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PERFORMANCE OF HERBICIDES FOR EFFECTIVE WEED MANAGEMENT IN WHEAT

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Abstract

Field experiment was carried out to assess the efficacy of herbicides for control of weeds in wheat.The dominant weed flora in wheat were *Cynodon dactylon, Cyperus rotundus, Chenopodium album, Medicago denticulate, Anagallis arvensis* and *Launaea nudicaulis.* The efficacy of herbicides pendimethalin 1000 g/ha PE, clodinafop-propargyl 60 g/ha and sulfosulfuron 25 g/ha was poor, which improved with the increase combined application of herbicides. However, combined application of post emergence sulfosulfuron + metsulfuron-methyl 20 + 4 g/ha and clodinafop-propargyl + metsulfuron-methyl 60 + 4 g/ha were significantly superior in reducing dry weight of both broad leaved and grassy weeds. The highest grain yield was recorded under weed free followed by clodinafop-propargyl + metsulfuron-methyl 60 + 4g/ha. Among the weed control treatments, maximum net returns of 87235/ha and highest B : C ratio (2.97) was recorded in clodinafop-propargyl + metsulfuron-methyl 60 + 4 g/ha.

Introduction

Wheat (*Triticum aestivum.* L) is the most extensively grown cereal crop in the world. Wheat crop infested with heavy population of diverse weed flora that included both monocot and dicot weeds. Major monocot weed flora in wheat crop was *Cynodon dactylon, Cyperus rotundus* and dicot weed flora *Launea nudicaulis, Chenopodium album, Anagalis arvensis* and *Medicago denticulate* (Malik *et al.* 2013, Sudha *et al.* 2016). If weeds sprout with the emerging crop seedling are not controlled in the early phases of crop growth, yield can be reduced by 10 to 40% (Singh and Singh 2005). Integration of different methods is needed to control broad spectrum weeds under non-chemical weed control. Chemical weed control is convenient and cost effective than manual weeding. Presently, several herbicide combinations are available for weed control in wheat but their efficacy against control of broad-spectrum weed flora is still to be tested. Therefore, the present experiment was carried out to evaluate the performance of pre and post emergence herbicides for weed control in wheat.

Materials and Methods

The experiment was conducted at College of Agriculture, Rewa Madhya Pradesh during *Rabi* season 2021. The experiment was laid out in a randomized block design with seven treatments replicated thrice.The treatment includes pendimethalin 1000 g/ha, sulfosulfuron 25 g/ha, clodinafop-propargyl 60g/ha, sulfosulfuron + metsulfuron-methyl 20+4 g/ha, clodinafop-propargyl

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+ metsulfuron-methyl 60 + 4 g/ha, two hand weeding at 25 and 40 DAS and weedy check. The soil was medium in nitrogen (253.12 kg/ha), phosphorus (15.46 kg/ha) and high in potassium content (313.05 kg/ha). Wheat variety GW 322 was sown at 20 cm spacing with fertilizer dose of 120 : 60 : 40 kg NPK/ha. For uniform and better germination, light irrigation was given after sowing and at same day pendimethalin was applied. Accordingly, all herbicides were applied manually by knapsack sprayer using flat fan nozzle. The observation on weed density and weed biomass were taken at 60 DAS randomly by using 25×25 cm quadrate on net plot area. Weeds under quadrates were collected by uprooting and cut close to the place where shoot end and root start. Then make group of monocot and dicot weed species wise and dried the samples in oven at 60°C. The finally dried samples were weighted and demonstrated as weed biomass (g m^{-2}). Square root transformation was done for weed density and dry weight by using formula ($\sqrt{x} + 0.5$). Weed control efficiency was calculated based on weed dry weight under different treatments. The economic analysis of each treatment was done on the basis of prevailing market price of input used and output under each treatment. Data on various growth and yield attributing character were analyzed using standard procedure.

Results and Discussion

The field was infested with diverse weed flora that included monocot weeds *C. dactylon, C. rotundus,* dicot weeds *C. album, A. arvensis, M. denticulate* and *L. nudicaulis*. Similar weed flora was observed by Malik *et al.* (2013) and Sudha *et al.* (2016). The data in Table 1 revealed significant reduction in weed density and weed biomass under all the weed control treatments over weedy check. This could be because of the herbicide applications both alone and in combination as reported by Choudhary *et al*. (2016), Jaiswal *et al.* (2020) and. However, the highest reduction in weed biomass was registered under hand weeding at 25 and 40 DAS (3.68 g/m^2) which was at par with clodinafop-propargyl + metsulfuron-methyl (9.88 g/m^2) followed by sulfosulfuron + metsulfuron-methyl (13.65 g/m^2). Sole applied herbicides *viz*., sulfosulfuron-methyl and clodinafop propargyl were found less effective in controlling both grassy and broad leaf weeds in comparison to their combination with metsulfuron-methyl. Effectiveness for controlling broad spectrum weed flora by combinations of herbicides either ready mix or tank mix was also reported by Choudhary *et al.* (2017), Jain *et al.* (2020). The effectiveness of post emergence herbicides in controlling both grassy and broad leaf weeds in terms of weed density and weed biomass were turn out effective compared to pre-emergence herbicide pendimethalin 1000 g/ha.

Weed control efficiency was the highest under hand weeded (97.83%) among the treatments whereas, among herbicides, maximum WCE was registered in clodinafop-propargyl + metsulfuron-methyl (94.18%) followed by sulfosulfuron + metsulfuron-methyl (91.95%), clodinafop-propargyl (85.81%), sulfosulfuron (80.76%) and the lowest was found in pendimethalin (65.16%), which was applied as pre-emergence (Table 2). Here sole applied herbicide showed very less WCE compared to combined herbicides (Chand and Puniya 2017). This shows the effective performance of combined herbicide which was significantly effective on minimizing the weed population closely related to Meena and Singh (2011) and Jain *et al.* (2020). Weed index on the other hand represent gain in crop yield due to weed control as percentage of yield from weed free crop. Lowest weed index was obtained in clodinafop-propargyl + metsulfuron-methyl (2.35%) followed by sulfosulfuron + metsulfuron-methyl (4.58%) and highest weed index in weedy check (66.82%) which shows loss in crop yield. Reduction in yield range varied from 2.35 to 38.76 % in treated plots as compared to weed free treatment. Weedy check plot provided favorable condition to weeds compared to crop nearly similar result reported by Deshmukh *et al.* (2020).

Table 1. Effects of different treatments on weed density and biomass in wheat at 60 DAS.

Treatments	*Chenopodium album*	*Medicago denticulata*	*Anagallis arvensis*	*Cynodon dactylon*	*Cyperus rotundus*	*Launea nudicaulis*	Total density (m^2)	Weedbiomass (gm^{-2})
Pendimethalin 1000 g/ha	2.20 (4.35)	3.83 (14.21)	2.59 (6.25)	3.51 (11.87)	3.38 (11.01)	1.6 (2.07)	7.08 (49.75)	7.72 (59.13)
Sulfosulfuron 25 g/ha	2.02 (3.59)	3.71 (12.41)	2.55 (6.01)	2.91 (7.98)	2.74 (7.01)	1 (0.5)	6.16 (37.5)	5.75 (32.66)
Clodinafop propargyl 60 g/ha	1.67 (2.30)	2.77 (7.18)	1.94 (3.28)	2.58 (6.19)	2.50 (5.77)	0.94 (0.38)	5.05 (25.1)	4.95 (24.08)
Sulfosulfuron + metsulfuron-methyl 20 + 4 g/ha	1.63 (2.16)	2.67 (6.65)	1.89 (3.09)	1.80 (2.74)	1.36 (1.36)	0.90 (0.29)	3.84 (14.29)	3.76 (13.65)
Clodinafop propargyl+metsulfuron methyl 60 + 4 g/ha	1.46 (1.65)	2.30 (4.80)	1.69 (2.37)	1.59 (2.05)	1.13 (0.78)	0.88 (0.27)	3.52 (11.92)	3.22 (9.88)
Two hand weeding	1.10 (0.73)	1.7 (2.45)	1.09 (0.7)	1.00 (0.52)	1.03 (0.57)	0.84 (0.20)	2.38 (5.17)	2.04 (3.68)
Weedy check	4.85 (23.09)	7.76 (59.76)	6.15 (34.43)	5.00 (24.60)	5.28 (27.48)	5.03 (24.80)	13.95 (194.16)	13.04 (169.76)
SEm ±	0.04	0.20	0.10	0.07	0.08	0.04	0.36	0.23
CD at 5%	0.13	0.59	0.30	0.21	0.22	0.12	1.06	0.66

Hand weeding required maximum investment because of more labour requirement for weeds two times 25 and 40 DAS. The gross return and B : C was minimum (Rs 42393/ha) under weedy check because of lowest economic yield. But it identically increased to a maximum level (Rs 128180/ha) when weeds were controlled by hand weeding closely followed by post emergence application of clodinafop-propargyl + metsulfuron-methyl (Rs. 126790/ha) was considerably higher, followed by sulfosulfuron + metsulfuron-methyl (Rs. 121620/ha). However, yield and economic returns were the lowest under weedy check. This showed the economic feasibility of herbicidal treatments over weedy check (Deshmukh *et al.* 2020, Soni *et al.* 2021, Kikraliya *et al.* 2025). The net return and benefit : cost ratio were minimum under weedy check and these indices were increased in the range of Rs 3933 to 87235 and 1.02 to 2.97, respectively, when weeds were controlled either by herbicides or by hand weeding. Though hand weeding twice fetched the highest gross returns, it had net monetary return (Rs 71520 /ha) and benefit : cost ratio (2.09) lesser than combined application of clodinafop-propargyl + metsulfuron-methyl, which had the highest net monetary return and benefit : cost ratio, closely followed by application of sulfosulfuron + metsulfuron-methyl in wheat. Deshmukh *et al.* (2020), Soni *et al.* (2021), Kikraliya *et al.* (2025) also reported similar results from their studies.

Table 2. Effects of weed control measures on weed control efficiency, weed index, yield and economics in wheat.

Treatments	Weed control efficiency (%)	Weed index (%)	Grain yield (q/ha)	Straw yield (q/ha)	Net monetary return (Rs/ha)	B : C Ratio
Pendimethalin 1000 g/ha	65.16	38.76	36.3	57.87	38777	1.83
Sulfosulfuron 25 g/ha	80.76	21.61	46.5	72.80	60740	2.35
Clodinafop propargyl 60 g/ha	85.81	17.48	49.06	76.96	66488	2.49
Sulfosulfuron + metsulfuron-methyl 20 + 4 g/ha	91.95	4.58	56.57	88.96	81655	2.85
Clodinafop propargyl + metsulfuron-methyl 60 + 4 g/ha	94.18	2.35	58.9	93.83	87235	2.97
Two hand weeding	97.83	0.00	59.41	94.34	71520	2.09
Weedy check	0.00	66.82	19.73	23.33	3933	1.02
SEm ±	-	-	1.13	2.10	-	-
CD at 5%	-	-	3.35	6.18	-	-

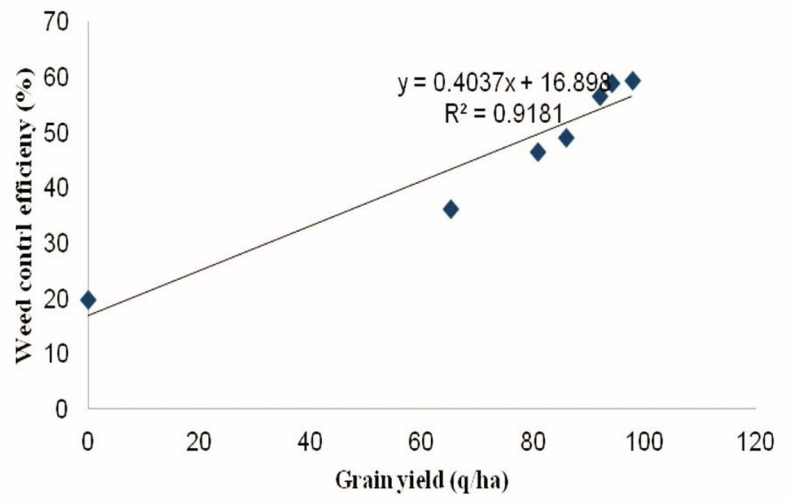

Fig. 1. Relationship between weed control efficiency and grain yield of wheat as influenced by various treatments of weed management.

The weed control efficiency and grain yield were positively associated with correlation co-efficient of 0.9181. This was further supported by the regression analysis. Thus, unit increase in weed control efficiency caused increase in wheat grain yield by 0.4037q/ha (Fig. 1).

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