Research Article

Effect of Extension-Farmers Contact on Farmers' Knowledge of Different Pest Management Practices in the Rain-Fed Districts of Khyber Pakhtunkhwa, Pakistan

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Abstract | This study was conducted to examine the effect of extension-farmers contact frequency on farmers' knowledge of improved ways of chemical, biological and cultural control methods in the rain-fed districts of Khyber Pakhtunkhwa, Pakistan. Using multistage random sampling technique data were collected from 395 respondents according to Yamane's formula. The study uses the Kruskal–Wallis H test for checking differences among farmers knowledge with differences in their contact with extension service providers. The results revealed significant differences in farmers' knowledge of chemical, biological and cultural control methods of pest with differences in the frequency of extension-farmers' contacts. With the increase in extension-farmers' contacts the farmers' level of knowledge on chemical, biological and cultural control methods of pest increase and vice versa. The study recommends that the rain-fed farmers need reasonable extension services for increasing knowledge on pest management techniques. Therefore, for providing effective services, extension agent may increase their visits to the farming community and may reach maximum farmers and encourage them to visit the extension office for seeking information.

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Introduction

Agriculture sector plays a vital role in Pakistan's economy, which depend deeply on its major crops (Rehman et al., 2015). It contributes 18.9 percent to the country's GDP and absorbs 42.3% of the labour force while also providing the raw material for a number of value-added industries (GoP, 2017-18). Despite an agricultural country, there is a huge gap between actual and acquired crop production in Pakistan, mostly because of farmers' poor adoption of improved technology, improper use of inputs at an unsuitable time and inadequate extension services on insect pest control (Rehman et al., 2015). The pest attack on crops is one of the major reasons for low crop production in Pakistan (Nabeel et al., 2018).

The poverty is more severe in rain-fed rural agricultural communities where many factors have downed farmers' adaptive capacity of improved agricultural practices (Gentle and Maraseni, 2012). Rain-fed agriculture on the one hand in Pakistan faces diverse problems including moisture stress, soil erosion, poor nutrient use efficiency and pest infestation (Baig et al., 2013).

While on the other hand, pesticides are principally being used in agricultural production to manage pests and diseases to decrease or eradicate yield losses and sustain productivity (Damalas and Eleftherohorinos, 2011). One of the major potential threats to farms In Khyber Pakhtunkhwa (KP) that remarkably decreases the crop yield is a pest attack (Khan et al., 2016). In KP farmers' mostly use synthetic chemicals unwisely for the control of insect pest (Rehman et al., 2015) which results in the degradation of the environment (Khan and Damalas, 2015). The lack of knowledge on pest management among farmers has been reported as strongly linked to excessive pesticide use (Chen et al., 2013 and Jayasooriya and Aheeyar, 2016). Biological and cultural control methods are very effective for controlling pest in KP however, because of information deficiency among farmers their use is more complex than chemical control (Fahad et al., 2015; Khan et al., 2015). A basic limitation to begin an active pest management method for farmers is the absence of satisfactory information on farmers' knowledge, perceptions and practices in pest management (Khan and Damalas, 2015; Midega et al., 2012).

The change from traditional agriculture into knowledge-based agriculture and move from cereal to high-value agriculture primarily depends on extension services (Shah et al., 2016). Agricultural extension services are intended to deliver farmers the important information and develop their knowledge, which is crucial for agricultural and rural development since meeting fresh social challenges, necessitates farmers to adopt new methods and production systems (Prager et al., 2017). Agricultural extension services aim to increase the livelihoods and well-being of the rural community by increasing information, knowledge and capacity of farmers for collective action (Bourne et al., 2017).

The southern district of KP province is more backward and poverty-stricken because the returns from various crops in these districts are substantially low than that of the Peshawar Valley (Khan and Shah, 2012). This study is the first attempt to identify the influence of the frequency of extension-farmers' contact on farmers' knowledge of pest management in the rain-fed areas of KP using econometric methods. The study also explores farmers' perception of their level of knowledge on different pest management methods in comparison of their contacts with extension service providers with a view to providing relevant information to guide researchers and extension workers and policymakers on this very important sector of the rural economy. This is because the previous studies have proven that the lack of sustainable agricultural production in KP can be addressed through effective regional agricultural policies based on local level research findings and subsequent well designed agricultural extension structure incorporating need-based advisory services with better dissemination of information and farm level training (Zulfiqar and Thapa, 2017). The main objective that this study address is.

To assess the effect of the frequency of extension-farmers' contact on farmers' knowledge of pest management practices in the rain-fed districts of KP, Pakistan.

The specific objectives include

- To know the frequency of extension-farmers' contact in the study area.
- To see the effect of differences in extension-farmers' contact on farmers' level of knowledge on chemical, biological and cultural control methods.

Materials and Methods

The universe of the Study

The present study was conducted in 2017-18 in the rain-fed districts of Khyber Pakhtunkhwa Province. Khyber Pakhtunkhwa is located in the north of the country (31°49 `N, Palynology 70°55 `E to 35°50 `N, 71°47 `E) covering an area of 74,521 km2 (Jan et al., 2016). The economy of KP province is primarily based on farming (Fahad et al., 2018). Primary data for this study was collected from purposively selected two districts, i.e. Karak and Lakki Marwat because these are the primary rain-fed districts of KP (Hassan et al., 2006; Khan et al., 2011; Khan et al., 2015). Lakki Marwat contains an area of 3164 km^2 with a cultivated area of about 116,900 ha, is situated 32° 61 N and 70°91 E at an altitude of 200–1000 m above sea level is mainly rain-fed (Ullah et al., 2014). Similarly, District Karak is positioned at 32° 47 to 33° 28 North and 70° 30 to 71° 30 East (Roohi et al., 2014). District Karak mainly rain-fed is a sub-mountainous in topography, which lies in the arid zone of the province (Khattak et al., 2011).

Selection of sample

The researcher used a multi-stage random sampling technique to collect primary data from 395

respondents. The first stage involves the purposive selection of 2 districts out of total 25 from the province because these were the primary rain-fed areas of KP. The 2nd stage involves random selection of 1 tehsil from the selected districts, making the total number of tehsils also 2. The 3rd stage involves randomly selection of 2 Union Councils (UCs) from each selected tehsil making the total number of UCs as 4. The 4th stage involves randomly selection of villages from each selected UC making the total number of villages eight. In the fifth stage, a list of farmers from all selected villages are made for sample respondent's selection, with the help of local agricultural extension officials/department, revenue department and officials of population welfare department. From that list, the sample size of 395 randomly selected sample respondents for the study was calculated using Yamane's formula (Yamane, 1967). Also, the proportional allocation sampling technique was used to select the sample size in each village (Cochran, 1977). Data collected from each village is given in Table 1.

Table 1: *Distribution of selected sampling units.*

S. No.	District	Tehsil	Union council	Village	Farming population	Sampled
1	Lakki-Marwat	Lakki Marwat	Kaka Khel	Kaka Khel	7200	93
				Mela Mandra Khel	8800	113
			Mela Shahab Khel	Mela Shahab Khel	5720	74
				Wanda Kalan	3680	47
2	Karak	Takht-e-Nasrati	Chokara	Mehrab Khel	845	11
				Payenda Khel	759	10
			Jehangiri	Seerak Banda	1641	21
				Lakki Banda	1987	26
Total	2	2	4	8	30632	395

Source: *Authors' calculation using Yamane's formula, 2017.*

Pre-test of constructed interview schedule

Before collecting the actual data, a pilot survey was conducted by randomly choosing a small number of unselected respondents to check the validity and reliability of the developed interview schedule. Then jury method (Kerlinger, 1973) was employed by exposing the complete interview schedule to the scrutiny of pertinent experts including scientist and researchers. Each of the judges (experts) gives out independently his own professional opinion on the relevance of the constricted interview schedule. Needed corrections was made in the interview schedule based on this pre-test.

Statistical analysis of data

The collected data was entered into the Statistical Package for Social Science (SPSS) version 22 software for analysis. Data were tested for normality of distribution using the Kolmogorov-Smirnov test (de Assunção et al., 2018), where the data significantly deviated from normality. The data were summarised using frequencies and percentages. Kruskal-Wallis H test for categorical variables with more than three sets of values was used (Liu et al., 2011; Elliott and Hynan, 2011).

Results and Discussion

Descriptive statistics from the interview schedule is provided to show extension-farmers contact frequency in relations to farmers' level of knowledge on chemical, biological and cultural control methods of pest management in the rain-fed districts of KP province. The extension-farmers' contact frequency in this study was defined as the frequency of extension agent contacts with farmers or farmers contacts with an extension agent. Based on the results of the survey, Table 2 gives information on extension-farmers' contact frequency in relation to farmers level of knowledge on appropriate chemical control methods of the pest.

Table 2 shows results on extension-farmers contact frequency in relations to farmers' level of knowledge on chemical control methods. It can be seen in the table that most of the respondents (5.8%) who have reported daily contact with extension service providers have reported high knowledge of chemical control methods. It is also clear from the table that no farmer having daily contact with extension service provider have reported no knowledge of chemical control methods in the study area. Similarly, most of the respondents (23.0%) who have reported no contact with extension service providers showed no knowledge of chemical control methods in the study area. These results are somewhat in agreement with

Table 2: *Frequency of extension-farmers contact and farmers' level of knowledge on chemical control methods.*

Frequency of extension-farmers' contact	Chemical Control				Total
	No knowledge	Low knowledge	Medium knowledge	High knowledge	
Daily	0 (.0)	4 (1.0)	6 (1.5)	23 (5.8)	33 (8.4)
Weekly	0 (.0)	5 (1.3)	19 (4.8)	8 (2.0)	32 (8.1)
Monthly	6 (1.5)	15 (3.8)	25 (6.3)	9 (2.3)	55 (13.9)
Once a year	56 (14.2)	17 (4.3)	49 (12.4)	19 (4.8)	141 (35.7)
Never	91 (23.0)	15 (3.8)	23 (5.8)	5 (1.3)	134 (33.9)
Total	153 (38.7)	56 (14.2)	122 (30.9)	64 (16.2)	395 (100.0)

Source: *Field survey, 2017; Values in parenthesis are percentages.*

Table 3: *Frequency of extension-farmers contact and farmers' level of knowledge on biological control methods.*

Frequency of extension-farmers' contact	Biological control				Total
	No knowledge	Low knowledge	Medium knowledge	High knowledge	
Daily	4 (1.0)	6 (1.5)	10 (2.5)	13 (3.3)	33 (8.4)
Weekly	6 (1.5)	1 (.3)	20 (5.1)	5 (1.3)	32 (8.1)
Monthly	9 (2.3)	9 (2.3)	28 (7.1)	9 (2.3)	55 (13.9)
Once a Year	75 (19.0)	30 (7.6)	30 (7.6)	6 (1.5)	141 (35.7)
Never	126 (31.9)	3 (.8)	4 (1.0)	1 (.3)	134 (33.9)
Total	220 (55.7)	49 (12.4)	92 (23.3)	34 (8.6)	395 (100.0)

Source: *Field survey, 2017; Values in parenthesis are percentages.*

the findings of Ogunjimi and Farinde (2012) who reported that about 65% of the respondents in Osun (Nigeria) and 97.0% in Edo state (Nigeria) had no extension contact and thus no knowledge of chemicals control methods.

Data in Table 3 shows results on extension-farmers contact frequency in relations to farmers' knowledge of biological control methods of the pest in crops. The table revealed that 3.3% of the respondents who have reported daily contact with extension service providers had reported high knowledge of biological control methods of the pest in contrast to 1.0% of the respondents who reported daily visit but revealed no knowledge of biological control methods of the pest. Likewise, most of the respondents (31.9%) who reported no contact with extension service providers showed no knowledge of chemical control methods in contrast to 0.3% who reported no contact but revealed the knowledge of biological control methods in crops. The findings of Pinthukas (2015) have stressed similar results by reporting that the knowledge constraints faced by farmers in adoption of biological control methods are a big disadvantage while increasing frequency of extension visits can significantly contribute to farmers' knowledge on organic crop production.

The results in Table 3 indicate the extension-farmers contact frequency in relations to farmers' knowledge of cultural control methods of the pest in crops. The table revealed that 4.1% of the respondents who have reported daily contact with extension service providers had reported high knowledge of cultural control methods of the pest in contrast to 0.5% of the respondents who reported daily visit but revealed no knowledge of biological control methods of the pest. Likewise, most of the respondents (13.7%) who reported no contact with extension service providers showed no knowledge of cultural control methods in contrast to 6.8% who reported no contact but revealed the knowledge of cultural control methods in crops. Combining all tables suggest that more than half of the respondents have either no contact with extension agent or only one contact all over the year. Moreover, by comparing all three tables, i.e. Table 2, 3 and 4, it can be seen that no knowledge and low knowledge is highly in no contact farmers or farmers with one contact in a year. In contrast, the level of farmers' knowledge of different pest management methods was higher among contact farmers. Results of Alalade et al. (2017) shows that all farmers were aware of the cultural control methods. However, only 73.3% and 17.5% were aware of chemical and biological pest

Table 4: *Frequency of extension-farmers contact and farmers' level of knowledge on cultural control methods.*

Frequency of extension-farmers' contact	Cultural control				Total
	No knowledge	Low knowledge	Medium knowledge	High knowledge	
Daily	2 (.5)	4 (1.0)	11 (2.8)	16 (4.1)	33 (8.4)
Weekly	6 (1.5)	6 (1.5)	11 (2.8)	9 (2.3)	32 (8.1)
Monthly	6 (1.5)	7 (1.8)	23 (5.8)	19 (4.8)	55 (13.9)
Once a Year	26 (6.6)	21 (5.3)	56 (14.2)	38 (9.6)	141 (35.7)
Never	54 (13.7)	16 (4.1)	37 (9.4)	27 (6.8)	134 (33.9)
Total	94 (23.8)	54 (13.7)	138 (34.9)	109 (27.6)	395 (100.0)

Source: *Field survey, 2017; Values in parenthesis are percentages.*

control methods, respectively. Moreover, they reported that farmers' level of knowledge on cultural, biological and chemical pest control methods increased with increase in extension-farmers' contacts. These results are also in agreement with the findings of Abdollahzadeh et al. (2018) who reported a weak contact among farmers and extension agent with no contact or just one contact in an entire year among extension agent and farmers, however; they reported extension services as very effective in increasing the knowledge among contact farmers.

Inferential statistics

To see whether differences in the extension-farmers contact frequency effect farmers knowledge of chemical, biological and cultural control methods, the Kruskal-Wallis H test were used. Table 5 Shares statistically significant differences in farmers level of knowledge between the differences in extension-farmers' contact based on the results of the Kruskal-Wallis H test.

Table 5: *Results of Kruskal-Wallis H test.*

Variables	Frequency of extension-farmers' contact	N	Mean Rank	Chi-Square values	Sig.
Chemical control	Daily	33	324.53	119.931	.000
	Weekly	32	279.84		
	Monthly	55	240.34		
	Once a year	141	195.45		
	Never	134	132.60		
Biological control	Daily	33	302.65	166.462	.000
	Weekly	32	284.70		
	Monthly	55	280.73		
	Once a year	141	194.14		
	Never	134	121.63		
Cultural control	Daily	33	255.44	28.391	.000
	Weekly	32	202.36		
	Monthly	55	229.40		
	Once a year	141	205.14		
	Never	134	162.41		

Source: *Authors' estimation based on field survey data, 2017.*

The results in Table 5 showed that there was a statistically significant difference in farmers level of knowledge scores on chemical, biological and cultural control methods of pest with the difference in extension-farmers' contact as P value for each variable is P= .000 with the different mean ranks for each variable reported. These results indicate the importance of extension-farmers' contact in providing farmers with knowledge on chemical, biological and cultural control methods in the study area. These results are in agreement with the findings of Rahaman et al. (2018) who found significant differences in farmers' knowledge of biological, cultural and chemical pest control methods with differences in farmers' contacts with extension personnel. Results of Ogunlade et al. (2009) show that more than half of the respondents made regular contacts with an extension agent and extension services improved farmers' knowledge among contacted farmers. These results are also inconsistent with the findings of Karamidehkordi and Hashemi (2010) who reported little extension-farmers' contacts and consequently farmers had low knowledge of biological, cultural and chemical pest control. They further found that because of low knowledge farmers hardly use biological or cultural pest control methods. They suggest that increasing extension services to farmers can improve farmers' knowledge on chemical, biological and cultural pest control methods. Results of Tsinigo and Behrman (2017) found that the numbers of extension contacts were a most important forecaster of the farmers' decision to adopt improved methods in agriculture thus; increasing extension contacts with farmers can enable them to

attain needed information regarding innovations and expose them to the practice of using those.

Conclusions and Recommendations

Based on the results, it is concluded that though weak extension-farmers' contact exists in the study area, however, it is very important for developing knowledge among farmers on chemical, biological and cultural control methods of the pest in crops. The study found significant differences in farmers' knowledge on all three crop pest management techniques based on differences in the frequency of farmers contact with extension service providers. It descriptive statistics suggest that increase in extension-farmers' contacts the farmers' level of knowledge increases and vice versa.

It was recommended that the rain-fed farmers need reasonable extension services for increasing knowledge on pest management techniques. Increased extension-farmers' contacts are crucial for improving farmer's knowledge of chemical, biological and cultural control methods, therefore; strong emphasis may be given to establishing an effective frequent contact between farmers and extension service providers so as to equip farmers with the necessary information they need for increasing crop management practices. For providing effective services, extension agent may increase their visits to the farming community and may reach maximum farmers and encourage them to visit the extension office for seeking information.

Author's Contributions

This research article is a part of PhD research work of Ayat Ullah which was supervised by Associate Professor Dr. Ayesha Khan.

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