ANALYSIS Vol. 4, 2018

ISSN 2347–3819 EISSN 2347–386X

DISCOVERY Agriculture

Damaging effects of weeds in Cotton-Wheat cropping system in the Punjab: Implications for smallholder farmers

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Article History
Received: 27 March 2018
Accepted: 09 May 2018
Published: May 2018

Citation
Raza Ejaz, Khalid Mahmood Chaudhary, Ijaz Ashraf, Umair Talib, Muhammad Shoaib, Awais Ali Khan, Muhammad Usman. Damaging effects of weeds in Cotton-Wheat cropping system in the Punjab: Implications for smallholder farmers. *Discovery Agriculture*, 2018, 4, 69-74

ABSTRACT

Present study was conducted at Institute of Agricultural Extension and Rural Development, University of Agriculture Faisalabad, Pakistan in 2017 in order to explore the awareness level of the farmers of district Sahiwal regarding different weeds of cotton-wheat cropping system and their damage extent. Weeds are unwanted plants that compete with the crops grown and responsible for

severe losses in crop production. Weed infestation is one of the major among various factors that result in reducing crop production and responsible for economic losses to the farming community. Multistage random sampling technique was used for the selection of sample of 130 respondents. The data were collected through a reliable and validated interview schedule. And were analyzed using statistical package for social sciences (SPSS). Descriptive and inferential statistical techniques were used for data analysis. Results indicate that Lehli, Dumbisitti, JangliJavi, MadhanaGhass, Itsit and Chibber (*Convolvulus arvensis L., Phalaris minor Retz., Avenafatua L., Dactylocteniunaegyptium L., Trianthemaportulacastrum L.* and *Mukiamaderasaspatana L. M. Roem*) were known to all of the respondents among weeds of cotton-wheat crop system. While, KallriBooti and PhullanBooti (*Spergulaarvensis L.* and *Stellaria media (L.)Vill*) were not known to any of the respondents. Itsit, Lehli, Tandla and Bathu (*Trianthemaportulacastrum L., Convolvulus arvensis L., DigeraarvensisForsk* and *Chenopodium album L.*) were found most harmful among broad leaf weeds of cotton-wheat cropping system with mean values of 4.7, 4.0, 3.93 and 3.90. While, DumbiSitti, SwankiGhass, JangliJavi and KhabbalGhass (*Phalaris minor Retz., Echinochloacolonum (L.) Link, Avenafatua L.* and *Cynodondactylon L. pers*) were found most harmful among narrow leaf weeds of cotton-wheat cropping system with mean values of 4.70, 4.61, 4.10 and 3.99.

Keywords: cotton-wheat cropping system; weeds; farmers' awareness; damage extent; Sahiwal; Pakistan

1. INTRODUCTION

Weed infestation is becoming a very major issue among all the problems that are being faced by agricultural sector leading towards greater economic losses in terms of production and ultimately the livelihoods of farming community of rural areas. Weeds are actually undesired plants that grow out voluntarily in different cultivated crops. Weeds negatively influence the plants because they keep on competing with plants for getting nutrients, light, water and space as well. Weeds are also known as the oldest pollutants of agricultural field crops. Moreover, they are more dangerous than insect/pests and other diseases thus most of the weeds are also very harmful equally for men and animals because of their poisonous nature. Weeds are one of the major problems in Pakistan which may reduce crop yield up to a great extent. Weeds may cause reduction in crop yield up to 40-50% if these are not controlled in early 40 days of growing crop (Hafeez, 2011).

The weeds may reduce 14-42% yield of wheat by using productivity of land in terms of water and nutrients up take. In case of cotton, the attack of insect/pests and virus has a linkage with population of weed near water channels, ridges and road sides (Govt. of Punjab, 2010; Ahmad and Shaikh, 2003). Therefore, weeds are the main problem which can influence the production and quality of any crop (Khan *et al.*, 2011).

FAO (2004) described that there are 08 different types of farming systems being practiced in Pakistan such as pulses-wheat, rice-wheat, maize-wheat-oilseed, cotton-wheat, maize-wheat, mixed crops, peri-urban and orchards/vegetable-wheat. Cotton-wheat cropping system was the most commonly practiced among all these systems in rural areas of Punjab (southern) and Sindh.

Wheat (*Triticumaestivum L.*) is an important cereal crop and is gaining popularity all over the world and especially in Pakistan. Due to increase in population and food prices, higher yield of the wheat can play a vital role in stabilizing the food prices directly or indirectly. Management of many factors can significantly contribute in increasing the grain yield of wheat in Pakistan. Among these factors, weed management is an important factor and can increase the wheat yield by more than one million ton in Pakistan. Weeds are an important obstacle to crop production, particularly in low-input and organic systems (Clark *et al.*, 1998; Penfold *et al.*, 1995; Stonehouse *et al.*, 1996).

Cotton production is hampered by many factors like sowing at optimum time, germination, stand establishment, nutrient management and weeds infestation. Due to high competition for water, nutrients, light and space, weeds drastically affect the production of crop (Mubeen *et al.,* 2009).

Both these crops (cotton and wheat) are majorly grown in district Sahiwal under cotton-wheat cropping system. High yield of these crops is directly associated with the increased livelihoods and betterment of the farmers. There are several reasons for low yield of both of these crops while, spreading of weeds is considered one of the main causes that are responsible for low crop yield.

That is why the present study was planned to analyze awareness level of farmers about different weeds of cotton-wheat cropping system and their Extent of damage in district Sahiwal. It was supposed that the findings of the study would be beneficial in identifying the awareness level of the farmers about different weeds and extent of their damage and would also provide guide-line to government authorities (extension organizations) for planning a reasonable strategy in future for improved extension working regarding weed control measures.

2. MATERIALS AND METHODS

The study was conducted in Sahiwal district of Punjab Pakistan, which consists of two tehsils. Tehsil Chichawatni was selected purposively because cotton-wheat is most commonly practiced cropping system in this tehsil. Tehsil Chichawatni consists of 37 union councils out of which 33 are rural while 4 are urban UCs. Out of 33 rural UCs 5 UCs were selected. Two villages were selected from each of the selected UCs thus by making a total of 10 villages. From each of the 10 villages 13 respondents were selected thus by making a sample size of 130 respondents. Keeping in view the objectives of the study, an interview schedule was developed for data collection. Considering the suitability of Likert Scale for assessing the effectiveness of problems, a five point Likert scale (1= Very Low), 2= Low, 3= Medium, 4= High, 5= Very High) was used. Descriptive statistics and inferential statistic such as frequencies, means, standard deviations and rank orders were used for interpretation of data.

3. RESULTS AND DISCUSSION

Awareness about Weeds and Extent of Damage Caused by Them

Weeds are actually undesired plants, which grow out voluntarily in any of the cultivated crop resulting in financial losses by having a negative impact on crop yield. There are several factors playing a vital role in reducing the yield and weeds are one of these most important factors. They keep on competing with plants for getting nutrients, light and space as well. Effects of weeds are more drastic as compared to that of insect/pests, different diseases, viruses and nematodes (Ashiq *et al*., 2007). In cotton- wheat cropping system there are many species of weed that are considered responsible for yield reduction. Farmers were asked about their level of awareness about different weeds and their extent of damage. Data in this regard are provided in table 1 and 2.

Table 1 Farmers' awareness about weeds and extent of their damage in cotton

Cotton weeds		Awareness	Extent of damage			
Botanical name	**Local name**	**percentage**	**Weighted score**	**Rank**	**Mean**	**Standard deviation**
Broad leaf weeds						
Trianthemaportulacastrum L.	Itsit	100.0	613	1	4.7	0.50
Convolvulus arvensis L.	Lehli	100.0	520	2	4.0	0.39
*Digeraarvensis*Forsk.	Tandla	93.0	476	3	3.93	0.30
Mukiamaderaspatana(L.)M. Roem.	Chibber	100.0	463	4	3.56	0.65
Xanthium strumarium L.	Mahabatbooti	86.0	347	5	3.04	0.30
Tribulusterrestris L.	Bhakra	89.0	329	6	3.58	0.53
Euphorbia granulate L.	Hazardanidhodhak	67.0	181	7	2.87	0.41
Portulacaoleracea L.	Kulfa	50.0	159	8	2.89	0.36
Sesbania aculeate (L.) Pers.	Dhaincha	39.0	100	9	2.66	0.57
Corchorusantichorus	Bhauphali	30.0	82	11	2.59	0.55
Amaranthusviridis L.	Junglichulai	35.0	80	10	2.07	0.41
Euphorbia hirta L.	Laldhodak	28.0	54	12	2.01	0.31
Narrow leaf weeds						
Echinochloacolonum (L.) Link	Swankighass	96.0	554	1	4.61	0.58
Cynodondactylon(L.) pers	Khabbalghass	93.0	481	2	3.99	0.15
Dactylocteniunaegyptium (L.) beauv.	Madhanaghass	100.0	422	3	3.19	0.45
Sorghum halepense (L.) Pers.	Baru	78.0	320	4	3.07	0.64

Scale- 1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High

It is clear from the data presented in the table 1 that all (100%) of the respondents were aware of broad leaf weeds such as Lehli, Itsit and Chibber while in the category of narrow leaf weeds, only MadhanaGhass was the weed which was known to all (100%) of the respondents. Awareness of the respondents about KhabbalGhass, SwankiGhass and Baru was 93.0, 96.0 and 78.0% respectively. While, awareness of the respondents about Tandla, Bkhakra, MohabbatBooti, Kulfa and Hazardanidodak was 93,89,86,50 and 67 percent respectively. JangliChulai, Bhaupali, Dhaincha and LalDodak were known to 35, 30, 39 and 28 percent respondents respectively.

An overview of the table reveals that among broad leaf weeds, Itsit, Lehli and Tandla were ranked 1st, 2nd and 3rd in terms of damaging cotton crop with a weighted score of 613,520 and 476 respectively. Chibber, MohabatBooti, Bhakra, HazardaniDodak and Kulfa were ranked 4th, 5th, 6th, 7thand 8th with a weighted score of 463,347,329,181 and 159 respectively. Dhaincha, Bhaupali, JangliChulai, and LalDodak were ranked 9th, 10th, 11th and 12th respectively with a weighted score of 100, 82, 80 and 54 respectively. Data reveal that Itsit, Lehli and Tandla are the most harmful broad leaf weeds of cotton in terms of damage extent with a mean value of 4.7 (high tending towards very high), 4.0 (high) and 3.93(medium tending towards high) respectively. Swankighass and Khabalghass are the most harmful weeds of cotton among the narrow leaf weeds with a mean value of 4.61 (high tending towards very high) and 3.99 (high) respectively. While Dhaincha, Bhaupali, JangliChulai and LalDodak are less harmful with a mean value of 2.66, 2.59, 2.07, 2.01 respectively that indicates their extent of damage is between low and medium level.

Table 2 Farmer's awareness about different weeds and their extent of damage in wheat

Wheat weeds		Awareness	Extent of damage			
Botanical name	**Local name**	**Percentage**	**Weighted score**	**Rank**	**Mean**	**Standard Deviation**
Broad leaf weeds						
Convolvulus arvensis L.	Lehli	100.0	544	1	4.18	0.46
Chenopodium album L.	Bathu	94.0	454	2	3.90	0.49
Cirsiumarvensis (L.) Scop.	Laih	86.0	439	3	3.82	0.52
Medicagopolymorpha L.	JangliPalak	85.0	410	4	3.81	0.19
Rumexdentatus L.	Maina	89.0	310	5	2.98	0.39
C. murale L.	Krund	57.0	304	6	2.97	0.38
Melilotusparviflora L.	Sengi	72.0	284	7	3.12	0.38
*Trigonella incise*Benth.	Methi	77.0	272	8	2.84	0.40
Vicia sativa L.	Rewari	59.0	219	9	3.01	0.31
Emexspinosa (L.) Campd.	Palikkanda	53.0	191	10	2.97	0.23
Fumariaindica(Hausskn.)	Shahtra	50.0	166	11	2.80	0.46
Silybummarianum (L.) Gaertn	Kandiali	39.0	125	12	2.47	0.53
Anagallisarvensis L.	Billibooti	36.0	118	13	2.37	0.52
Argemonemexicana L.	Sialkanta	39.0	94	14	2.03	0.27
Coronopusdidymus (L.) Sm.	Janglihaloon	29.0	92	15	2.29	0.51
Sonchusoleraceous L.	Dodak	22.0	67	16	2.16	0.49
Lathyrusaphaca L.	Jangli matter	23.0	49	17	1.65	0.51
Euphrobiahelioscopia L.	Chhatridodak	9.0	37	18	2.29	0.66
*Carthamusoxyacantha*Bieb.	Pohli	14.0	35	19	2.05	0.34
Sinapisarvensis L.	Janglisarsoon	14.0	30	20	1.50	0.71
Spergulaarvensis L.	Kallribooti	0.0	0	-	-	-
Stellaria media (L.) Vill.	Phullanbooti	0.0	0	-	-	-
Narrow leaf weeds						
Phalaris minor Retz.	Dumbisitti	100.0	612	1	4.70	0.50
Avenafatua L.	Janglijavi	100.0	533	2	4.10	0.42
Asphodelustenuifolius Cav.	Piazi	39.0	104	3	2.06	0.33

Scale- 1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High

The data given in table 2 highlight that among broad leaf weeds, Lehli was the only weed known to all (100%) of the respondents while, Bathu, Sengi, Methi, Maina, JangliPalak, Laih, Shahtra and Palik Kanda were known to 94, 72, 77, 85, 89, 86, 50 and 53 percent of the respondents respectively. KallriBooti and PhullanBooti were not known to any of the respondents. Weeds like JangliHaloon, Jangli Matter and Kandiali were known to 29, 23 and 39 percent of the respondents respectively. While 22% respondents were aware about Dodak. A very small percentage of the respondents (9%) was aware about the Chattridodak while

JangliSarsoon was also known to a small number (14%) of the respondents. Narrow leaf weeds like JangliJavi and DumbiSitti were equally known to all (100%) of the respondents. Piazi was known to 39% of the respondents.

It is quite obvious from the data mentioned in the table that among broad leaf weeds of wheat; Lehli, Bathu, Laih and Janglipalak are more harmful and they are ranked 1st, 2nd, 3rd and 4th respectivelyin terms of damage extent with a mean value of 4.18 (high), 3.90 (medium tending towards high), 3.82 (medium tending towards high) and 3.81 (medium tending towards high) respectively. While mean value of extent of damage caused by Bathu, Laih, JangliPalak and Maina was 3.91, 3.82, 3.81 and 2.98 respectively that clearly indicates their damage extent is between medium to high. Billibooti, Sialkanta and janglisarsoon are the weeds with extent of damage ranging between low to medium (mean value= 2.37, 2.03 and 1.50 respectively).

Dumbisitti and Janglijavi were ranked 1st and 2nd among narrow leaf weeds of wheat with a weighted score of 612 and 533. Dumbisitti is reported as the most harmful weed of wheat with a mean value of 4.70 that clearly indicates that its damage extent is high tending towards very high.

4. CONCLUSION

Weeds of cotton

Level of awareness of the respondents about the weeds of cotton was ranging between 21-100%. Respondents were 100% aware about itsit, lehli, chibber and madhanaghass (*Trianthemaportulacastrum* L., *Convolvulus arvensis* L., *Mukiamaderaspatana* (L.)M. Roem and *Dactylocteniunaegyptium* (L.) beauv.) Awareness about swankighass, khabbalghass, tandla, mohabbatbooti, bhakkra and baru (*Echinochloacolonum* (L.) Link, Cynodon*dactylon* (L.) pers, *Xanthium strumarium* L., *Tribulusterrestris* L. and *Sorghum halepense* L. Pers.) was ranging between 78-94%. Almost 30% respondents aware about Bhaupaali (*Corchorusantichorus*) and 28% aware about laldodak (*Euphorbia hirta* L.). While, awareness level of the respondents about janglichulaai, Dhaincha, kulfa and hazardanidodak (*Amaranthusviridis* L., *Sesbania aculeate* (L.) Pers., *Portulacaoleracea* L. and *Euphorbia granulate L.)*was ranging between 30-50%. According to the views and assessment of the respondents, itsit (*Trianthemaportulacastrum* L.) was considered as the most harmful weed of cotton crop. Swankighass (*Echinochloacolonum* L. Link) was ranked at 2nd while, lehli (*Convolvulus arvensis* L.) was ranked 3rdon the base of its harmfulness and damage to the crop. Khabalghass, tandla, chibber,madhanaghass, mohabbatbooti and bhakkra(*Cynodondactylon*(L.) pers, *Digeraarvensis*Forsk., *Mukiamaderaspatana*(L.) M. Roem., *Dactylocteniunaegyptium* (L.) beauv,*Xanthium strumarium* L. and *Tribulusterrestris* L.) were also declared damaging to the cotton crop between medium to high level with a mean value ranging between 3 to 4 (medium, tending towards high).

Weeds of Wheat

Dumbisitti, janglijavi and lehli(*Phalaris minor* Retz, *Avenafatua* L. and *Convolvulus arvensis* L.) were known to 100% respondents. Awareness about bathu, laih, maina and janglipalak (*Chenopodium album* L., Cirsium*arvensis* (L.) Scop, *Rumexdentatus* L. and *Medicagopolymorpha* L.) was also high ranging between 80-92%. Awareness about sengi, krund, methirewaari and palakkanda (*Melilotusparviflora* L., *C. murale* L., *Trigonella incise* Benth, *Vicia sativa* L. and *Emexspinosa* (L.) Campd.) was ranging between 50%-75%. Small number of respondents (ranging between 12-22%) were aware about pohli, chatridodak and janglisarsoon (*Carthamusoxyacantha* Bieb., *Euphrobiahelioscopia* L., and *Sinapisarvensis* L.). Not even a single respondent was aware of phullanbooti and kallribooti (*Stellaria media* (L.) Vill. and Spergulaarvensis L.).

Dumbisitti (*Phalaris minor* Retz.)was ranked 1st among the weeds of wheat due to its fast spreading and damages caused to the wheat crop. It was given 1st rank with a high weighted score of 612 and mean value of 4.76 clearly indicating its extent of damage from high to very high level. Lehli and janglijavi(*Convolvulus arvensis* L. and *Avenafatua* L.) were ranked 2nd and 3rd. While, bathu and laih (*Chenopodium album* L. and Cirsium*arvensis* L.Scop.) were given 4th and 5th rank.

Weeds like krund, palikkanda, maina, sengi, janglipalak and rewaari (*C. murale* L., *Emexspinosa* (L.) Campd, *Rumexdentatus* L., *Melilotusparviflora* L., Medicago*polymorpha* L., and *Vicia sativa* L.) were causing the damage between the range of medium (mean value=3) to high (mean value=4). Weeds like piazi, methi, dodak, kandiali,shahatra, janglihaloon, chatridodak, billibooti, pohli and sialkanta (*Asphodelustenuifolius* Cav., *Trigonella incise* Benth., *Sonchusoleraceous* L., *Silybummarianum* (L.) Gaertn, *Fumariaindica* (Hausskn.), *Coronopusdidymus* (L.) Sm., *Euphrobiahelioscopia* L., *Anagallisarvensis* L, *Carthamusoxyacantha* Bieb., and *Argemonemexicana* L.) were causing damage of low to medium level. While, jangli matter and janglisarsoon (*Lathyrusaphaca* L. and *Sinapisarvensis* L.) was reported to cause dame of very low to low level.

5. RECOMMENDATIONS

- Wheat is a major staple food crop while cotton is main cash crop of Pakistan. Ensuring quality production of both these crops demands that there is need to aware and educate the farming communities about the weeds of cropping-wheat cropping system to avoid the production losses
- Government need to take steps on priority basis to train farmers how to control the spread of major damaging weeds of cotton-wheat cropping system
- There is need to aware and educate the farmers about integrated weed management practices for controlling the most damaging weeds of cotton-wheat cropping system
- Farmers need to be provided with subsidized weedicides to control the major damaging weeds of cotton-wheat cropping system
- Government should ensure the supply of adulteration free weedicides among the farming communities

Funding:
This study has not received any external funding.

Conflict of Interest:
The authors declare that there are no conflicts of interests.

Peer-review:
External peer-review was done through double-blind method.

Data and materials availability:
All data associated with this study are present in the paper.

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