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EFFECTS OF DIFFERENT HERBICIDES TO CONTROL *PHALARIS MINOR* AS INFLUENCED BY DIFFERENT DATES OF SOWING OF WHEAT

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ABSTRACT

A field experiment was conducted at the farm of Lovely Professional University, Phagwara during rabi season of 2018-19 and 2019-20 to assess the effects of sowing dates and weed management practices on growth of *Phalaris minor* in wheat (*Triticum aestivum* L.) field under Punjab agro-climatic conditions. The investigations revealed that early sowing (first week of November) exerted a significant effect to decrease the density and dry matter of *Phalaris minor*. Among the different weed management treatments, application of (Sulfosulfuron + Metsulfuron Methyl 30 g ai/ha) recorded the lowest density and dry weight of weeds. Crop sown during first week of November, 2018-19 and 2019-20 recorded 75.50 and 71.55 % higher weed control efficiency.

***Keyword*:** *Phalaris minor*, yield attribute, dry matter, herbicides

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops and it is extensively grown throughout the world. It is the main staple food in the world. The wheat crop covers nearly 14 percent of global area that produces about 99.70 million tonnes of grains with an average productivity of 3371 kg/ha, corresponding to 13.64 percent of world production (Ramadas *et al*., 2019). Wheat crop renders a significant share in consumption and production of food basket with 36 percent of total cereal grains in India. It ensures food security along with nutrition security. Wheat possesses a higher protein content than maize and rice that makes it a good source of proteins in human diet. In Northern India, it is considered as the staple food since the population in this region depends on chapatti for their daily nutritional intake. India is the second largest producer of wheat followed by China, accounting for 12.91% of the global wheat production (Ramadas *et al*., 2019). However; *Phalaris minor* is considered as a major noxious weed of wheat crop to cause a greater loss on grain yield. Itis one of the major and most destructive monocot weeds in the wheat field, belonging to the grass family i.e., Poaceae which is similar to wheat and thereby, the growing habit and development of *Phalaris minor* is very much similar to wheat crop. As a consequence, it is very difficult to differentiate them from wheat during their vegetative phase. At present, there are several practices that could be adopted to control the weed population such as cultural methods, physical methods, mechanical methods, chemical methods or biological methods. Majority prefer the chemical method since it is fast acting and very effective. It also requires less labour and energy. But relying on chemical herbicides to control the weed population has led to detrimental effects on the ecosystem as well as human health. Therefore, instead of focusing on only chemical control measures, an integration of all above-mentioned methods to control the weed population is considered as a better option. Such integration program is called Integrated Weed Management (IWM). The present investigation highlights some important findings, specifically on IWM.

Materials and Methods

To evaluate the response of sowing dates and weed control methods, a field experiment was conducted during 2018-19 and 2019-20 at the experimental farm of the Department of Agronomy, Lovely Professional University, Phagwara, Punjab, India. The split plot design was used as an experimental layout with 3 replications. Three dates sowing of (November 1, November 20 and December 10) were assigned in the main plots, while five different weed control treatments (Sulfosulfuron 25g/ha, Clodinafop 60g/ha followed by metsulfuron 5g/ha, Sulfosulfuron + Metsulfuron

30g/ha, Weed free and weedy check) were used in sub plots. Field was charged with five different resistance biotypes of *Phalaris* minor, collectedfrom different farmers' fields. The field was prepared by 3–4 ploughings (disk harrows and cultivators), followed by planking. PBW Unnat 343 wheat variety was used with recommended doses of fertilizers (50 N, 25 P_2O_5 and 12 K_2O kg/acre). A complete dose of phosphate and potassium was applied as basal application and nitrogen was applied in two split doses before first and second irrigation. All weed control treatment were applied at 30 DAS as per treatments. Weed control efficiency (WCE) was estimated using the formula described by Singh *et al*., 2014.

Weed control efficiency (WCE) = 100 x (Weed population in control – Weed population in treated plot) / Weed population in control.

Data of weeds were recorded at different periodical interval 30DAS, 60DAS, 90DAS and at harvest. Recorded data were analyzed by OPSTAT-HAU.

Result and Discussion

Weed count

Weed count is one of the important parameters which influences the growth and yield of crop. Weed data, recorded periodically at 30, 60, 90 DAS and at harvest, during 2018-2019 and 2019-2020 are presented in Table 1 and interaction effect between wheat sowing time and herbicidal treatment are depicted in Figure 1. Dates of sowing affected the weed density significantly. First date of sowing (1 November) observed significantly less number of weed as compared to 2nd (20 November) and 3rd date of sowing (10 December). This might be due to relatively higher temperature during first date of sowing than second and third. Ideal temperature for germination of *Phalaris minor* is 17 – 20 ^{0}C (Singh and Ghosh, 1982). Different weed control treatments were found to exert statistically non- significant results at 30 DAS, as the herbicides was applied at 30 DAS. Higher weeds population was recorded in weedy check which is significantly more than other weed control treatments and weed population were found to be zero in weed free treatment**.** However, herbicidal treatments started to exhibit their varied responses against *Phalaris minor* with passage of time. Among different herbicides, Sulfosulfuron + Metsulfuron 30g ai /ha was found to contain significantly less number of weeds than of Sulfosulfuron 25g/ha and Clodinafop 60g/ha + Metsulfuron 5g/ha. At 60, 90 DAS and at harvest herbicide Sulfosulfuron 25g/ha was found to exert more pronounced effect than Clodinafop 60g/ha + Metsulfuron 5g/ha. The results are in conformity with earlier reports (Punia *et al*., 2011). The interactive effects among various dates of sowing and weed control treatments were found to be statistically significant. Interestingly, treatment of Sulfosulfuron + Metsulfuron @ 30g ai /ha showed significantly less number of weeds at all dates of sowing as compared to other treatments such as, Sulfosulfuron 25g/ha. and Clodinafop 60g/ha + Metsulfuron 5g/ha.

Dry matter accumulation in weeds

Data on dry matter of weeds at 30, 60, 90 DAS and at harvest are depicted in Table (Give no.).At 30 DAS, significantly less dry matter accumulation was observed in the case of 1st November date of sowing as compared to sowing on 20th November and 10th December. At 30 DAS, data on weed dry matter for second date of sowing (20th November) and third date of sowing (10th December) were found to be statistically at par. Among dates of sowings at 60, 90 DAS and at harvest, data revealed less dry matter accumulation in the case of 1st November sowing as comparisons to other sowing dates (20th November and 10th December). Similar trends were found in both year 2018-19 and 2019-20.

From different weed control treatments, weedy check recorded significantly highest dry matter. At 60, 90 DAS and at harvest, Sulfosulfuron + Metsulfuron 30g ai /ha resulted significantly lower dry matter accumulation with respect to treatments of Sulfosulfuron 25g/ha and Clodinafop 60g/ha + Metsulfuron 5g/ha. At 90 DAS, herbicidal treatments of Clodinafop 60g/ha + Metsulfuron 5g/ha and Sulfosulfuron 25g/ha were found statistically at par. All herbicides showed significantly lower weed dry matter accumulation as compared to weed check.Similar trend were found in earlier reports (BrarandWalia, 2008; Meena and Singh, 2013; Malekian *et al*., 2013) also.

Weed control efficiency

A higher weed control efficiency (75.50 and 71.77%) was obtained in first date of sowing (1st November) as compared to second date (20th November) and third date of sowing (10th December) (Table 3). It revealed that WCE is highest in weed free treatment followed sequentially by herbicidal treatments of Sulfosulfuron + Metsulfuron 30g ai /ha, Sulfosulfuron 25g/ha and Clodinafop 60g/ha + Metsulfuron 5g/ha. Similar trend was observed during both 2018-19 and 2019-20. Among the herbicidal treatments, maximum weed control efficiency was obtained in Sulfosulfuron + Metsulfuron 30g ai /ha. This might be due to the fact that herbicides such as Sulfosulfuron and Metsulfuron belong to the sulfonyl ureas group that synthesizes aceto lactase compound (ACT) leading to quick weed control. These results are also in conformity with other earlier findings (Chopra and Chopra, 2005); Mishra *et al*., 2010)

Table 1 : Effect of date of sowing and different weed control treatment on weed count in year 2018-2019 and 2019-20.

Weed count per meter square								
Main plots	**30 DAS**		**60 DAS**		**90 DAS**		**At harvest**	
	2018-19	**2019-20**	**2018-19**	**2019-20**	**2018-19**	**2019-20**	**2018-19**	**2019-20**
D1 (1 November)	49.55	75.73	20.18	25.01	19.19	23.41	20.23	25.03
D2 (20 November)	73.96	97.36	23.16	31.12	22.02	28.00	23.34	30.97
D3 (10 December)	75.59	98.82	30.04	34.59	25.60	31.92	26.75	34.52
CD 5%	1.799	2.387	1.104	2.012	1.95	1.122	2.00	1.458
Sub plots								
Sulfosulfuron 25g/ha	67.25	91.73	11.38	19.63	10.81	17.51	11.17	20.93
Clodinafop 60g/ha followed by metsulfuron 5g/ha	66.31	91.36	13.65	21.20	12.82	20.29	13.19	23.67
Sulfosulfuron + Metsulfuron 30g/ha	65.33	90.13	8.14	11.11	9.59	13.77	9.89	17.60
Weed free	66.96	91.41	0.0	0.0	0.0	0.0	0.0	0.0
Weedy check	65.98	88.55	89.15	99.33	78.13	87.31	82.97	88.66
CD 5%	NS	NA	1.206	1.966	1.62	1.336	1.84	1.249
CD interaction	NS	NA	2.210	3.643	3.06	2.431	3.44	2.351

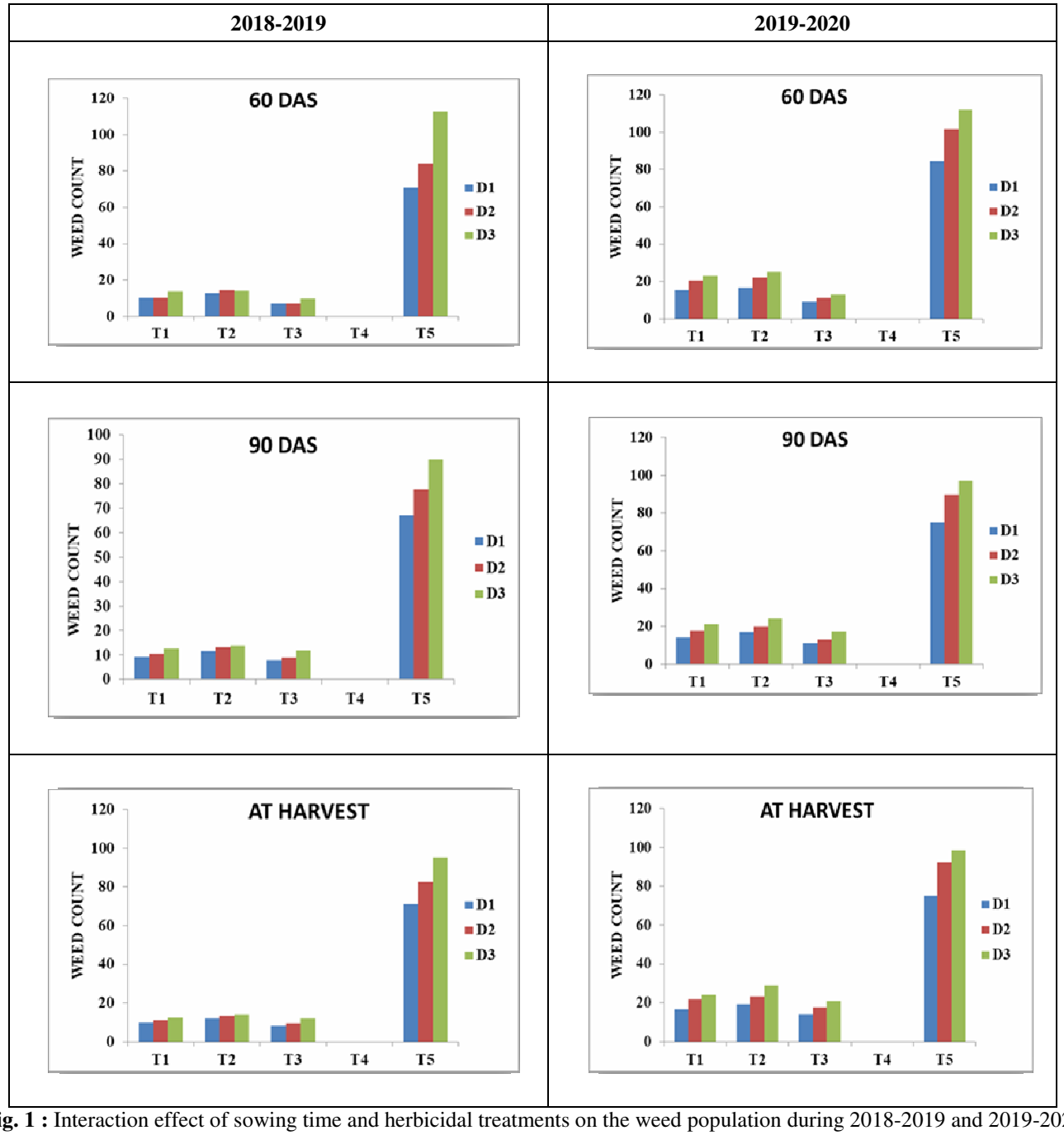

Fig. 1 : Interaction effect of sowing time and herbicidal treatments on the weed population during 2018-2019 and 2019-2020

Table 2 : Effect of date of sowing and different weed control treatments on weed dry matter accumulationduring 2018-2019 and 2019-20

Weed dry matter production g/m^2								
Main plots	**30 DAS**		**60 DAS**		**90 DAS**		**At harvest**	
	2018-19	**2019-20**	**2018-19**	**2019-20**	**2018-19**	**2019-20**	**2018-19**	**2019-20**
D1 (1 November)	8.48	12.75	10.78	13.20	17.34	21.38	19.79	24.54
D2 (20 November)	12.58	16.29	12.29	16.37	19.78	25.46	22.77	30.12
D3 (10 December)	12.79	16.41	15.94	18.21	22.93	28.98	26.03	33.16
CD 5%	0.514	0.427	0.443	0.815	1.400	0.942	1.98	1.53
Sub plots								
Sulfosulfuron 25g/ha	11.41	15.32	6.44	10.33	10.92	17.53	10.75	20.85
Clodinafop 60g/ha followed by metsulfuron 5g/ha	11.30	15.26	7.15	11.16	11.37	18.19	12.88	22.40
Sulfosulfuron + Metsulfuron 30g/ha	11.20	15.09	4.28	5.84	8.511	12.35	9.66	17.09
Weed free	11.29	15.21	0.0	0.0	0.0	0.0	0.0	0.0
Weedy check	11.22	14.88	47.15	52.31	69.29	78.30	81.03	86.02
CD 5%	NS	NS	0.957	1.400	2.019	1.912	1.74	1.51
CD interaction	NS	NS	1.686	2.487	3.623	2.741	3.270	2.81

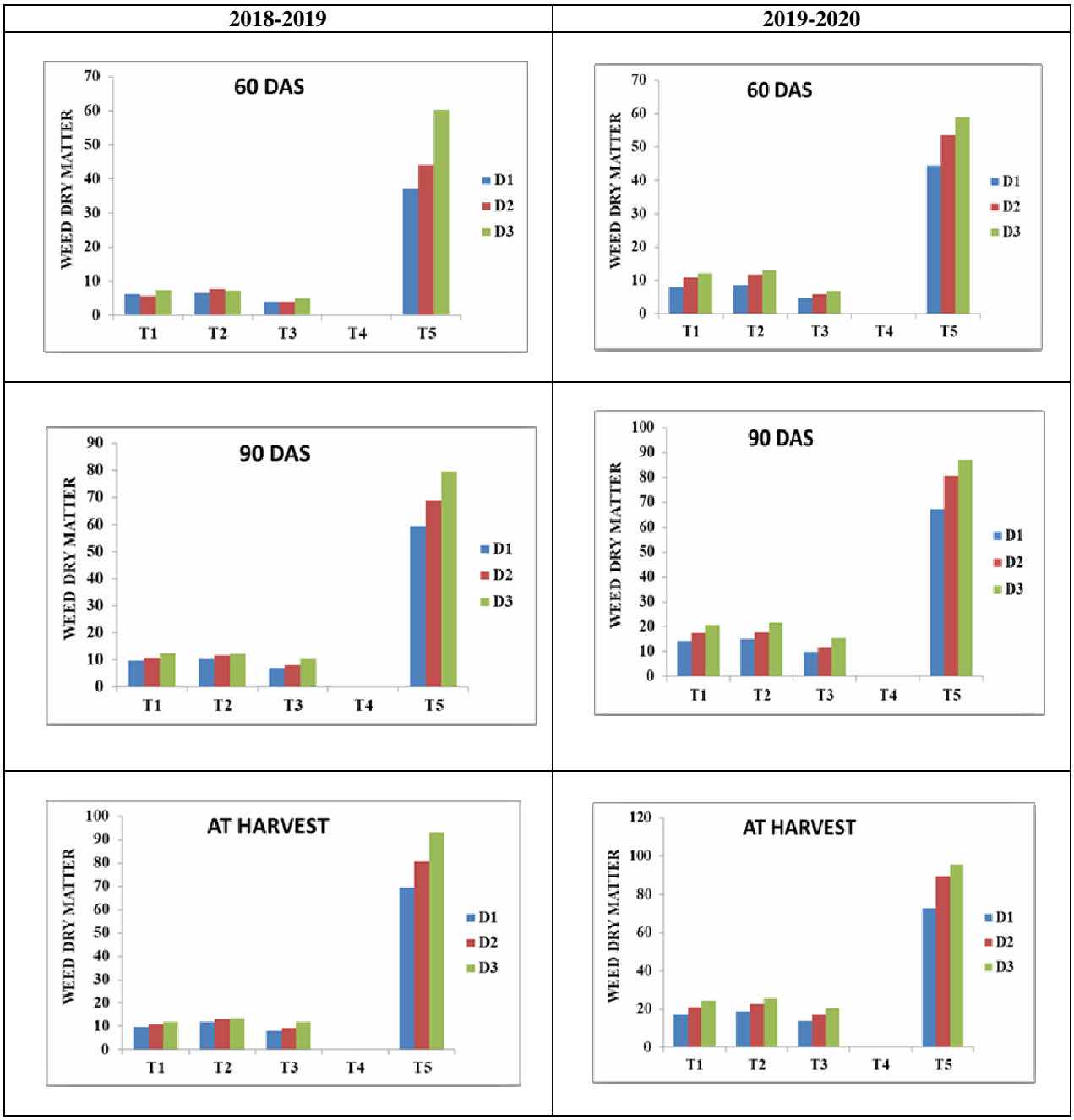

Fig. 2 : Interaction effect of sowing time and herbicidal treatments on the weed dry matter during 2018-2019 and 2019-2020

Table 3 : Effect of date of sowing and different weed control treatment on weed control efficiency (%WCE) in year 2018-19 and 2019-20.

%WCE		
Main plots	**2018-19**	**2019-20**
D1 (1 November)	75.50	71.55
D2 (20 November)	71.71	65.06
D3 (10 December)	67.62	62.11
Sub plots		
Sulfosulfuron 25g/ha	85.88	76.01
Clodinafop 60g/ha followed by metsulfuron 5g/ha	84.10	74.47
Sulfosulfuron + Metsulfuron 30g/ha	88.07	80.13
Weed free	100	100

Conclusion

The present investigations revealed that early sowing (first week of November) exerted a significant effect to decrease the density and dry matter of *Phalaris minor*. Among the different weed management treatments, application of (Sulfosulfuron + Metsulfuron Methyl 30 g ai/ha) recorded the lowest density and dry weight of weeds. Thus, it is recommended to use sowing time for wheat as first week of November and to use mixture of Sulfosulfuron + Metsulfuron Methyl @ 30 g ai/haas a herbicidal treatment against *Phalaris minor.*

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