Short Communications

Indian Journal of Agricultural Sciences **92** (1): 140–3, January 2022/Short Communication
https://doi.org/10.56093/ijas.v92i1.120878

Management of complex weed flora of wheat (*Triticum aestivum*) through appropriate herbicides

R K SINGH[1]*, U K TRIPATHI[2] and S R K SINGH[3]

Krishi Vigyan Kendra, Chhatarpur, Madhya Pradesh 471 201, India

Received: 23 February 2021; Accepted: 18 August 2021

Keywords: Net return, WCE, WCEI, Weed dyanamic, Yield

High yielding dwarf wheat (*Triticum aestivum* L.) varieties are highly responsive to irrigation and fertilizers. Intensive cultivation of these varieties leads to significant changes in crop ecological conditions that favours intensification of grassy and broad leaved weeds. These weeds become troublesome and difficult to control by traditional methods. It poses serious problems in wheat production and adversely affects the quality of produce. The magnitude of yield losses varying from 15–30% depends on the type of weeds and duration of competition for available resources (Kumar *et al.* 2011). Therefore, a consistent effort is required for the effective management of the weed population by using one or more compatible molecules of herbicide for effective management of complex weed flora. Selective herbicide with single molecule would be effective against either grasses or broad-leaved weeds. While its compatible mixture of two or more molecules was quite effective against complex weed flora in wheat. This resulted into maximum weed control efficiency, weed index and enhanced the production and income per unit area.

A series of field experiments were conducted in wheat (*cv*. GW 322 and JW 3211) at farmers' field and instructional farm of Krishi Vigyan Kendra (KVK), Chhatarpur during 2017–18 to 2018–19. The soil was medium black, natural in reaction *p*H 7.6, low in organic carbon (0.43%). The nitrogen, phosphorus and potassium content were 230, 14 and 350 kg/ha, respectively with at KVK farm. The experiment, was conducted in a randomized block design with seven treatments, viz. T_0: control, T_1: 2, 4 D @750 g a.i./ha, T_2: metsulfuron-methyl @4g a.i./ha, T_3: sulfosulfuron @25 g a.i./ha, T_4: 2, 4 D + metsulfuron-methyl @500 + 4 g a.i./ha, T_5: sulfosulfuron + metsulfuron-methyl @30 + 2 g a.i./ha, T_6: clodinafop propargyl + metsulfuron-methyl @60 + 4 g a.i./ha. The seed-cum ferti drill was used to sow the seeds in lines with a planting distance of 20 cm × 10 cm. The sowing was done in the 2nd fortnight of October during 2017–18 and 2018–19. The recommended dose of fertilizers (100:60:40 N, P_2O_5, K_2O kg/ha) and no herbicides were applied in the check plots. Further, sufficient soil moisture was maintained at the time of herbicide spray. The herbicides were sprayed at 25 days after sowing (DAS) under sufficient moisture by knapsack sprayer fitted with flat fan nozzle (500 litres/ha). The quadrate sampling was done to record the weed density at 60 DAS. Data on weed population was subjected to square root transformation, because of wide variations, x is the actual weed density recorded on the field. The weed fresh and dry biomass was recorded from different plots at 25 and 60 DAS. Data on weed control efficiency, weed control efficiency index and weed index was calculated as:

$$\text{WCE (\%)} = \frac{(WD_c - WD_t)}{WD_c} \times 100$$

Where WDc = Weed density in control plot; *WDt* = Weed density in treated plot.

$$\text{WCEI (\%)} = \frac{(WDM_c - WDM_t)}{WDM_c} \times 100$$

Where WDMc = Weed dry weight in control plot; *WDMt* = Weed dry weight in treated plot

$$\text{Weed Index (\%)} = \frac{(Yt - Yc)}{Yt} \times 100$$

Where Yt = Seed yield in weed free plot; *Yc* =Seed yield in control plot.

The statistical analysis of data as described by Panse and Sukhatme (1973) and the differences were tested by F test.

Among the herbicidal treatments, the lowest total weed density and total weed biomass (fresh and dry weight) and maximum weed control efficiency and weed control efficiency index (85.9% broad leaved weeds and 90.3% narrow leaved weeds and 87.2%), respectively, were recorded with the application of clodinafop propargyl +

Present address: [1]Krishi Vigyan Kendra, Chhatarpur, Madhya Pradesh; [2]Krishi Vigyan Kendra, Satna, Madhya Pradesh; [3]ATARI Zone IX Jabalpur, Madhya Pradesh. *Corresponding author e-mail: rajiv_kvk@rediffmail.com.

Table 1 Effect of different herbicide and its compatible mixture on weed spectrum and their control efficiency

Treatment	Weed density at 25 DAS		Fresh Weed biomass g/ m^2 at 25 DAS		Dry Weed biomass g/m^2 at 25 DAS		Weed density at 60 DAS		Fresh Weed biomass g/m^2 at 60 DAS		Dry Weed biomass g/m^2 at 60 DAS		Total weed dry biomass g/m^2	Reduce the weed dry biomass (%)	WCE		WCEI
	No. of BLW	No. of NLW	BLW	NLW	BLW	NLW	BLW	NLW	BLW		BLW	NLW			BLW	NLW	
Control plot	4.1 (13.2)	4.6 (17.0)	5.3	5.4	3.8	3.8	4.2 (14)	4.7 (18)	11.6	-	7.6	8.8	16.4	-	-7.6	-5.9	-
2,4 D	4.2 (14.1)	4.9 (19.2)	5.7	6.1	4.1	4.3	1.9 (2)	4.9 (19)	1.7	36.6	1.1	9.3	10.4	36.5	85.7	27.8	36.6
Metsulfuron methyl	4.1 (13.0)	4.4 (15.1)	5.3	4.8	3.8	3.4	1.9 (2)	4.3 (15)	1.7	51.8	1.1	6.9	7.9	51.8	84.6	7.2	51.8
Sufosulfuron	4.6 (16.9)	4.9 (20.2)	7.0	6.4	5.0	4.5	4.2 (14)	2.7 (5)	11.6	39	7.6	2.4	10.0	39.0	17.6	75	39
2,4 D + metsulfuron methyl	4.4 (15.1)	4.7 (18.0)	6.2	5.8	4.4	4.0	1.5 (1)	4.2 (14)	1.7	51.8	1.1	6.9	7.9	51.8	86.6	22.2	51.8
Sufosulfuron + metsulfuron methyl	4.6 (17.1)	5.0 (20.3)	7.0	6.4	5.0	4.5	2.2 (3)	2.2 (3)	2.5	81.1	1.6	1.5	3.1	81.1	82.4	85	81.1
Clodinofoppropegyl+ metsulfuron methyl	4.6 (17.0)	5.1 (21.0)	7.0	6.7	5.0	4.7	1.9 (2)	1.9 (2)	1.7	87.2	1.1	1.0	2.1	87.2	85.7	90.5	87.2
SEM ±	0.43	0.48	0.33	0.07	0.17	0.14	0.32	0.11	0.15	0.20	0.07	0.16	0.38				
CD (P=0.05)	1.3	1.4	1	0.2	0.5	0.4	0.9	0.3	0.4	0.6	0.2	0.4	1.1				

Pooled data of two years. Data given in parenthesis are original values, and outside are square-root transformed value. *BLW, Broad leave weed; NLW, Narrow leave weed; WCE, Weed control efficiency; WCEI, Weed Control Efficiency Index.

141

Table 2 Effect of herbicide on growth, yield attributes and economics of wheat

Treatment	No. of effective tillers/m²	No. of ineffective tillers/m²	No. of grains/ear	Test weight (g)	Yield (q/ha)	Economics of wheat cultivation		
						Cost of cultivation (₹/ha)	GR (₹/ha)	NR (₹/ha)
Control plot	200.0	45.0	40.5	36.8	25.9	28500	51023	22523
2,4 D	220.0	42.0	42.5	36.9	27.5	29600	54175	24575
Metsulfuron-methyl	242.0	35.0	43.5	38.2	28.7	29900	56539	26639
Sufosulfuron	255.0	30.0	45.6	38.2	28.9	29900	56933	27033
2,4 D + metsulfuron methyl	261.0	32.0	45.8	39.4	34.5	31000	67965	36965
Sufosulfuron + metsulfuron methyl	266.0	5.0	49.5	39.5	38.8	32500	76436	43936
Clodinofoppropegyl + metsulfuron methyl	272.0	5.0	49.8	39.8	39.9	32500	78603	46103
SEm +_	3.57	0.99	0.39	0.16	0.11			
CD (P=0.05)	11	3.1	1.2	0.5	0.3			

Pooled data of two years.

*GR, Gross return; NR, Net return.

metsulfuron-methyl @60+4 g a.i./ha that was statistically at par with post-emergence application of sulfosulfuron + metsulfuron-methyl @30 + 2 g a.i./ha as compared to control plot. While 2, 4 D, and metsulfuron-methyl were highly effective for management of broad-leaved weeds (Table 1). Therefore, maximum broad-leaved weed control efficiency (84.6–85.7%) was recorded in this treatment because their dual action through uptake via roots and leaves leads to rapid translocation of herbicide. It acts by mimicking the action of the plant growth hormone auxin which results in uncontrolled growth of cell and inhibits cell division in shoot and roots by inhibits plant amino acid synthesis. This results in quick damage of broad-leaved weeds (Chand and Puniya 2017). While clodinafop propargyl and metsulfuron-methyl is absorbed by the leaves and stem and rapidly translocated to the growing points of leaves and stems. It interferes with the cell division and elongation resulting in stunted growth. They inhibit the enzyme acetyl coenzyme A carboxylases that disrupts fatty acid biosynthesis in susceptible grasses and subsequently growth was stopped within 48 h of application of this herbicide (Pal *et al*. 2016 and Singh *et al.* 2020).

Crop yield and its economics (net return) were found significantly higher (39.9 q/ha and ₹46103) under the application of clodinafop propargyl + metsulfuron-methyl followed by application of sulfosulfuron + metsulfuron-methyl (38.8 q/ha and ₹43936/ha) as compared to other treatments (Table 2). The development of more and healthy leaves under low weed infestation might have helped to improve the photosynthetic efficiency of the crop and supported large number of effective tillers, number of grains that resulted in enhanced production per unit area against the weed infested plots due to higher net assimilation rates than the cultivated crops. Similar results were reported Singh *et al.* (2020). Higher cost : benefit ratio is self-explanatory of economic viability of the experiment and convinced the farmers for adoption of intervention.

It may be concluded that the use of single herbicide is either ineffective or less effective against complex weed flora. However, a combination of two or more compatible herbicide like clodinafop propargyl + metsulfuron-methyl and sulfosulfuron + metsulfuron-methyl is quite effective against complex weed flora in wheat resulting in higher WCE, WCEI, yield and economic return/unit area. Therefore, the combination of two compatible herbicide molecules will be a better alternative for managing complex weed flora in the wheat field than the sole herbicide.

SUMMARY

Field experiment was conducted at the Instructional Farm of Krishi Vigyan Kendra, Chhatarpur during *rabi* 2017–18 and 2018–19 to evaluate appropriate herbicides for effective management of complex weed flora of wheat crop. The present investigation concluded that the use of single herbicide was either ineffective or less effective against complex weed flora. However, combination of two or more compatible herbicide molecules like clodinafop propargyl + metsulfuron-methyl and sulfosulfuron + metsulfuron-methyl was quite effective against complex weed flora in wheat resulting in higher WCE, WCEI, yield and economic net return/unit area (85.9% broad leaved weeds and 90.3% narrow leaved weeds, 87.2%. 39.9 q/ha and ₹46103/ha), respectively, followed by application of Sufosulfuron + metsulfuron methyl (82.4% broad leaved weeds and 85% narrow leaved weeds, 81.1%, 38.8 q/ha and ₹43936/ha), respectively, as compared to control plot. Therefore, the combination of two compatible herbicide molecules clodinafop propargyl + metsulfuron-methyl and sulfosulfuron + metsulfuron-methyl is quite effective against complex weed flora in wheat. This can be a better alternative for managing complex weed flora in the wheat field than the sole herbicide.

REFERENCES

Kumar S, Angiras N N and Rana S S. 2011. Bio-efficacy of clodinafoppropargyl + metsulfuron-methyl against complex weed flora in wheat. *Indian Journal of Weed Science* **43**(3,4): 195–8.

Panse V G and Sukhatme P V. 1954. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi, India.

Pal S, Sharma R, Sharma H B and Singh R. 2016. Influence of different herbicides on weed control, nutrient removal and yield of wheat. *Indian Journal of Agronomy* **61**(1): 59–63.

Chand L and Puniya R. 2017. Bioefficacy of alone and mixture of herbicides against complex weed flora in wheat, (*Triticum aestivum*) under sub-tropical conditions. *Indian Journal of Agricultural Sciences* **87**(9): 1149–54

Singh R P, Verma SK and Kumar S. 2020. Weed management for enhancing yield and economics of wheat (*Triticum aestivum*) in Eastern India.*Indian Journal of Agricultural Sciences* **90**(7): 1352–5.