

Original Research Article

Effect of Different Weed Management Practices on Weed Flora in Wheat (*Triticum aestivum* L.)

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ABSTRACT

An experiment was conducted during *rabi* season of 2017-18 at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India, situated at 260.470 North latitude, 80.1200 East longitude at an altitude of about 113.0 meter from mean sea level. Weed infestation is one of the main causes of low yield not only in India but all over the world, as it reduces wheat yield by 37-50%, which may be minimized to a greater extent simply by adopting an appropriate weed management practices. The experiment was comprised of nine treatments of weed management viz. (i) Sulfosulfuron (POE) @ 25g a.i./ha (ii) Clodinafop+ metsulfuron (POE) @ 60+4g a.i./ ha (iii) Fenoxaprop P-ethyl+metribuzin (RM) (POE) @ 100+75g a.i./ha (iv) Mesosulfuron+iodosulfuron(RM) (POE) @12+2.4g a.i./ha (v) Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha (vi) Pendimethalin fb 2,4-D (PE+POE) @ 1000+500g a.i./ha (vii) Metribuzin (POE) @ 175g a.i./ha (viii) Hand weeding (2) at 20 and 40 DAS Weedy check. The experiment was framed in Randomized Block Design (RBD) with three replications. The wheat variety HUW-234 was used for sowing. The crop was fertilized with recommended dose of NPK and other cultural operations were performed accordingly. The result revealed that application of Sulfosulfuron + metsulfuron (RM) (POE) @ 30+2g a.i./ha were found most effective control of the all types of weeds followed by hand weeding control of weeds than the rest of the treatments and improving growth, yield and quality of wheat followed by hand weeding than the rest of the treatments. Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha was recorded highest net income (61253.7 Rs ha⁻¹) and B-C ratio (1.80) followed by hand weeding (54344 Rs ha⁻¹).

Keywords

Weed management, wheat, Weed infestation, Economics

Introduction

Wheat (*Triticum aestivum* L.) is staple food of the world and falls under *Poaceae* family. Origin North Western parts of the Indian subcontinent. The three major species of

wheat which are in cultivation nowadays are *Triticum aestivum*, *Triticum durum* and *Triticum dicoccom* which are known as common bread wheat, Marconi wheat and Emmer wheat, respectively. About 80 to 85%

of wheat grains are consumed in the form of chapaties made by wheat flour. It ranks first in the world among the cereals both in respect of area i.e. 219.51 million ha and production i.e. 758.02 million tons (USDA, report 2017-18). In India, it is cultivated on an area of 30.70 million hectare having productions of 98.51 million tones with average productivity of 3200 kg ha⁻¹ (USDA, report 2017-18). Uttar Pradesh rank first with respect to area 9.67 million hectare and production 33.66 million tones the productivity is much lower 3.48 tones ha⁻¹ as compared to Punjab and Haryana 4.50 tones h⁻¹ (Anonymous, 2017). The prominent weeds noted in wheat fields are *Phalaris minor*, *Chenopodium album*, *Anagallis arvensis*, and *Cynodon dactylon* etc (Singh *et al.* (2015). Weeds alone cause about 33-50 per cent reduction in wheat yield. Weed infestation is one of the main causes of low wheat yield, it reduces wheat yield by 37-50 % (Waheed *et al.* 2009). Under the present circumstances control of weed through the herbicides is effective. Introduction of herbicides has made it possible to control a wide spectrum of weeds in wheat effectively. Herbicide application (30 DAS) of sulfosulfuron + metsulfuron @ 32 g/ha was found effective to reduce density and biomass of weeds.

Materials and Methods

Field experiment was conducted during *rabi* season of 2017-18 at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India. The experimental site belongs to sub humid and sub tropical climate of indo-gangetic plains (IGP) having alluvial calcareous soil and located at 26.470 North latitude, 80.1200 East longitude at an altitude of about 113.0 meter from mean sea level. The field experiment was comprised of nine treatments

of weed management viz. (i) Sulfosulfuron (POE) @ 25g a.i./ha (ii) Clodinafop+metsulfuron (POE) @ 60+4g a.i./ ha (iii) Fenoxaprop P-ethyl+metribuzin (RM) (POE) @ 100+75g a.i./ha (iv) Mesosulfuron + iodosulfuron (RM) (POE) @12+2.4g a.i./ha (v) Sulfosulfuron+metsulfuron (RM)

(POE)@ 30+2g a.i./ha (vi) Pendimethalin *fb* 2,4-D (PE+POE) @ 1000+500g a.i./ha (vii) Metribuzin (POE) @ 175g a.i./ha (viii) Hand weeding (2) at 20 and 40 DAS (IX) Weedy check were laid out in a Randomized Block Design (RBD) and replicated three times. The soil of experimental field was silt loam in texture with 28.5% sand, 54.00% silt and 17.5% clay with having 8 pH. It was moderately fertile being medium in organic carbon (0.32%), low in nitrogen (180.0 Kgha⁻¹), medium in phosphorus (18.0 Kgha⁻¹) and high in potassium (260.0Kgha⁻¹).

The wheat variety HUW-234 was late sown on 5 December, 2017. The other management operations performed as per standard recommendation. Meteorological conditions such as distribution of rainfall, temperature (maximum and minimum), relative humidity and evaporation rate recorded during the crop season of study revealed that weekly mean minimum and maximum temperatures during the crop season was ranged from 5.9 to 18.70°C and 13.8 to 39.20°C, total rainfall received was 9.8 mm during the varied crop season relative humidity, evaporation rate and sunshine hours were from 53.7 to 83.14 per cent, 1.45 to 6.50 mm day⁻¹ and 0.36 to 8.4 hours, respectively. Crop responses to the treatments were measured in terms of predetermined quantitative Indices. The observations so recorded were subjected to statistical analysis. Valid comparisons between various treatments were drawn using the respective CD (Critical difference) values (Table 1 and 2).

Results and Discussions

Effect of treatments on weeds

Weed flora

The major weed noted in the experimental field in weedy check plot such as *Phalaris minor*, *Cynodon dactylon*, *Avena fatua* of grassy weeds, *Chenopodium album*, *Angallis arvensis*, *Convolvulus arvensis*, and *Lathyrus aphaca* of broad leaf weed and *Cyperus rotundus* of sedges were noted. Similar weed flora of wheat crop under normal as well as late sown condition has also reported by Tripathi and Vaishya (1997).

Weed density

The species wise density of weed recorded at various stage of crop growth reveal that the wheat crop was infested with grassy as well as non-grassy weed. Post emergence application of Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha (14.10 m^2) was found most effective to control the weeds as compared to other herbicide at all the stages, except 30 DAS. Which was found at par with hand weeding (18.90 m^2) and both were significantly superior as compared to weedy check. However, the poor response of Metribuzin (POE) @ 175g a.i./ha (63.70 m^2) was recorded due to high weed population and weed dry weight owing due to poor control of weed. Effective weed control in wheat by the use of isoproturon and 2,4-D has also been observed by Nayak *et al.* (2003).

Weed dry matter accumulation

The dry matter of total weed species increased with advancement of the crop age and found highest at 90th DAS, thereafter, declined at harvest stage of the crop. The weed dry weight recorded at harvest stage was lower than 90th day stage due to senescence of weed

plants with the advancement of age. Post emergence application of Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha (4.62 g m^{-2}) was found the most effective to reduce the weed dry weight g m^{-2} which remained at par with hand weeding. Reduced weed density under these treatments have resulted in reduced weed dry weight. Similar findings were also reported by Wani *et al.*, 2005.

Weed control efficiency

The spectrum of weeds has a bearing on the efficiency of the management practices adopted. Post emergence application of Sulfosulfuron+metsulfuron (RM) (POE) @ 30+2g a.i./ha resulted in the highest weed control efficiency (73.12%) followed by hand weeding (68.88%). This was mainly due to lowest number of weed count, under the effects of above treatment. Nayak *et al.* (2003) have also reported increase in weed control efficiency with use of herbicides in wheat.

Weed index

Post emergence application of Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha the recorded lowest weed index of (00 %) followed hand weeding of (5.94%) as compared to weed index of (31.66 %) noted with weedy check. This was mainly due to lesser crop weed competition in herbicidal treatment as compared to weedy check within term resulted higher yield vis-à-vis reduce weed index. The results are in agreement with Chhipa *et al.* (2005).

Studies on crop

Plant height

The plant height increased significantly by the different weed management practices at 60th, 90th day and at harvest stage of crop

growth. Tallest plant of (89.9 cm) was recorded under Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha which was at par with hand weeding (88.4 cm). The shortest (70.1 cm) plants were observed under weedy check. The increase in plant height was due to greater availability of nutrient which resulted profuse growth of plants at various growth factors. Similar results have also been reported by Sriprakash (1996).

Number of shoots

The number of shoots m^{-2} increased up to 90th day stage of crop growth, thereafter, it decreased slightly. The number of shoots m^{-2} increased significantly under various weed management treatments as compared to weedy check at all the stages. Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha ($427 m^{-2}$) treatment being at par with hand weeding ($417 m^{-2}$), but produced significantly higher shoots than weedy check ($255 m^{-2}$) at all the growth stages of crop. It may be attributed due to the fact that there was better availability of nutrients under well managed plots which resulted in highest shoot m^{-2} than weedy check plots. Similar results have been also reported by Sriprakash (1996).

Leaf Area Index

The leaf area increased with increase in age of crop up to 90th day stage. The leaf area index increased significantly with various herbicide treatments and recorded the highest with Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha treatment (5.79) which is significantly at par with hand weeding (5.71), Mesosulfuron + iodosulfuron(RM) (POE) @12+2.4g a.i./ha (5.54), and followed by Fenoxaprop P-ethyl+Metribuzin (RM) (POE) @ 100+75g a.i./ha. The better leaf area index with Sulfosulfuron + metsulfuron (RM) (POE)@

30+2g a.i./ha might be due to fact that sufficient moisture and nutrient availability due to lesser weed density under above treatment resulted in better growth i.e. leaf number and size leading to increased leaf area, and leaf area index. These results are in conformity with those of Tariful *et al.* (1999).

Dry matter accumulation

At harvest, the highest dry matter accumulation was recorded by post emergence application of Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha ($775.60 gm/m^2$) which was at par with all treatment except Pendimethalin+2,4-D (PE+POE) @ 1000+500g a.i./ha, Metribuzin (POE) @ 175g a.i./ha, and weedy check. This might be attributed to profuse growth of crop due to higher availability of nutrient owing to effective control of weeds, more synthesis of food materials in plants under less weedy condition. Wani *et al.* (2005) have also reported increase in dry matter production with herbicides as compare to weedy check ($588.20 gm/m^2$).

Yield and yield contributing characters

Yield attributes is the resultant of the vegetative and reproductive development of the plants. The entire yield attributes viz. number of grains spike⁻¹, length of spike (cm) and test weight (g) increased significantly with herbicide application as compare to weedy check. The significantly highest values of all the yield contributing characters were recorded with Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha, which was at par with hand weeding, Fenoxaprop P-ethyl+metribuzin (RM) (POE) @ 100+75g a.i./ha, all these treatments significantly higher than weedy check. This may be due to better availability of nutrient owing to lower weed population and dry weight under well managed treatments which resulted better growth and development of plants vis-à-vis yield attributes.

Table.1 Effect of various weed control treatments on yield and yield attributing characters of wheat

Sr.	Treatments	Plant height (cm) 90 DAS	Number of shoots (m ⁻²) 90DAS	LAI 90 DAS	DM (gm/cm ²) 90 DAS	Grain yield qha ⁻¹	Straw yield qha ⁻¹	Harvest index %	Test weight (g)
T ₁	Sulfosulfuron (POE) @ 25g a.i./ha	78.80	390	5.06	689.86	37.60	47.56	44.15	39.10
T ₂	Clodinafop+ metsulfuron (POE) @ 60+4g a.i./ ha	81.50	396	4.27	693.80	38.00	47.63	44.37	38.40
T ₃	Fenoxaprop P-ethyl+metribuzin (RM) (POE) @ 100+75g a.i./ha	84.00	399	5.39	703.20	38.50	48.23	44.39	38.80
T ₄	Mesosulfuron+iodosulfuron(RM) (POE) @12+2.4g a.i./ha	86.20	410	5.54	730.30	40.00	49.92	44.48	39.00
T ₅	Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha	90.40	427	5.79	775.60	42.60	52.65	44.72	40.90
T ₆	Pendimethalin+2,4-D (PE+POE) @ 1000+500g a.i./ha	77.00	376	4.95	661.60	36.00	45.86	43.98	38.90
T ₇	Metribuzin (POE) @ 175g a.i./ha	76.20	348	4.90	648.40	35.20	45.08	43.84	37.70
T ₈	Hand weeding (2) at 20 and 40 DAS	88.90	417	5.71	763.40	41.90	51.91	44.66	39.60
T ₉	Weedy check	70.60	255	4.39	588.20	31.20	42.00	42.62	37.40
	SEM +	3.36	16.24	0.19	24.00	1.48	1.97	-	1.04
	C.D. at 5%	10.09	48.64	0.57	71.95	4.44	5.89	-	NS

Table.2 Effect of various treatments on weed density, dry matter, WCE and weed index

Sr.	Treatments	Weed density (m ²) 90DAS	Weed DM (gm/cm ²) 90 DAS	W.C.E. (%)	W.I. (%)
T ₁	Sulfosulfuron (POE) @ 25g a.i./ha	(43.30) 6.61	8.03	52.82	16.07
T ₂	Clodinafop+ metsulfuron (POE) @ 60+4g a.i./ ha	(39.90) 6.35	7.71	54.72	14.86
T ₃	Fenoxaprop P-ethyl+metribuzin (RM) (POE) @ 100+75g a.i./ha	(35.40) 5.99	7.26	57.36	13.51
T ₄	Mesosulfuron+iodosulfuron(RM) (POE) @ 12+2.4g a.i./ha	(27.70) 5.31	6.43	62.29	10.49
T ₅	Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha	(14.10) 3.82	4.62	73.12	0.00
T ₆	Pendimethalin+2,4-D (PE+POE) @ 1000+500g a.i./ha	(50.90) 7.16	8.70	48.83	20.06
T ₇	Metribuzin (POE) @ 175g a.i./ha	(63.70) 8.00	9.73	42.69	20.83
T ₈	Hand weeding (2) at 20 and 40 DAS	(18.90) 4.40	5.33	68.88	5.94
T ₉	Weedy check	(192.90) 13.89	16.90	0.0	31.66
	SEM +	0.26	0.29	-	-
	C.D. at 5%	0.78	0.85	-	-

Value in parenthesis after square root transformation

Angiras and Sharma (1996) have also observed increase in yield attributes with use of herbicides in wheat.

Grain yield

Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha recorded the highest grain yield (42.60 q ha⁻¹) over rest of treatment followed by hand weeding (41.90 q ha⁻¹) which is significantly at par with all treatment except Pendimethalin+2,4-D (PE+POE) @ 1000+500g a.i./ha, Metribuzin (POE) @ 175g a.i./ha and weedy check (31.20 q ha⁻¹).

Straw yield

The highest straw yield (60.00 q ha⁻¹) was recorded in Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha followed by hand weeding (51.91 q ha⁻¹). The similar results have been also reported by Chhokar *et al.* (2006).

Test weight

The test weight of wheat grain was not affected significantly due to different weed control treatment due to it is directly related with genetic behavior of crop or variety. However, highest test weight was recorded Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha (40.90 g) due to source -sink relationship owing to better growth of crop and lesser weed dry weight.

Economics

Post emergence application of Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha recorded the highest net income of (Rs. 61253.7 ha⁻¹) followed by hand weeding (Rs. 54344 ha⁻¹). In these treatments Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha recorded highest benefit cost

ratio of (1.80) followed by Clodinafop+ metsulfuron (POE) @ 60+4g a.i./ ha (1.57). Weedy check was not found to be economical in comparison to other herbicidal treatments because of its high labors expenditure involved in keeping the plots free of weeds. The Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha was obtained higher net return (61253.7 Rs ha⁻¹) per rupee investment was mainly due to higher grain and straw yield to greater extent as compare to lesser increase in cost of cultivation with these treatments. The results are in agreement with Ali *et al.* (2003).

On the basis of experiment it may be concluded that: Among the different herbicides application of Sulfosulfuron + metsulfuron (RM) (POE)@ 30+2g a.i./ha were found most effective control of the all types of weeds followed by hand weeding control of weeds than the rest of the treatments, and application of Sulfosulfuron+metsulfuron (RM) (POE)@ 30+2g a.i./ha was most suitable for improving growth, yield and quality of wheat followed by hand weeding than the rest of the treatments. Sulfosulfuron + metsulfuron (T₅) (RM) (POE)@ 30+2g a.i./ha was recorded highest net income (61253.7 Rs ha⁻¹) and B-C ratio (1.80) followed by hand weeding (54344 Rs ha⁻¹) and B-C ratio (1.36).

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