SIGNIFICANCE OF AGRICULTURAL EXTENSION IN ADDRESSING THE WEEDS INFESTATION IMPACT ON MAJOR CROPS IN DISTRICT BAJAUR KP-PAKISTAN

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ABSTRACT

The current study investigated the impact of weeds on major seasonal crops in district Bajaur Khyber Pakhtunkhwa, Pakistan. The aim was to know the prevailing weed management system and encourage the farmers to integrate cultural practices with chemical control measures. A three stage stratified sampling technique was adopted to collect data from the selected respondents through a well-designed interview schedule. Statistical Package for Social Sciences (SPSS v 20) was used to analyze the primary cross-sectional data and the obtained findings were depicted in tables and figures. Descriptive statistics revealed that majority of the respondents i.e. 31.3% were of middle age with 63.9% illiteracy rate and 60.8% reported living in household size of 10 and above family members. *Echinocloa crus-galli* (L.) was the most invasive weed specie among the Kharif weeds as reported by 26% respondents, while among Rabi weeds, *Convolvulus arvensis* (L.) was the most reported weed as mentioned by 21% respondents. The study established that maize and wheat are the main crops impacted by Kharif and Rabi weeds respectively, where mechanical weeding was the most applied control method adopted by 51.8% respondents, followed by chemical (42.2%) and manual weeding (6%) in the study area. Study observed a significant decrease in crops yield due to various weeds found in farmers' fields. Effective extension services are needed to encourage farmers integrate cultural practices with chemical control management in order to get better crop yield and avoid environmental and human health hazards..

Keywords: Agricultural extension, weed infestation, impact, Kharif, Rabi

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INTRODUCTION

Agriculture provides a big share to the economic development of Pakistan through supplying food, strengthening industry and employing major segment of its people (Sanaullah and Pervaiz, 2019). It contributes almost 18.5% to Gross Domestic Product (GDP) and provides job opportunities to about 38.5% citizens, thus helps in bringing prosperity and uplifting living standard of the community (GoP, 2018-19). Major cereal crops like wheat, rice and maize are the key sources for food supply earning (Afzal and Ahmad, 2009). Hence, efficient yield potential of these crops needs to be enhanced in order to effectively improve our agriculture sector along with those industries that are dependent on agriculture (Nosheen and Iqbal, 2008).

Besides other observed obstacles, hostile weeds negatively affect field crops and their growth (Siddiqui *et al.,* 2010). Weed species compete with standing crops on available soil nutrients, light and water etc. which decrease crop yield and quality (Zareen *et al.*, 2017). The yield losses could be measured from the factors like weed intensity, weed-plant competition duration, time of emergence and plant health (Ali *et al.,* 2015). In Pakistan, up to 30% yield loss occurs in major crops due to weeds (Hussain *et al.,* 2007) which is about 12%, referring to 10% average global average loss (Rabbani *et al.,* 2013). Regarding monetary losses, weed infestation results in a huge loss of about USD 1 billion annually in Pakistan (Saeed *et al.,* 2010). Efficient weed control is among the main factors to boost yield of major crops in Pakistan. Per year yield of some major crops was estimated and observed in Pakistan, reporting that wheat suffered 17-25%, rice 20-63%, sugarcane in range of 15-35% and cotton crop was recorded which reduced yield up to 13-31% (Abbas, 2006). Timely weed management is a key to avoid adverse effects of these weeds on crops (Fahad *et al.,* 2014). Integration of modern and local control methods need to be applied for the eradication of weed species (Rabbani *et al.,* 2013). Unavailability of machinery/technology, lack of information, lack of financial resources and costly inputs are the key causes for not allowing poor farmers to get rid of weeds menace (Khaliq *et al.,* 2013). Furthermore, overuse of chemical weedicides is not appreciated as they cause weed resistance and results in environmental threat and human health hazards (Marwat *et al.,* 2011). Chemical weed control is effective in eradicating crop weeds but raise issue related to ecology and humans (Riaz *et al.,* 2007). Before the herbicides were introduced, some beneficial weed control approaches had to be used i.e. hand weeding, crop rotation and specific tillage operations (Anderson, 2015).

OBJECTIVES OF THE STUDY

1. To assess the impact caused by weed infestation in Pakistan and study weed management practices in District Bajaur.
2. To encourage the farmers to integrate chemical control measures with cultural operations and indigenous knowledge for effective weed management.
3. Awareness regarding safe use of herbicides.

MATERIALS AND METHODS

Universe of the study

The present research study was conducted in district Bajaur of Khyber Pakhtunkhwa, Pakistan. District Bajaur is bound on its north-east by District Dir, on its south-east by District Malakand, on its south by District Mohmand and on its west and south-west by Afghanistan. The District lies between 34°-33 to 34°-58 north latitudes and 71°-15 to 71°-45 east longitudes (Atlas, 1985). The total land area of Bajaur is 1,290 square kilometers (www.thebajaur.com).

Sampling design

A three stage stratified random technique was used to draw the sample for the study. At first stage, three tehsils namely Mamund, Khar and Nawagai were selected purposively on the basis of suitable land for major crops production in district Bajaur. At stage two, one village from each tehsil was selected out of the selected three tehsils. At the last stage, 166 respondents were selected randomly from the sampled villages and all these

growers were interviewed for this research study.

Research instrument

The study included both primary and secondary data as well as field observation by the researcher. For data collection, a well-structured interview schedule was prepared and used as a research instrument in the light of research objectives. The interview schedule consisted of both open-ended and closed ended questions to collect relevant information (Sanaullah et al., 2020).

Data analysis

To analyze the collected data, SPSS v. 20 was used and the obtained results were presented in the form of percentages, counts and graphs.

RESULTS AND DISCUSSION

Demographic attributes of the respondents

Some main demographic characteristics of the study respondents were studied which provide base for conducting a social sciences research especially in the field of agricultural sciences.

Age

Age has a key role in allowing the families to whether adopt or reject an innovation. According to research, young people are more persuaded towards technology adoption than older ones (Okwu et al., 2007). Table 1 shows data regarding age of the growers whose age was divided into four categories. Study outcomes revealed that out of the total 166 farmers, majority respondents (31.3%) had age in range of 25-30 years, followed by 29.5%, 23.5% and 15.7% farmers with age values of 46 and above years, 36-5 years and up to 25 years, respectively.

Table 1. Distribution of the respondents according to their age

Tehsil	Age of the respondents (in years)				
	Up to 25	25-35	36-45	46 and above	Total
Mamund	6 (3.5)	8 (4.4)	12 (7.5)	10 (6.2)	36 (21.7)
Khar	3 (1.7)	12 (7.5)	16 (9.4)	19 (11.2)	50 (30.1)
Nawagai	17 (10.5)	32 (19.4)	11 (6.6)	20 (12.1)	80 (48.2)
Total	26 (15.7)	52 (31.3)	39 (23.5)	49 (29.5)	166 (100)

Source: Field survey, 2018-19

Note: Figures in parenthesis show percentages

The depicted data in Table 1 demonstrates that maximum (31.3%) farmers had age category of 25-35 years. Similar results were identified by Farah et al. (2011) where maximum i.e. 35.17% study respondents were recorded having age between 18-35 years. The study outcomes indicated that younger farmers were more inclined towards innovative technologies and to adopt modern farming practices and new techniques (Sanaullah et al., 2020).

Literacy status

Literacy status is a determining factor for the acceptance of latest agricultural technologies. Hence, a literate farmer is more interested and motivated to take new information as compared to illiterate one (Sanaullah and Pervaiz, 2019). Anandajayasekeram (2008) established that literacy status of the farmers plays a dominant role in the adoption of innovative agricultural techniques. Figure 1 illustrates that almost two third that is 63.9% of the total farmers were reported illiterate, while 36.1% respondents were found literate. Among the literate, 58% were up to primary level, middle (18.3%), matriculate (13.4%) and 8.3% farmers had education up to intermediate or higher in the study area. Illiteracy demotivates rural people to take bold steps needed to accept improved technologies and hence prevents skills development (Oyekale and Idjesa (2009).

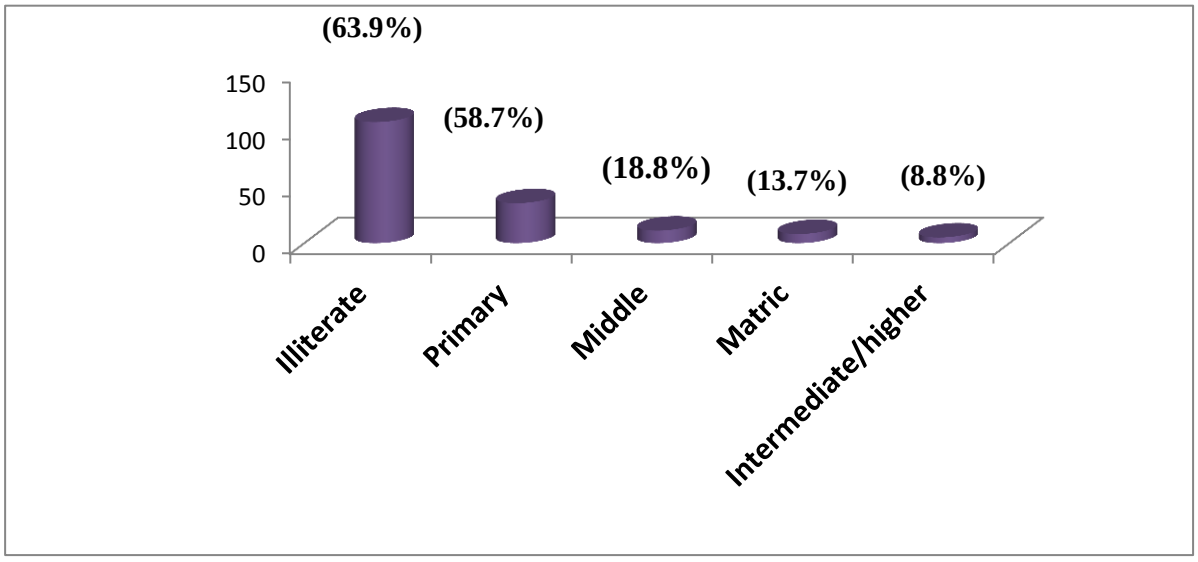

Figure 1. Distribution of respondents on the basis of their literacy status

Household size

Household size is an important variable determining level of technology adoption and effective weed management. Figure 2 portrays data of study respondents regarding number of their family members. The data revealed that maximum number of the respondents i.e. 60.8% had household size of 10 and above family members; 7.8% respondents reported that they had up to 5 family members, while 31.4% respondents were found living in between 6-9 member households. Muriithi (2003) recorded that more than half i.e. 52.5% households had between 7-13 family members. A large household size can provide the opportunity for labor services enabling them to efficiently eradicate weeds from their fields and adopt effective weed management strategy. Moreover, it encourages the farmers to adopt innovation and enhancing their capacity to carry out their field operation efficiently (Doss, 1999).

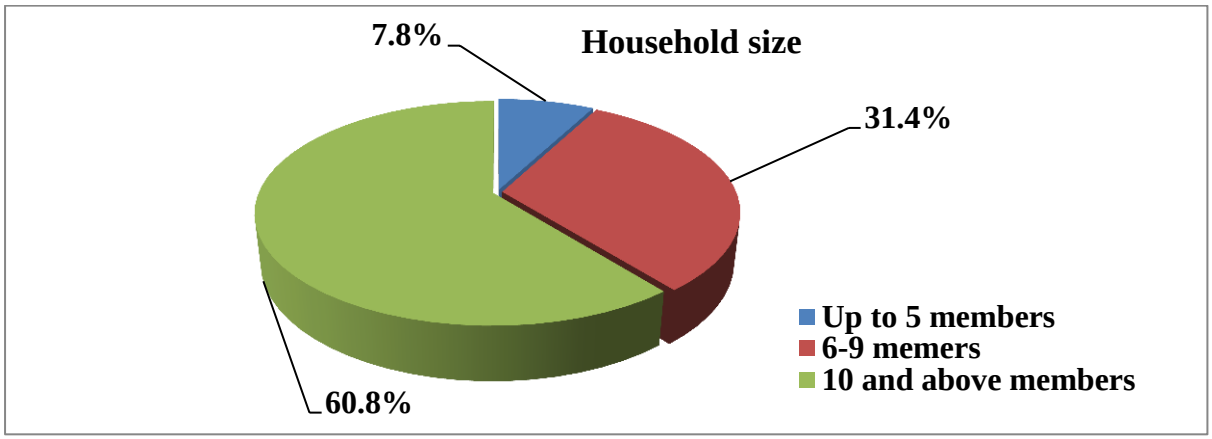

Figure 2. Distribution of respondents on the basis of their household size

Weed infestation

Plants which are not grown intentionally and their adverse impacts are more than positive ones, are called weeds. Weeds cause diseases in crops and support the insect pests. In agricultural term, weeds are called pest because they cause damage to the crop (Oad et al., 2007). Usually weeds can be classified as annuals, biennials and perennials which are responsible for the decrease in crop yield in various agricultural crops and forests (Khan et al., 2004). Weeds are further divided into Rabi and Kharif weeds. Rabi weeds infest the Rabi crops, while Kharif weeds are those which

infest the Kharif season crops. Different types of weeds were found in the major field crops of district Bajaur whose detail is presented in Table 2.

Table 2. Respondents' opinion regarding various Kharif and Rabi weeds in their major crops

Main Kharif crop	Major weeds	No of respondents (Frequency)	Percentage
Maize	*Cyperus rotundus*	31	18
	Echinocloa crus-galli	44	26
	Amaranthus hybridus	25	15
	Achyranthus aspera	9	6
	Sorghum halepense	15	9
	Portulaca oleraceae	11	7
	Digitaria spp.	13	8
	Cucumis spp.	7	4
	Convolvulus arvensis	11	7
Total		166	100
Main Rabi crop	**Major weeds**	**No of respondents (Frequency)**	**Percentage**
Wheat	*Convolvulus arvensis*	35	21
	Carthamus oxyacantha	24	14
	Cynodon dactylon	18	11
	Avena fatua	5	3
	Asphodalus tenuifolius	12	7
	Aanagallis arvensis	17	10
	Chenopodium album	8	5
	Cyperus rotundus	9	6
	Fumaria indica	13	8
	Medicago denticulate	4	2
	Euphorbia helioscopia	11	7
	Phalaris minor	10	6
Total		166	100

Source: Field survey, 2018-19

Data regarding different Kharif and Rabi weeds found in two major seasonal crops were displayed in Table 2. Among Kharif weeds, the data depicted that majority (26%) of the farmers were noted who claimed that weed-*Echinocloa crus-galli* L. was the most dominant weed in their maize fields, followed by *Cyperus rotundus* L. and *Amaranthus hybridus* L. in terms of severity as reported by 18% and 15% respondents, respectively. Similarly, data regarding Rabi weeds were also gathered which were affecting wheat, the main Rabi crop in study area. Study observation revealed that among Rabi weeds, *Convolvulus arvensis* L., *Carthamus oxyacantha* M. Bieb. and *Cynodon dactylon* L. were key weeds negatively impacting wheat crop as noted by 21%, 14% and 11% respondents, respectively in the study area.

Influence of weed-crop competition on crop yield

Wheat

Wheat crop has tremendous potential of higher yield but unluckily, Pakistan gains low per acre yield with reference to other countries of the world (Chivasa et al., 1998). Weed infestation and its bad impacts are among the main concerns responsible for unsatisfactory wheat production (Shehzad et al., 2012). As a consequences, almost 30% yield loss occurs which becomes Rs.1150 million per annum in term of money (Marwat et al., 2008). For what crop, a total of 8.74 million hectares land is allocated in Pakistan, giving per year production of 25.19 million tons, with an average yield

of 2883 kg/hec (GoP, 2018-19). Besides other, uncontrolled weed infestation, inefficient fertilizer application and lack of irrigation water are the fundamental factors constraining to obtain the desired wheat production (Jabran et al., 2011). Out of the mentioned problems, weed is the main limiting factor hindering the increased yield loss up to 18-30% in total wheat produce per year (Ashiq and Cheema, 2005). Additionally, wheat grain could also be badly decreased from 20-50% due to these weeds in wheat fields (Hussain et al., 2012).

Maize

Among the cereals, maize is the third key crop cultivated in the country sown for both purposes i.e. grain and fodder (Ullah et al., 2008). Approximately 1.318 million hectares of maize was grown in Pakistan, which produced 9.309 million tonnes grain production during 2018 (GoP, 2018-19). The average maize yield in Pakistan is near 4.3 t/ha which is still below than global average (5.1 t/ha) (USDA, 2012). In Pakistan, large scale weed growth and ineffective weed management practices among others, are the main factors responsible for low maize yield (Fahad et al., 2014). Weed infestation is considered of premier importance, as grain yield losses due to weeds in maize have been estimated to be 35-83% (Usman et al., 2001). The most occurring weeds like, *Cyperus rotundus* L. and *Cynodon dactylon* L. negatively affect maize growth and cause a significant decrease in production (Ullah et al., 2008). Observing the deteriorated maize situations due to weed, it is need of the day to implement integrated weed management practices integrating herbicide us with cultural measure.

Weed management

In order to obtain more crop yield, effective weed management is highly recommended. The presented data in Table 3 reveals various weeding procedures applied by farmers in the study area. The Table shows that mechanical method of weed control is among the most used control method adopted by 51.8% farmers, followed by 42.2% respondents who had used chemical control method, while only small portion (6%) farmers reported manual procedure for their weed eradication.

Table 3. Distribution of respondents on the basis of different weeding methods

Tehsil	Weeding method			Total
	Chemical	Mechanical	Manual	
Mamund	57 (34.3)	19 (11.4)	4 (2.4)	80
Khar	4 (2.4)	42 (25.3)	4 (2.4)	50
Nawagai	9 (5.4)	25 (15.1)	2 (1.2)	36
Total	70 (42.2)	86 (51.8)	10 (6.0)	166

Source: Field survey, 2018-19

From the given information, it is concluded that mechanical method was mostly in use which is a good sign for the growers in terms of protecting environment and securing human health from overuse of chemical herbicides. In some of the European countries like, France, Italy and Hungary, farmers mostly rely on mechanical weed control against weeds (Meissle et al., 2009).

Challenges to weed management in Pakistan and role of extension education

Farmers in Pakistan apply different weed control measures from manual to herbicide use in order to eliminate the existing weeds from their fields. Out of these methods, chemical control method can cause environmental pollution and health concerns as well as increase weed resistance to herbicides (Khaliq et al., 2011). Changing attitude of the farmers about excessive use of chemical pesticides and persuading them regarding importance of cultural practices is beneficial in favor of farmers and environment. Poor farmers are more

vulnerable to be affected by hostile weeds as they are unable to buy necessary technologies and materials required for timely weed management (Khaliq et al., 2011). Keeping in view the severity of the issue, integration of indigenous knowledge with chemical use is highly needed and encouraged without disturbing crop yield. Furthermore, extension trainings are needed to create awareness among the public regarding adverse effects of weeds and motivate them to use environment friendly measures. Previous research studies emphasize the vital importance of possible modifications in prevailing indigenous practices (Khaliq et al., 2013).

CONCLUSIONS AND RECOMMENDATIONS

The fast spread of weed species amongst various crops in Pakistan is becoming a critical challenge for the growers and weed scientists. Due to unawareness regarding judicious use of herbicides, farmers become addicted to misuse of weedicides which put negative consequences on environment and human health. In such circumstances, environment friendly and sustainable approaches are the best feasible options to reduce the adverse effects of weed infestation. Maize and wheat are the major Kharif and Rabi crops respectively, infested by invasive seasonal weeds. Some invasive weeds cause tremendous reduction in seasonal crop yields and badly affect their growth. Mechanical weed control is the most used procedure for weed management which is a positive symbol for agriculturists and farmers itself. Indigenous practices in collaboration with chemical herbicides can facilitate the growers in mitigating weed impact on major crops while keeping yield benefits undisturbed. Nonetheless, in-depth research work is needed to identify view point of farmers about weed management concerns and they need to be motivated to adopt effective extension approaches in order to avoid negative impacts of weeds. Extension department may provide necessary trainings to create community awareness about safe use of herbicides and encourage farmers to integrate cultural practices with technological measures.

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