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Distribution of weed flora of wheat under rice-wheat cropping system in Western Plain Zone of U.P

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Abstract

The rice-wheat cropping system is the most important agricultural production system in western plain zone of U.P. A survey of weed flora of rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.) crop in rice-wheat cropping system under western plain zone of U.P. was conducted, during Kharif & Rabi season of 2015-16 and 2016-17. *Echinochloa crus galli*, *Echinochloa colona*, *Asteracantha longifolia* and *Cyperus difformis* were highly associated in rice crop in all the districts. *Echinochloa crus galli* and *Echinochloa colona* was most dominant weed in all the districts. The highest R.D. 19.67% was recorded with *Echinochloa crus galli* followed by other like *Cynodon dactylon*, *Eclipa prostrate* and *Monochoria vaginalis* some other weeds i.e. *Cyperus iria* were found in Bulandshahr, Meerut and Saharanpur. *Chenopodium album*, *Saccharum spontanium*, *Vicia sativa*, *Anagallis avensis*, *Fumaria parviflora*, *Cypresus rotundus*, *Cynodon dactylam*, *Lathyrus aphaca*, *Carthamus oxycantha*, *Melilotus alba*, *Convolvulus arvensis*, *Phalaris minor* and *Avena ludoviciana* were found highly associated with wheat crop in all districts. *Phalaris minor* was the most dominant weed in all district the average the relative density 24.75% followed by other *Lathyrus aphaca*, *Chenopodium album*, *Fumaria parviflora* some other weed like *Saccharum spontanium* found in Baghpat, Bulandshahr, G.B. Nagar and Saharanpur having heavy soil in cultivated and non-cultivated land. Under very severe infestations of weeds, the losses may go up to 25 to 80%.

Keywords: Weed survey, weed flora, rice-wheat system and western plain zone of UP

Introduction

The rice-wheat cropping system (RWCS) is one of the most important agricultural production systems in the world owing to the large extent of area it occupies and the vast population it feeds. The productivity of rice-wheat system is decreasing after 1990s due to emergence of multinutrient deficiencies and building up of soil pathogens and weed flora besides increasing soil health problems. Weeds are probably the most ever-present class of crop pests and on the old occasion cause massive crop failures over vast areas. They reduce the crop yield and deteriorate the quality of produce and hence reduce the market value of the turn out (Arif *et al.*, 2006) [1].

Rice occupies a pivotal role in Indian agriculture and it contributes to 15 % of annual GDP of agriculture and provides 43 % calorie requirement for more than 70 % of. Its accounts for about 40.92% of total food grain production and 44.07% of cereal production in the country. Rice is generally cultivated by transplanting in puddle soil, because of better growing condition to achieve higher productivity under transplanted rice. Irrespective of the method of rice establishment, weeds are major problem for rice production as these competes with crop for resources that ultimately affects the product quality. In India, the extent of yield reduction in transplanted rice due to weeds alone has been reported to be from 10 to 70 % (Rajkhowa *et al.*, 2006) [2].

Wheat is the second most important cereal crop of India next to rice and accounts for 36.2% of total food grain basket of the country. It covers an area of 31.19 million hectare with total production of 95.9 million tones and average productivity of 3.075 t ha⁻¹. In India, U.P having first rank in production (30.30 mt) and area (9.73 mha⁻¹), while in productivity Haryana having first ranked with 42.32 q ha⁻¹ and UP fourth rank with 31.13 q ha⁻¹. Poor weed management is the major cause for lower productivity among all other constraints.

Heavy weed infestation is one of the major constraints in transplanted rice causing severe yield losses. Weeds emerge simultaneously with germination rice seedling resulting in severe competition for nutrient, light, and space. Intensity of competition increased when one of the resources (nutrient, light, moisture and space) fall short of total requirement of rice –weed, Weeds by virtue of their high adoptability and faster growth dominate the crop habitat reduce

the yield potential. The degree of rice –weed competition depends on crop factor i.e. cultivar, crop density, crop age, plant spacing etc. Reduction in wheat yield ranges 10-40 % due to weed infestation in this zone.

The type of irrigation, cropping pattern and weed control measures and environmental factors also have a significant influence on the intensity and infestation of weeds (*Saavedra et al.* 1980). So, knowledge of weed species associated with crops in a region is, therefore, pivotal and necessary to plan and execute a sound and economical weed management schedule depending upon various factors affecting weed distribution in different areas. The present survey was the first attempt in totality to cover all wheat growing districts of western plain zone of U.P. to study the composition of weed flora infesting these crops. To upgrade the knowledge of weed species associated with rice and wheat crops in a region is therefore pivotal and necessary to plan and execute a sound and economical weed management schedule depending upon various factors affecting weed distribution in western plain zone of U.P.

Material and Methods

To study the floristic composition of weeds in rice and wheat crop in rice-wheat cropping system in western plain zone of U.P. 336 field were surveyed in seven districts i.e. Ghaziabad, Baghpat, Bulandshahr, G.B. Nagar, Meerut, Muzaffarnagar and Saharanpur district of U.P., during August – October in *Khari*, December – February in *Rabi* season of 2015-16 & 2016-17 as this period depicted most appropriate representation of majority of weed species as the weed have cumulative effect of all agronomic practices, soil types, fertilizer and irrigation application adopted during initial crop growing period. Four villages in a block were randomly selected from selected three blocks of each seven districts. Four farmers field of rice-wheat system from a village were observed. Five observations on wheat density of individual weeds were recorded per field from four places at one field in each season by using quadrates of (0.5x0.5 m) 100 meter deep inside the fields. Pooled average values of relative weed density, relative frequency of individual weeds and importance value index (IVI) were calculated for each district separately as per method suggested by Raju (1977) [3] as formula given below:

$$\text{Relative Density (RD) \%} = \frac{a}{b}$$

a = Number of individual of a species in all quadrates

b = No. of individual of all species in a quadrate

$$\text{Relative Frequency (RF) \%} = \frac{\text{Frequency of species A}}{\text{Sum Frequency of all species}} \times 100$$

$$\text{IVI (importance value index)} = \text{RD} + \text{RF}$$

Result and Discussion

The result of the phyto-sociological survey of weeds in rice-wheat cropping system in western plain zone of U.P is presented in Table 1 and 2. The data reveals that among the several weed flora present in field only sixteen dominant weed species were found in the phyto-sociological survey of weeds in rice crop in rice-wheat cropping system in western plain zone of U.P. Out of these weed species, 11 were highly associated with wheat crop. The weeds are *Echinochloa crus galli*, *Echinochloa colona*, *Cynodon dactylon*, *Asteracantha longifolia*, *Eclisa prostrate*, *Cynotis axillaris*, *Commelina benghalensis*, *Ammania baccifera*, *Monochoria vaginalis* and *Phyla nodiflora*. *Echinochloa crus galli*, *Echinochloa colona*, *Asteracantha longifolia* and *Cyperus difformis* were highly associated in rice crop in all the districts. *Echinochloa crus galli* and *Echinochloa colona* was most dominant weed in all the districts. The highest R.D. 19.67% was recorded with *Echinochloa crus galli* followed by other like *Cynodon dactylon*, *Eclisa prostrate* and *Monochoria vaginalis* some other weeds i.e. *Cyperus iria* were found in Bulandshahr, Meerut and Saharanpur.

Thirteen dominant weed species were found in the phyto-sociological survey of weeds in wheat crop in rice-wheat cropping system in western plain zone of U.P. Out of 13 weed species, 11 were found to be highly associated with wheat crop. The weeds are *Chenopodium album*, *Saccharum spontanium*, *Vicia Sativa*, *Anagallis avensis*, *Fumaria Parviflora*, *Cypresus rotundus*, *Cynodon dactylam*, *Lathyrus aphaca*, *Carthamus oxycantha*, *Melilotus alba*, *Convolvulus arvensis*, *Phalaris Minor* and *Avena ludoviciana*. *Phalaris Minor*, *Chenopodium album*, *Lathyrus aphaca* and *Fumaria Parviflora* were found to be highly aggressive and dominant over other weeds species in all the district of western plain zone of U.P. with a relative density 24.43% followed by others. Some weeds i.e. *Saccharum spontanium* was found in Baghpat, Bulandshahr, G.B. Nagar, Muzaffarnagar and Saharanpur having heavy soil. *Phalaris Minor* was among the first five dominating weeds in this district wheat is grown in Rice-Wheat System and Wheat crop sequence so ecological conditions are favorable for the *Phalaris Minor* establishment. Weed which was considered to be weed of cropped and non cropped area has also shown its presence in weeds i.e. *Saccharum spontanium* was found in Baghpat, Bulandshahr, G.B. Nagar, Muzaffarnagar and Saharanpur.

Table 1: Distribution of weed flora in Rice (*Oryza sativa* L.) in Rice-Wheat cropping system in Western Plain Zone of U.P. (Pooled data of *kharif* 2015 and 2016)

Major weed species	Ghaziabad			Bagpat			Bulandshahr			G.B.Nagar			Meerut			Muzaffarnagar			Saharanpur		
	RD %	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI
<i>Echinochloa crus galli</i>	19.51	15.19	34.7	18.6	14.2	32.8	9.7	11.5	21.2	13.7	11.7	25.4	12.6	12.20	24.8	12.8	14.8	27.6	13.6	11.5	25.1
<i>Echinochloa colona</i>	14.5	15.9	30.4	21.7	11.9	33.6	15.8	9.3	25.1	23.9	8.81	32.71	19.67	12.31	31.98	17.7	11.35	29.05	24.05	22.92	45.62
<i>Cynodon dactylon</i>	8.10	12.5	20.6	0	0	0	9.2	5.4	14.6	5.6	9.22	14.82	9.2	5.45	14.65	5.15	4.5	9.65	6.75	9.35	16.10
<i>Asteracantha longifolia</i>	4.2	5.0	9.2	0	0	0	0	0	0	1.9	3.3	5.2	0	0	0	8.3	6.2	14.5	0	0	0
<i>Eclipa prostrata</i>	0	0	0	3.3	4.5	7.8	2.8	2.1	4.9	2.2	3.9	6.1	2.25	2.90	5.15	0.9	4.5	5.4	3.6	2.9	6.5
<i>Cynotis axillaris</i>	8.7	7.5	16.2	12.7	9.5	22.2	0	0	0	2.7	4.89	7.59	0	0	0	0	0	0	0	0	0
<i>Commelina benghalensis</i>	9.8	6.4	16.2	14.5	12.6	27.1	11.8	14.7	26.5	10.6	7.9	18.5	8.10	5.9	14.0	9.9	10.6	20.5	7.9	7.4	15.3
<i>Ammania baccifera</i>	11.1	8.9	20.0	4.6	7.4	12.0	12.9	8.8	21.7	9.13	6.4	15.53	10.11	6.73	16.84	11.2	8.5	19.7	6.2	9.7	15.90
<i>Monochoria vaginalis</i>	9.7	9.3	19.0	0	0	0	1.93	2.1	4.03	1.3	6.7	8.0	9.8	4.85	14.65	2.34	7.0	9.34	7.9	5.4	13.3
<i>Phyla nodiflora</i>	0	0	0	6.8	11.0	17.8	4.4	6.2	10.6	2.9	9.9	12.8	2.6	8.5	11.10	1.9	4.6	6.5	5.2	6.18	11.38
<i>Phyllanthus niruri</i>	4.4	2.9	7.3	0	0	0	1.7	1.39	3.09	0	0	0	0	0	0	0	0	0	0	0	0
<i>Phyla nodiflora</i>	3.9	4.2	8.1	11.8	23.4	35.2	6.16	9.54	15.7	9.6	5.98	15.58	6.26	9.35	15.61	8.6	9.9	18.5	7.5	8.6	16.1
<i>Marselia guradshfilia</i>	0	0	0	0	0	0	3.4	5.89	9.29	0	0		6.2	10.5	16.7	7.7	4.4	12.10	3.15	4.55	7.7
<i>Cyperus iria</i>	2.8	10.4	13.2	6.0	5.5	11.5	13.7	8.8	22.5	9.3	17.42	26.72	9.6	11.8	21.4	9.9	7.2	17.1	10.61	8.4	22.01
<i>Cyperus difformis</i>	3.28	1.8	5.08	0	0	0	1.4	5.86	7.26	3.49	2.88	6.37	2.7	8.3	11.0	2.4	4.1	6.5	0	0	0
<i>Fambristylis milliacea</i>	0	0	0	0	0	0	5.1	8.4	13.5	3.6	0.97	4.57	0.9	1.2	2.1	1.20	2.15	3.35	1.88	3.09	4.97

Table 2: Distribution of weed flora in wheat (*Triticum astivum* L.) in Rice-Wheat cropping system in Western Plain Zone of U.P. (Pooled data of *Rabi* 2015-16 and 2016-17)

Major weed species	Ghaziabad			Baghpat			Bulandshahr			Gauttam Budh Nagar			Meerut			Muzaffarnagar			Saharanpur		
	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI	RD%	RF%	IVI
<i>Chenopodium album</i>	15.50	10.98	26.48	9.88	3.90	13.78	4.90	9.17	14.07	2.40	6.08	8.48	8.70	13.50	22.20	3.90	3.40	7.30	9.90	3.40	13.30
<i>Saccharum spontanium</i>	-	-	-	3.98	5.21	9.19	1.40	2.20	3.60	6.75	9.35	16.10	-	-	-	1.60	4.90	6.50	1.20	4.90	6.10
<i>Vicia sativa</i>	-	-	-	1.60	2.80	4.40	-	-	-	1.90	5.60	7.50	0.10	4.90	5.00	-	-	-	2.30	2.50	4.80
<i>Anagallis arvensis</i>	6.80	11.25	18.05	9.50	11.25	20.75	13.80	7.20	21.00	5.30	6.60	11.90	12.70	10.30	23.00	10.80	2.50	13.30	12.20	10.85	23.05
<i>Fumaria Parviflora</i>	14.90	22.60	37.50	11.90	17.54	29.44	-	-	-	1.60	3.51	5.11	8.60	9.24	17.84	9.50	9.85	19.35	2.60	9.00	11.60
<i>Cyperus rotundus</i>	9.80	6.90	16.70	18.50	8.27	25.41	7.72	5.07	12.79	2.30	7.90	10.20	6.20	3.85	10.05	3.20	8.85	12.05	4.50	7.86	12.36
<i>Cynodon dactylon</i>	5.70	3.92	9.62	3.40	5.40	8.80	1.80	6.45	8.25	5.80	7.21	13.01	8.87	4.54	13.41	6.28	6.86	13.14	2.50	6.99	9.49
<i>Lathyrus aphaca</i>	11.40	8.86	21.26	16.20	8.90	25.10	9.50	8.60	18.10	7.80	9.60	17.40	8.20	13.12	21.32	12.75	6.99	19.74	15.91	8.90	24.01
<i>Carthamus oxycantha</i>	1.40	1.10	2.50	3.40	6.19	9.59	1.70	6.29	7.99	2.30	5.15	7.45	2.70	3.50	6.20	4.25	12.00	16.25	3.20	4.92	8.12
<i>Melilotus alba</i>	2.38	3.70	6.08	2.60	6.75	9.35	17.20	7.64	24.84	2.90	6.30	9.20	1.30	8.55	9.85	8.28	4.92	13.20	2.00	1.68	3.68
<i>Convolvulus arvensis</i>	9.67	11.81	21.48	2.95	4.18	7.13	9.18	9.75	18.93	17.30	8.35	25.65	12.60	6.45	19.05	1.21	13.53	14.74	18.50	13.11	31.60
<i>Phalaris minor</i>	18.75	15.96	34.71	13.69	14.87	28.56	19.90	33.27	53.17	36.80	21.60	58.40	28.70	15.50	44.20	32.13	19.25	51.38	22.18	21.53	43.71
<i>Avena ludoviciana</i>	3.60	2.00	5.60	2.40	4.65	7.05	12.90	4.36	17.26	6.80	2.75	9.55	1.30	6.55	7.85	6.10	6.94	13.04	3.00	4.17	7.17

Conclusion

On the basis of study it can be concluded that the occurrence of weed species in rice-wheat system could directly be correlated to the soil type, fertility status underground quality water, cropping patterns and agronomic practices followed in that area. Careful monitoring of the changing and effective control measure depending upon the threshold value to keep the weeds at bay at an economical viable cost.

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