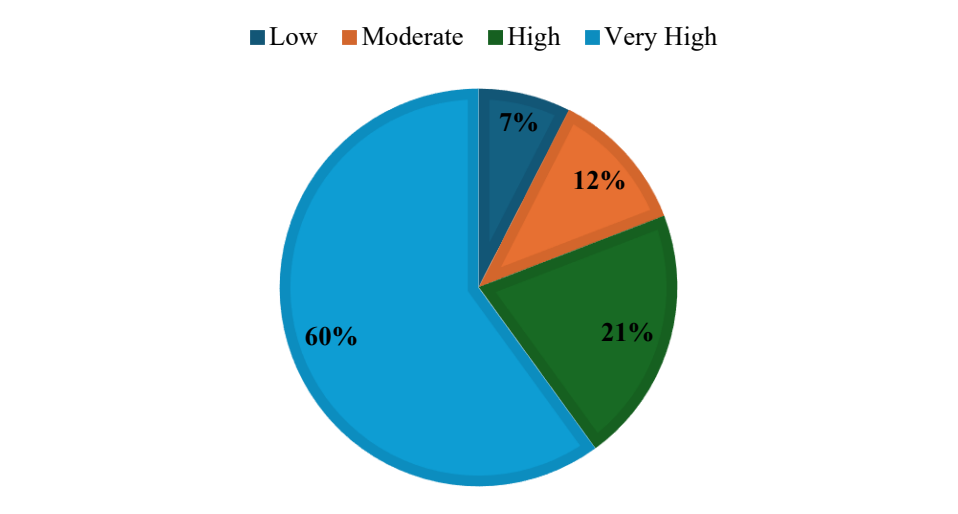

Figure 3: Distribution of Respondents Regarding Risk Perception of Pesticide Use

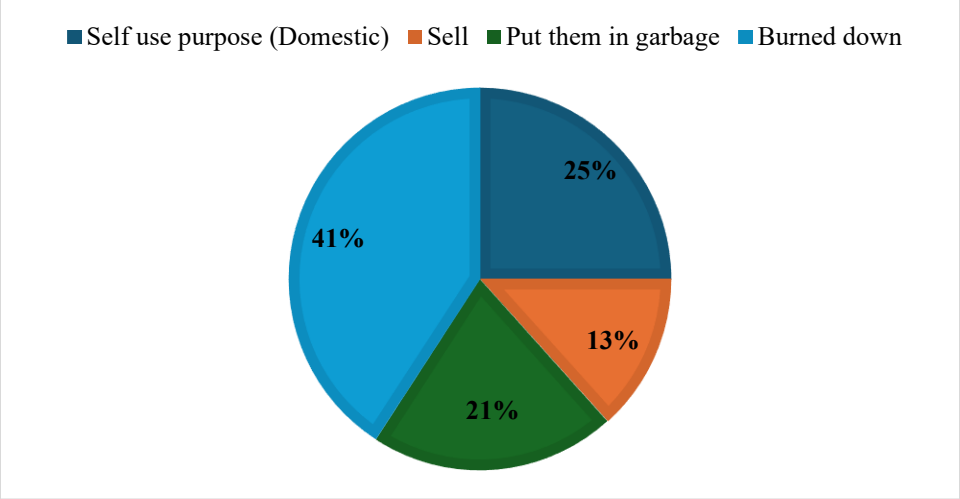

Figure 4: Disposal of pesticide containers by respondents

KNOWLEDGE OF PESTICIDE RISK PERCEPTION

Labels are printed on the pesticide container giving proper information Regarding the toxic level of the pesticide and how it should be safely handled. We asked farmers if they read the labels on pesticides. 146 (60.8%) respondents said yes while 94 (39.2%) said No. The use of personal protective equipment is essential for prevention. 60% of farmers did not use personal protective measures that could lead to detrimental health effects. Risk perception is directly proportional to the use of personal protective equipment. Knowledge of farmers regarding pesticide risk perception shows a significant association ($p>0.05$) with pesticide use practices by farmers (Table 1).

Table 1: Factors influenced by the knowledge of Pesticide risk perception

Variable	Standard error	p value	x^2 value
Use of personal protective equipment	0.065	0.03	8.369
Understanding of labels	0.04	0.00	150.6
Frequency of pesticide	0.009	0.00	235.6
Storage and disposal	0.066	0.03	8.345

DISCUSSION

In this study, the majority of farming activities were performed by male farmers (98%). Similar results have been reported by Waichman *et al.* (2006) and Adjrah *et al.* (2013) that most of the farm activities were performed by males in Brazil (97.4%) and Togo (92%), respectively. Due to the nature and hardness of the work, males may be higher in numbers than females in the farming profession. 53.3% of farmers belonged to the 35-49 age group. It shows correspondence with the previous study done by Rajashekar *et al.* (2017) who investigated that most of the people belonging to the agricultural sector (46.7%) are middle-aged farmers. Most of the farmers in the study area passed the secondary level of education while most of the farmers did not get any professional training on the safe use of pesticides. Nguetti *et al.* (2018) reported that the government extension department did not provide training on the safe and proper use of pesticides to the farmers in Ethiopia. That could be the reason that many farmers were not able to read or understand the labels available on pesticides. Labels are printed on the pesticide container giving proper information regarding the toxic level of pesticide and how it should be safely handled.

Most of the farmers 156 (65%) have more than one hectare of farm size. These results show coherence with Bagheri *et al.* (2019) who reported that 72% of the farmers have farm sizes between 1 to 3 hectares while 28% have above 3 hectares. The farming experience was less than ten years in the majority of farmers. Our results show incongruity with the results of Ullah *et al.* (2019) who reported that 52% of farmers have more than 10 years of farming experience. The divergence in results is due to the different areas and nature of the people.

Most farmers, 144(60%) farmers, have very high-risk perceptions of pesticide use. The study results are in coherence with Jin *et al.* (2016) who reported that most farmers have a high-risk perception of pesticide use. Sun *et al.* (2012) reported that insufficient services by government agricultural

extension departments are the most important cause of the overuse and misuse of pesticides. Misuse and overuse of pesticides cause serious health problems. Among the reported symptoms, eye irritation is the problem or symptom faced by most farmers, followed by headache, allergy, breathing problems, and dizziness. Satya *et al.* (2019) found similar results; eye irritation was the most reported symptom among farmers followed by headache. 60% of farmers did not use personal protective measures that could lead to detrimental health effects. Our results show coherence with Ma *et al.* (2021) who found out that most farmers don't use glass, boots, etc. while using pesticides on the farms. Proper disposal of pesticides is necessary to prevent environmental contamination and human health problems. Most farmers (40.8%) burned down their waste in the study; disposal is also an important part of appropriate pesticide use.

Similar findings reported by Benjamin *et al.* (2019) in Rwanda state that farmers used empty pesticide containers for domestic use, such as storing drinking water and food ingredients. Farmers in the study area overused pesticide The majority of the farmers didn't know about the frequency of pesticide use. 59.3% of farmers used to apply pesticides more than 10 times per season. Similar findings of overuse of pesticides per season have been reported in Tanzania where farmers sprayed more than 21 times per season (Ntow *et al.,* 2006). This study corresponds with the findings of Damalas and Khan (2016), who reported that the frequency of pesticide uses by farmers in Punjab, Pakistan is more than 10 or 11 times per season. This would lead to more contact with pesticides and ultimately, cause disastrous effects to human health and the environment (Amir *et al.,* 2020).

CONCLUSION

The study reveals that most farmers do not read or understand pesticide labels, likely due to low literacy levels and insufficient training. They primarily use pesticides to prevent crop losses and enhance production efficiency. Despite their extensive experience, many are unaware of the health hazards associated with pesticides, proper handling practices, the use of personal protection equipment, and appropriate storage and disposal methods. A significant factor contributing to this unawareness is inadequate training from government agriculture extension departments.

Handling toxic pesticides without personal protective equipment poses serious health risks to farmers. Misuse is prevalent; for instance, many farmers are unaware of the recommended frequency of pesticide application and neglect safe handling and storage practices, often storing pesticides for use in subsequent seasons. Improper disposal methods are common: many farmers burn empty pesticide containers leading to environmental pollution, while others discard them in garbage or reuse them for domestic purposes, posing serious health risks.

To mitigate these issues, professional training from agriculture extension departments and NGOs is essential. Such training should focus on the proper use of pesticides, safe handling, storage, and disposal practices, and the importance of using personal protection equipment, thereby enhancing farmers' knowledge and awareness of farmers regarding pesticide use in the District Chakwal.

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CONFLICT OF INTERESTS:

The authors declare no conflict of interest.

AUTHOR'S CONTRIBUTION:

Both authors contributed equally to the design, execution, and writing of this research.

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REFERENCES

Adjrah, Y., A. Dovlo, S. D. Karou, K. Eklu-Gadegbeku, A. Agbonon, C. de-Souza, M. Gbeassor. 2013. Survey of pesticide application on vegetables in the Littoral area of Togo. *Ann Agr Env Med*., 20(4):715–720.

Ali, N., S. Khan, M. Khan, M. Waqas and H. Yao. 2019. Endocrine disrupting pesticides in soil and their health risk through ingestion of vegetables grown in Pakistan. *Environmental Science and Pollution Research*, 26: 8808-8820.

Amir, S., Z. Saqib, M. I. Khan, M. A. Khan, S. A. Bokhari, M. Zaman-ul-Haq and A. Majid. 2020. Farmers' perceptions and adaptation practices to climate change in rain-fed area: A case study from district Chakwal, Pakistan. Pak. J. Agric. Sci, 57(2): 465-475.

Bagheri, A., N. Emami, C. A. Damalas. 2019. Farmers' knowledge, attitudes, and perceptions of pesticide use in apple farms of northern Iran: impact on safety behavior. *Environ Sci Pollut Res*., 26: 9343–9351. DOI10.1007/s11356-019-04330

Benjamin, N., A. Hellen, C. Jeanne, S. Nancy, N. Martin, V. W. Elizabeth. 2019. Pesticide Application Practices and Knowledge among Small-Scale Local Rice Growers and Communities in Rwanda: A Cross-Sectional Study. *Int J Environ Res Pu*., 16:4770. DOI: 10.3390/ijerph16234770

Calaf, G. M. 2021. Role of organophosphorous pesticides and acetylcholine in breast carcinogenesis. In Seminars in Cancer Biology, 76:206-217.

Damalas, C. A. and M. Khan. 2016. Farmers' attitudes towards pesticide labels: implications for personal and environmental safety. *International Journal of Pest Management*, 62(4): 319-325.

Jin, J., W. Wang, R. He and H. Gong. 2016. Pesticide Use and Risk Perceptions among Small-Scale Farmers in Anqiu County, China. *International journal of environmental research and public health*, 14(1): 29-36. DOI 10.3390/ijerph14010029

Kwon, H.A., Y. Jeong, S. Kim. 2020. Comparing Passive Dosing and Solvent Spiking Methods to Determine the Acute Toxic Effect of Pentachlorophenol on Daphnia Magna. *Ecotoxicology*, 29:286–294.DOI 10.1007/s10646-020-02172-w.

Ma, C. S., W. Zhang, Y. Peng, F. Zhao, X. Q. Chang, K. Xing and V. H. Rudolf. 2021. Climate warming promotes pesticide resistance through expanding the overwintering range of a global pest. Nature communications, 12(1): 5351-5362.

Mergia, M. T., E. D. Weldemariam, O. M. Eklo and G. T. Yimer. 2021. Small-scale farmer pesticide knowledge and practice and impacts on the environment and human health in Ethiopia. *Journal of Health Pollution*, 11(30): 210607.

Mishra, A.K., A. Gopesh, K.P. Singh. 2022. Acute Toxic Effects of Chlorpyrifos on Pseudobranchial Neurosecretory System, Brain Regions and Locomotory Behavior of An Air-Breathing Catfish, Heteropneustes Fossilis (Bloch 1794) *Drug Chem. Toxicol,* 45:670–679. DOI10.1080/01480545.2020.1762631.

Muñoz, J. P., T.C. Bleak and G. M. Calaf. 2021. Glyphosate and the key characteristics of an endocrine disruptor: A review. *Chemosphere*, 270, 128619.

Nguetti, J.H., J. K. Imungi, M. Okoth, W. J. Wang'ombe, W. F. Mbacham, S. E. Mitema. 2018. Assessment of the knowledge and use of pesticides by the tomato farmers in the Mwea Region, Kenya. *Afr J Agr Res*., 13(8):379–388. DOI 10.5897/AJAR2017.12864.

Ntow, W.J., H. J. Gijzen, P. Kelderman, P. Drechse. 2006. Farmer perceptions and pesticide use practices in vegetable production in Ghana. Pest Manag Sci., 62: 356–365. DOI 10.1002/ps.1178.

Palinkas, L. A., S. M. Horwitz, C. A. Green, J. P. Wisdom, N. Duan and K. Hoagwood, K. 2015. Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and policy in mental health,* 42(5): 533–544. DOI 10.1007/s10488-013-0528.

Rajashekar, B., V. Sudharani, M. Madhavi and M. J. M. Reddy. 2017. A Study on Profile Characteristics of Respondents about Practicing Integrated Weed Management (IWM) Practices in Major Crops in Mahaboobnagar District in Telangana State. *Int. J. Pure App. Biosci.,* 5 (4): 1302-1308.

Rashid, S., W. Rashid, R. X. S. Tulcan and H. Huang. 2022. Use, exposure, and environmental impacts of pesticides in Pakistan: a critical review. *Environmental Science and Pollution Research*, 29(29): 43675-43689.

Satya Sai, M. V., G. D. Revati, R. Ramya, A. M. Swaroop, E. Maheswari, and M. M. Kumar. 2019. Knowledge and Perception of Farmers Regarding Pesticide Usage in a Rural Farming Village, Southern India. *Indian journal of occupational and environmental medicine*, 23(1): 32–36. DOI 10.4103/ijoem.IJOEM_121_18

Sun, B., I. Zhang, L. Yang, F. Zhang, D. Norse, Z. Zhu. 2012. Agricultural Non-Point Source Pollution in China: *Causes and Mitigation Measures. Ambio.*, 41:370–379. DOI 10.1007/s13280-012-0249-6.

Ullah, W., M. Nafees, M. Khurshid and T. Nihei. 2019. Assessing farmers' perspectives on climate change for effective farm-level adaptation measures in Khyber Pakhtunkhwa, Pakistan. *Environmental monitoring and assessment*, 191: 1-18.

Waichman, A.V., N. C. Eve E, da Silva Nina. Do farmers understand the information displayed on pesticide product labels? A key question to reduce pesticide exposure and risk of poisoning in the Brazilian Amazon. *Crop Prot.* 2007;26(4):576–583. DOI 10.1016/j.cropro.2006.05.011.