

ASSESSMENT OF WEED COMPLEX IN SPRING POTATO CROP FIELDS OF MIX-CROPPING SYSTEM UNDER IRRIGATED CONDITIONS OF THE PUNJAB PLAINS OF FAISALABAD DISTRICT

Mukhtar Ahmad Shaikh, Ahmad Saleem, Nazir Ahmad Malik
and Munir Ahmad Shahzad¹

ABSTRACT

Faisalabad fields of spring potato crop representing the mix-cropping zone of the Punjab plains were surveyed to assess the prevalence of weeds during the years 2002 and 2003. The studies were conducted at four sites viz. Sammundri, Jaranwala, Faisalabad rural and Faisalabad suburbs, of the district Faisalabad. The weed density was recorded during 15-20, 30-35 and 45-52 days after crop sowing and finally at the time of crop harvest. The data on weed count showed the presence of varying types of weed flora belonging to Broad leaf weeds (BLW), Grasses (G) and Sedges (S). It was found that *Cyperus rotundus* - a sedges was the predominant weed persistently found in the field throughout the crop season. The two year average densities of the weed species were 136.25, 144.50, 148.15 and 148.15 m^{-2} , respectively when recorded during the sequential periods. The BLW were the second largest group constituting the average densities of 23.95, 25.35, 25.85 and 19.57 weeds m^{-2} on the four respective stages of the observations. The grasses showed the lowest average densities of 4.40, 5.37, 18.20 and 19.57 weeds m^{-2} during the same periods. In competitive terms, the stand of G, BLW and S was around 3, 14 and 83% during the first two observation periods. This trend of weed infestation was found changed during 45 to 52 days after crop sowing because of the overwhelming increase in G. Later, BLW declined at harvest by 3.11%, because of the maturity of *Melilotus indica* earlier than potatoes. *Convolvulus arvensis* and *Coronopus didymus* among BLW, *Cynodon dactylon* and *Sorghum halepense* in G and *Cyperus rotundus*- an S were thriving well and might become a relay menace for the succeeding kharif crops on potato fields. The full span study on the issue showed that spring potato crop favours emergence, development and maturity of a variety of weeds which are specific solely to kharif or rabi crops.

INTRODUCTION

Potato is an important cash vegetable crop widely grown in the mix-cropping zone of the Punjab plains. It produces more calories per gram as compared to many other crops. In Pakistan, it is grown during the moderate seasons of both spring and autumn around the year. The average potato tuber yield of Pakistan was static at 16400 kg/ha for the two consecutive years of 2000-01 and 2001-2002, which is very low as compared to that of North America with average tuber yield of 38122 kg ha⁻¹. The yield loss due to various pests was assessed as 24% and out of which 5% was caused by the weeds only. In South Asia, the overall yield loss due to pests was 44% and the share towards loss inflicted by weeds was 10% (Anonymous, 2002). One of the causes of low

¹ Plant Protection Institute, Ayub Agricultural Research Institute, Jhang Road, Faisalabad - Pakistan.

tuber yield, although very serious but less noticeable is the weed competition with the crop for all normal growth factors, weeds, therefore, cause more losses in crop yields than any other pest or disease (Khan et al., 1992). Crop yield losses of 15 to 55% occur due to weed infestation alone and in severe cases, weed infestation completely suppress the crops and result in the total collapse of the objectives of the crop production (Chaudhri, 1987). About 8000 plant species are said to behave as weeds, but only 250 of these are important for world agriculture (Holm et al., 1979). Various environmental factors viz; light temperature, water, soil and micro-organisms determine the specific weed spectrum, their distribution and growth (Barbour et al., 1980). As the environmental conditions vary considerably from one region to another, geological differentiation has characterized the weed species in each region (Peng, 1984). Halimie et al., 1995 reported the presence of *Convolvulus arvensis* and *Cynodon dactylon* in cotton crop which were carried over from Rabi crops of Faisalabad area. *Cynodon dactylon* is a serious threat to our National Agriculture after *Trianthema monogyna* and cause yield losses to the crops (Shad, 1987). Presence of weeds throughout the season reduced yield by 1.28 and 1.60 t/ha compared to yields of 2.41 and 2.33 t/ha from weed free cotton fields of India (Panwar et al., 1988). In view of the ecological differentiation of weeds in different regions of Pakistan, ten most important weeds of Pakistan have been identified in various crops and regions (Ghafoor et al., 1987). Study of some potato fields of Faisalabad showed predominance of *Trianthema monogyna*, *Chenopodium album* and *Melilotus parviflora* in autumn sown potatoes, necessitated to adopt chemical control measure which increased the potato tuber yield by 28 to 40% over weedy check (Halimie et al., 1995).

Recognizing the gravity of the weed problem, the natural fluctuations in its composition and population density due to seasonal variation, differences in the cropping system and agronomic practices, warrant, that weed complex of a crop and degree of infestation of each weed species be determined. The study will not only serve as a basic pre-requisite to plan and evolve effective and judicious weed management technology for a specific area but also help exploit the agronomic yield potential of potato crop at micro-zone level. The study will also contribute towards information bank on broad spectrum distribution and establishment of weeds in Pakistan.

MATERIALS AND METHODS

Potato fields were surveyed for two consecutive spring seasons during the year 2002 and 2003. Ten potato fields were sampled for their associated weeds from four sites viz; Sammundri, Jaranwala, Faisalabad rural and Faisalabad suburbs, of the district Faisalabad. Weeds were surveyed and sampled using a one square meter quadrat and identified with the help of the information published covering the aspect (Nasir and Ali, 1970; Stewart, 1972 and Ahmad, 1980). The survey samples were also compared and confirmed with the web shots available in the crop protection compendium (Anonymous, 2002). The data on weed complex found in potato fields were collected during four distinct durations starting from visible stand of the weeds till the harvest of potato crop. The observation durations were 15-20, 30-35, 45-52, and finally at the time of the crop harvest. Data so recorded were compiled and tabulated. Percent weed frequency was also calculated for every set of observations separately.

RESULTS AND DISCUSSION

Data presented in Table-1 showed that spring potato crop of Faisalabad district was infested with all of the three major weed flora groups namely; the broad leaf weeds

(BLW), narrow leaf weeds (G) and sedges (S). The weed complex mainly comprised of 11 weed species of competitive importance with regard to the potato crop. The record of weed complex in potato fields for both the assessment year comprised of *Cyperus rotundus*, *convolvulus arvensis*, *Chenopodium album*, *C. murale*, *Mellilotus indica*, *Coronopus didymus*, *Rumex dentatus*, *Anagallis arvensis*, *Euphorbia helioscopia*, *Cynodon dactylon* and *Sorghum halepense*. Out of these weeds; *Cyperus rotundus*- an S and *C. dactylon* and *S. halepense* belonging to G group. The remaining 8 weed species were BLW. In an earlier study most of these weed species had been reported to be present in the potato crop fields (Holm *et. al.*, 1979).

The district average data on weed density (Table-2) recorded 15 to 20 days after crop sowing showed exclusively monopolized by the *C. rotundus* (136.25 m⁻²) followed by BLW (23.95 m⁻²). The stand of G was the lowest with only 4.40 weeds m⁻². The trend towards the share of weed stand of the three groups remained the same when data were recorded after 30 to 35 days of crop sowing. The weed density, however, increased slightly as compared to the initial observation and the infestation went up to the level of 144.50, 25.35 and 5.37 weed m⁻² in respect of S, BLW and G, respectively. Thereafter, G started multiplying at a rapid pace and raised its density over four times than the initial stand. The drastic increase in G reached the level of 18.20 weeds m⁻² when recorded after 45 to 52 days of the potato sowing. The density of BLW and sedges was found stabilized and almost the same that was observed earlier and showed no change worth of mention. Finally the data recorded at the time of potato digging falling between 19-23 April 2002 and 2003 (Table-8) showed a decline in BLW was attributed to the maturity of *M. indica* prior to the crop harvest and attaining of maturity by *C. album*, *C. murale*, *R. dentatus*, *A. arvensis* and *E. helioscopia*. Only two species of BLW viz; *C. arvensis* and *C. didymus* were continuing their growth at the time of potato harvesting. The trend of increase in the density of S and G was although continued but at a slower pace. The overall density of the weed complex recorded after 15-20 days of potato sowing was 164.55 and rised to 175.22 and 192.20 weeds m⁻² when recorded after 30 to 35 and 45 to 52 days of crop sowing. At the time of potato digging the density of weed complex was 186.99 weeds m⁻² which was a slight decline as against the previous stand. The decline in the weed complex refer to the seasonal shift of weed flora from rabi to kharif set-up. The findings are in conformity with those of Halimie *et. al.*, 1995, Shad, 1987 and Panwar *et. al.*, 1980 who mentioned the presence of the weed in question found in cotton crop as being carried from the Rabi/spring crops.

In case of the share of frequency percentage of the individual weeds and the different weed groups, the maximum infestation of 82.83% was captured by *C. rotundus* concerning to sedges type of weeds followed by 14.51% share occupied by BLW group. The infestation of G was the minimum with only 2.66% (Table-3). The trend of the percentage weed infestation almost remained the same when calculated from the data recorded after 30 to 35 days of potato sowing (Table-5). The frequency percentage altered by the drastic increase in the infestation of G 45-52 days after potato sowing when the percent weed infestation was 77.04, 13.44 and 9.52 concerning to S, BLW and G, respectively. At the time of potato digging, the percent infestation saw a nominal change with the increase in G density. Considering the percentage infestation of individual weed, *C. rotundus* alone occupied the leading position with the maximum infestation ranging between 77 to 83% and it persisted in the fields throughout the potato crop season.

It is concluded from the above discussion that potato field of Faisalabad district on the whole were infested with a weed complex comprising various types of weed

belonging to three major groups viz; S, BLW and G. The weed complex of spring potato fields was a mixture of weeds adaptable to both the rabi and kharif seasons. Weed control management may, therefore be planned keeping in view the gravity of the problem for securing successful potato crop capable of producing optimum tuber yield. The findings show that control of weed is critical at the early stage of crop and the menace should be pursued till harvest of potatoes by adopting adequate weed managerial tactics.

Table-1. Major weed groups of the study area

Sr. No.	Technical Name	Local Name
I. Sedges (S)		
1.	<i>Cyperus rotundus</i>	Deela
II. Broad leaf weeds (BLW)		
1.	<i>Convolvulus arvensis</i>	Lehli
2.	<i>Chenopodium album</i>	Bathu
3.	<i>C. murale</i>	Karund
4.	<i>Melilotus indica</i>	Senji
5.	<i>Coronopus didymus</i>	Jangli Halon
6.	<i>Rumex dentatus</i>	Jangli Palak
7.	<i>Anagallis arvensis</i>	Billi Booti
8.	<i>Euphorbia helioscopia</i>	Chattri Dodhak
III. Grasses (G)		
1.	<i>Cynodon dactylon</i>	Khabbal Ghas
2.	<i>Sorghum halepense</i>	Baru

Table-2. Weed density (m^{-2}) recorded 15 to 20 days after sowing of potato (16 to 21 Feb. 2002-2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	135.0	147.0	135.0	128.0	136.25
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	4.5	6.4	6.4	5.9	5.80
2. <i>Chenopodium album</i>	Bathu	3.5	4.5	4.4	4.5	4.22
3. <i>C. murale</i>	Karund	2.7	4.1	3.4	3.1	3.33
4. <i>Melilotus indica</i>	Senji	2.2	3.6	3.0	3.3	3.02
5. <i>Coronopus didymus</i>	Jangli Halon	2.1	3.5	2.8	2.7	2.78
6. <i>Rumex dentatus</i>	Jangli Palak	1.4	2.2	2.2	2.1	1.97
7. <i>Anagallis arvensis</i>	Billi Booti	1.6	1.4	1.8	2.2	1.75
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.8	0.6	1.3	1.4	1.03
Total:		18.8	26.3	25.3	25.2	23.95
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	1.5	3.4	2.9	3.1	2.72
2. <i>Sorghum halepense</i>	Baru	2.0	1.8	1.2	1.7	1.68
Total:		3.5	5.2	4.1	4.8	4.40
Grand Total:		157.3	178.5	164.4	158.0	164.55

Table-3. Weed frequency (%) recorded 15 to 20 days after sowing of potato (16 to 21 February 2002-2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	85.83	82.35	82.13	81.01	82.83
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	2.86	3.59	3.89	3.73	3.52
2. <i>Chenopodium album</i>	Bathu	2.22	2.52	2.68	2.85	2.57
3. <i>C. murale</i>	Karund	1.72	2.30	2.07	1.96	2.01
4. <i>Melilotus indica</i>	Senji	1.40	2.02	1.82	2.09	1.83
5. <i>Coronopus didymus</i>	Jangli Halon	1.33	1.96	1.70	1.71	1.67
6. <i>Rumex dentatus</i>	Jangli Palak	0.89	1.23	1.34	1.33	1.20
7. <i>Anagallis arvensis</i>	Billi Booti	1.02	0.78	1.09	1.39	1.07
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.51	0.34	0.79	0.89	0.63
Total:		11.95	14.74	15.38	15.95	14.51
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	0.95	1.90	1.76	1.96	1.64
2. <i>Sorghum halepense</i>	Baru	1.27	1.01	0.73	1.08	1.02
Total:		2.22	2.91	2.49	3.04	2.66

Table-4. Weed density (m⁻²) recorded 30 to 35 days after sowing of potato (4 to 9 March 2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	146.0	159.0	146.2	126.8	144.50
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	4.7	8.5	6.3	5.5	6.25
2. <i>Chenopodium album</i>	Bathu	3.8	4.6	4.5	4.4	4.32
3. <i>C. murale</i>	Karund	2.6	4.6	3.5	3.4	3.53
4. <i>Melilotus indica</i>	Senji	2.4	4.2	3.4	3.2	3.30
5. <i>Coronopus didymus</i>	Jangli Halon	2.3	3.9	2.9	2.7	2.95
6. <i>Rumex dentatus</i>	Jangli Palak	1.5	2.3	2.2	2.3	2.07
7. <i>Anagallis arvensis</i>	Billi Booti	1.6	1.5	1.9	2.3	1.83
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.8	0.7	1.4	1.5	1.10
Total:		19.7	30.3	26.1	25.3	25.35
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	2.2	3.6	3.8	3.7	3.32
2. <i>Sorghum halepense</i>	Baru	2.3	2.2	1.7	2.0	2.05
Total:		4.5	5.8	5.5	5.7	5.37
Grand Total:		170.2	195.1	177.8	157.8	175.22

Table-5. Weed frequency %age recorded 30 to 35 days after emergence of potato (4 to 9 March 2002-2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	85.78	81.50	82.23	80.35	82.46
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	2.76	4.36	3.54	3.49	3.54
2. <i>Chenopodium album</i>	Bathu	2.23	2.36	2.53	2.79	2.48
3. <i>C. murale</i>	Karund	1.53	2.36	1.97	2.15	2.00
4. <i>Melilotus indica</i>	Senji	1.41	2.15	1.91	2.03	1.88
5. <i>Coronopus didymus</i>	Jangli Halon	1.35	2.00	1.63	1.71	1.67
6. <i>Rumex dentatus</i>	Jangli Palak	0.88	1.18	1.24	1.46	1.19
7. <i>Anagallis arvensis</i>	Billi Booti	0.94	0.77	1.07	1.46	1.06
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.47	0.36	0.79	0.95	0.64
Total:		11.57	15.54	14.68	16.04	14.46
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	1.29	1.85	2.14	2.34	1.90
2. <i>Sorghum halepense</i>	Baru	1.36	1.11	0.95	1.27	1.17
Total:		2.65	2.96	3.09	3.61	3.08

Table-6. Weed density (m⁻²) recorded 45 to 52 days after crop emergence (23-31 March, 2002-2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	146.4	164.0	153.0	129.2	148.15
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	4.6	8.4	6.2	6.2	6.35
2. <i>Chenopodium album</i>	Bathu	3.7	4.2	4.4	4.2	4.12
3. <i>C. murale</i>	Karund	2.6	4.5	3.3	3.2	3.40
4. <i>Melilotus indica</i>	Senji	2.3	4.2	3.3	3.3	3.28
5. <i>Coronopus didymus</i>	Jangli Halon	2.1	3.7	3.2	3.1	3.02
6. <i>Rumex dentatus</i>	Jangli Palak	1.9	2.6	2.4	2.1	2.25
7. <i>Anagallis arvensis</i>	Billi Booti	2.1	1.8	2.1	2.7	2.18
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.9	0.9	1.6	1.6	1.25
Total:		20.2	30.3	26.5	26.4	25.85
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	12.0	13.0	13.2	12.6	12.70
2. <i>Sorghum halepense</i>	Baru	6.0	5.8	5.0	5.2	5.50
Total:		18.0	18.8	18.2	17.8	18.20
Grand Total:		184.6	213.1	197.7	173.4	192.20

Table-7. Weed frequency (%) recorded 45 to 52 days after crop emergence (23-31 March, 2002-2003)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
1. <i>Cyperus rotundus</i>	Deela	79.31	76.96	77.39	74.51	77.04
II. Broad Leaf Weeds						
1. <i>Convolvulus arvensis</i>	Lehli	2.49	3.95	3.14	3.58	3.29
2. <i>Chenopodium album</i>	Bathu	2.00	1.97	2.22	2.42	2.15
3. <i>C. murale</i>	Karund	1.41	2.11	1.67	1.84	1.76
4. <i>Melilotus indica</i>	Senji	1.24	1.97	1.67	1.90	1.69
5. <i>Coronopus didymus</i>	Jangli Halon	1.14	1.74	1.62	1.79	1.57
6. <i>Rumex dentatus</i>	Jangli Palak	1.03	1.22	1.21	1.21	1.17
7. <i>Anagallis arvensis</i>	Billi Booti	1.14	0.84	1.06	1.56	1.15
8. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.49	0.42	0.81	0.92	0.66
Total:		10.94	14.22	13.40	15.22	13.44
III. Grasses						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	6.50	6.10	6.68	7.27	6.64
2. <i>Sorghum halepense</i>	Baru	3.25	2.72	2.53	3.00	2.88
Total:		9.75	8.82	9.21	10.27	9.52

Table-8. Weed density (m⁻²) recorded at potato harvest (19-23 April, 2002-03)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
A. Growth continued						
1. <i>Cyperus rotundus</i>	Deela	146.4	164.0	153.0	129.2	148.15
II. Broad Leaf Weeds						
A. Matured before potato harvest.						
1. <i>Melilotus indica</i>	Senji	-	-	-	-	-
B. Matured at potato Harvest						
1. <i>Chenopodium album</i>	Bathu	3.2	3.8	3.9	3.7	3.65
2. <i>C. murale</i>	Karund	2.4	4.0	3.0	3.0	3.10
3. <i>Rumex dentatus</i>	Jangli Palak	1.0	1.5	1.0	1.0	1.15
4. <i>Anagallis arvensis</i>	Billi Booti	1.4	1.2	1.8	1.8	1.45
5. <i>Euphorbia helioscopia</i>	Chattri Dodhak	0.2	0.3	0.8	0.9	0.55
C. Growth continued						
1. <i>Convolvulus arvensis</i>	Lehli	4.6	8.4	6.2	6.2	6.35
2. <i>Coronopus didymus</i>	Jangli Halon	2.1	3.7	3.2	3.1	3.025
Total:		14.9	22.9	19.9	19.7	19.27
III. Grasses						
A. Growth continued						
1. <i>Cynodon dactylon</i>	Khabbal Ghas	12.5	13.7	14.0	13.8	13.50
2. <i>Sorghum halepense</i>	Baru	6.4	6.3	5.7	5.9	6.07
Total:		18.9	20.0	19.7	19.7	19.57
G. Total:		180.2	206.9	192.6	168.6	186.99

Table-9. Weed frequency (%) recorded at potato harvest (19-23 April 2002-03)

Weed type/class	Local name	Sumd.	J/wala	Fsd(R)	Fsd(S)	Average
I. Sedges						
A. Growth continued						
1. <i>Cyperus rotundus</i>	Deela	81.24	79.27	79.44	76.63	79.14
II. Broad Leaf Weeds						
A. Matured before potato harvest.						
1. <i>Melilotus indica</i>	Senji	-	-	-	-	-
B. Matured at harvest						
1. <i>Chenopodium album</i>	Bathu	1.78	1.84	2.02	2.19	1.96
2. <i>C. murale</i>	Karund	1.33	1.93	1.56	1.78	1.65
3. <i>Rumex dentatus</i>	Jangli Palak	0.55	0.72	0.52	0.59	0.59
4. <i>Anagallis arvensis</i>	Billi Booti	0.78	0.58	0.93	1.07	0.84
5. <i>Euphorbia helioscopia</i>	ChattriDodhak	0.11	0.14	0.42	0.53	0.30
Total:		4.55	5.21	5.45	6.16	5.34
C. Growth continued						
1. <i>Convolvulus arvensis</i>	Lehli	2.55	4.06	3.22	3.68	3.38
2. <i>Coronopus didymus</i>	Jangli Halon	1.17	1.79	1.66	1.84	1.61
Total:		3.72	5.85	4.88	5.52	4.99
III. Grasses						
A. Growth continued						
1. <i>Cynodon dactylon</i>	KhabbalGhass	6.94	6.62	7.27	8.19	7.26
2. <i>Sorghum halepense</i>	Baru	3.55	3.05	2.96	3.50	3.27
Total:		10.49	9.67	10.23	11.68	10.53

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