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Effect of Different Solo and Ready-Mix Post-Emergence Herbicides on wheat (*Triticum aestivum* L.)

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ABSTRACT

Field experiment was conducted at crop research centre of ITM University Gwalior, (M.P.) to study the "Effect of different solo and pre-mix post-emergence herbicides on wheat (*Triticum aestivum* L.)"during *Rabi* season of 2023-24 and the experiment was laid out in Randomized block design with 3 replication and 12 treatments. Among the herbicide treatments lower weed density and dry matter accumulation of weed was recorded with the application of T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM)(20.66 no.m^{-2} and 5.85g m^{-2}) and being at par with T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM)(22.33 no.m^{-2} and 12.20g m^{-2}) over other weed control treatments. Among the different herbicide treatments, maximum grain, and straw yield were recorded under T_{11}-Weed free (46.27 and 56.69 q ha^{-1}) being at par with T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM) (42.89 and 53.59 q ha^{-1}), and followed by T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM) (38.70 and 50.46 q ha^{-1}) rest of the other treatments.

Key words: *Post-emergence, Herbicide, Weeds, Weed control efficiency, Yield*

Introduction

Wheat is the world's leading cereal crop, cultivated over an area of 221.11 million ha with a production of 785.10 million metric tons. In India, wheat is cultivated in almost all parts of the country and occupies 34.30 million ha with a production of 110.60 million metric tons and an average productivity of 3552 kg ha^{-1} (Anonymous, 2022-23). There are numerous factors that influence crop growth and production. The initial infestation of weed is one of the important factors that hinders its overall growth and productivity. The weeds compete with the crop plants for all the resources required for growth, like space, water, sunlight, and air, resulting in a reduction in crop yield (Verma *et al*., 2015). The critical period of crop weed competition is 30-45 DAS, and weed infestation is one of the main causes of low wheat yield not only in India but all over world, as it reduces wheat yield by 37-50% (Waheed *et al*., 2009). Chaudhary *et al*. (2008) have reported that in wheat field with production of each kilogram of weed, one kilogram wheat grain reduced. Hence weed control is essential for increasing wheat production. Some new ready-mix herbicide, *viz*. Clodinafop propargyl + Metsulfuron methyl (pre-mix), Sulfosulfuron +Metsulfuron-methyl (pre-mix), Mesosulfuron-methyl + Iodosulfuron-methyl sodium (pre-mix), must be tested to control many of the weeds in wheat crop because some of broad-leaved weeds (BLWs) or grassy weeds are not control by applying single herbicide molecule in wheat (Singh *et al*., 2019). Considering this fact in view, a field experiment was conducted during *Rabi* season of 2023-24 at crop research farm of ITMUniversity Gwalior (M.P.) to study effect of different solo and

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pre-mix post-emergence herbicides on of wheat.

Materials and Methods

The field experiment was conducted during *Rabi* season in 2023-24 at Crop research farm, of ITM University Gwalior (M.P.). The experimental site was situated in main campus of university, about 12 km. away from Gwalior at 78°20′ E longitude and 26°13′ N latitude, 412 above Mean Sea level, Madhya Pradesh, the average annual rainfall of gird zone was 750 mm. During the experiment the minimum and maximum temperature ranged between 5.3°C and 38.6°C, respectively. The soil of experimental sites was sandy loam in texture, having pH 7.9, electrical conductivity 0.41S/m, organic carbon 0.30, 175, 25 and 312 kg ha^{-1}available nitrogen, phosphorus and potassium respectively. The crop was fertilized with 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1}. The experiment was laid out in Randomized block design (RBD) with three replications, comprising 12 treatments viz. T_1-Mesosulfuron-methyl 3% + Iodosulfuron-methyl sodium 0.6 WDG (RM), T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM), T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% WP (RM), T_4-Clodinafop propargyl + Carfentrazone ethyl (TM), T_5-Sulfosulfuron 75 % WG, T_6-Carfentrazone ethyl 40% DF, T_7-Metsulfuron methyl 20% WG, T_8-Clodinafop propargyl 15% WP, T_9-Metribuzin 70 % WP, T_{10}-2,4 D ethyl ester 38 % EC, T_{11}-Weed free check, T_{12}-Weedy check allocated randomly. Variety (*Raj-4037*) of wheat was sown on 12 December 2023. The herbicide treatments were executed at 35 DAS with the help of machine operated knapsack sprayer fitted with flat fan nozzle using 500 liters water ha^{-1}.

Data on weed density was taken with quadrate measuring 0.5m ×0.5m placed randomly at three spot to each net plot at 60 DAS and weed control efficiency was calculated based on total biomass of weeds. The weed data were subjected to square root transformation to normalize the distribution. The data on yield of wheat were recorded at the time of crop harvest.

Results and Discussion

Weed flora

A field was infested with different type of weed flora in which among narrow leaf *Phalaris minor*, among broad leaf weeds i.e., *Chenopodium album, Anagalis arvensis, Convolvulus arvensis*, and *Melilotus indica*. Only one sedge weed, i.e. *Cyperus rotundus.* Due to less population, some of the weed species were included in the group of other weeds like *Fumeria parviflora, Melilotus alba, Asphodelus tennifolius, Parthenium hysterophorus, and Cynodon dactylon*. Similar weed flora was recorded by Jaiswal *et al*. (2020)

Table 1. Effect of herbicides on total weed density, weed dry weight and Weed control efficiency at 60 DAS.

Treatment	Doses (g ha^{-1})	Weed density (no.m^{-2})	Weed dry wt. (g m^{-2})	WCE (%)
T_1-Mesosulfuron-methyl 3% + Iodosulfuron-methyl sodium 0.6 WDG (RM)	400	5.90(34.37)	4.76(22.16)	66.38
T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM)	40	4.77(22.33)	3.56(12.20)	81.49
T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM)	400	4.58(20.67)	2.51(5.85)	91.12
T_4-Clodinafop propargyl + Carfentrazone ethyl (TM)	400+50	6.08(36.50)	5.02(24.67)	62.57
T_5-Sulfosulfuron 75 % WG,	33.3	6.47(41.38)	5.34(27.99)	57.53
T_6-Carfentrazone ethyl 40% DF	50	7.61(57.44)	5.76(32.75)	50.31
T_7-Metsulfuron methyl 20% WG	20	7.37(53.82)	5.59(30.78)	53.30
T_8-Clodinafop propargyl 15% WP	400	9.39(87.75)	6.73(44.90)	31.87
T_9-Metribuzin 70 % WP	250	6.72(44.66)	5.44(29.17)	55.74
T_{10}-2,4 D ethyl ester 38 % EC	1300 ml	8.05(64.26)	5.77(32.82)	50.21
T_{11}-Weed free check	-	0.71(0.00)	0.71(0.00)	100.00
T_{12}-Weedy check	-	11.99(145.28)	8.09(65.91)	0.00
SEm±		0.33	0.23	-
CD (p=0.05)		0.96	0.67	-

*Value in parentheses is original. **Value transformed by ($\sqrt{x} + 0.5$); WEC: weed control efficiency

Effect on weeds

The density of total weeds in wheat was significantly influenced by different treatments at 60 DAS. Among the weed control treatments of T_{11}-Weed free check recorded significantly lower density and dry weight of total weeds (0.0 no.m^{-2} and 0.0 g^{-2}) at 60 DAS. However, maximum density of total weeds was recorded in weedy check (145.28 no. m^{-2} and 65.91 g^{-2}) due to uninterrupted growth of weeds. Solo application of herbicides, i.e. Sulfosulfuron 75 % WG, Carfentrazone ethyl 40% DF, Metsulfuron methyl 20% WG, Metribuzin 70 % WP, 2,4 D ethyl ester 38 % minimize density of total weeds at different stages. But application of Clodinafop propargyl 15% WP only affects on grassy weeds viz., *Phalaris minor* (Kaur *et al*., 2015). However, ready-mic application of T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM) recorded significantly lower density and dry weight of total weeds (20.67 no.m^{-2} and 5.85 g m^{-2}) at 60 DAS. It was due to proper reduction in density and dry weight of weeds due to inhibition of weeds activities like minimize the photosynthetic activities or check the lipid or protein synthesis. It was at par with T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM) and followed by T_1-Mesosulfuron-methyl 3% + Iodosulfuron-methyl sodium 0.6 WDG (RM), T_4-Clodinafop propargyl + Carfentrazone ethyl (TM) Malik *et al*. (2013) and Chaudhari *et al*. (2017) reported that Clodinafop + metsulfuron control both broad and grassy weeds effectively.

The weed control efficiency of various treatments against weedy check was worked out on the basis of weed dry weight at 60 DAS. on the basis of Table 1. At 60 DAS,weed control efficiency (%) of total weeds was affected by various herbicidal treatments. Among the herbicides T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM) recorded significantly higher Weed control efficiency (%) of total weeds 91.12 % and 81.19% was found in T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM)at 60 DAS. Among the weed control treatments T_{11}- Weed free check recorded significantly higher weed control efficiency (100%) at 60 DAS. Due to illumination of all types of weeds during critical crop weed competition. Similar result was also reported by Kumar *et al*. (2012) and Deshmukh *et al*. (2020).

Effect on Crops

Grain and straw yields were significantly affected by different herbicide treatment where highest grain yield was recorded in T_{11}-Weed free check plot and among the herbicide treatment application of T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM) (42.89 q ha^{-1} and 53.59 q ha^{-1}) recorded significantly higher grain and straw yield than rest of the other treatments. It was at par with T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM) (38.70 q ha^{-1} and 50.46 q ha^{-1}) Yadav *et al*. (2019) and Singh (2022) reported similar result.

There was no significant difference in the harvest index due to different weed control treatments was statistically not distinguishable. However, the maximum harvest index (44.94%) of the wheat crop was

Table 2. Effect of weed control treatments on Grain yield, Straw yield, and Harvest index

Treatment	Grain Yield (q ha^{-1})	Straw Yield (q ha^{-1})	Harvest Index (%)
T_1-Mesosulfuron-methyl 3% + Iodosulfuron-methyl sodium 0.6 WDG (RM)	33.44	43.92	43.17
T_2-Sulfosulfuron 75% + Metsulfuron-methyl 5% WG (RM)	38.70	50.46	43.40
T_3-Clodinafop propargyl 15% + Metsulfuron methyl 1% (RM)	42.89	53.59	44.46
T_4-Clodinafop propargyl + Carfentrazone ethyl (TM)	32.37	42.66	43.14
T_5-Sulfosulfuron 75 % WG,	31.22	41.25	43.09
T_6-Carfentrazone ethyl 40% DF	28.31	37.75	42.83
T_7-Metsulfuron methyl 20% WG	29.13	38.73	42.93
T_8-Clodinafop propargyl 15% WP	28.03	37.52	42.77
T_9-Metribuzin 70 % WP	30.68	40.52	43.08
T_{10}-2,4 D ethyl ester 38 % EC	28.06	37.54	42.79
T_{11}-Weed free check	46.27	56.69	44.94
T_{12}-Weedy check	22.73	30.51	42.74
SEm±	1.61	2.10	-
CD at 5%	4.72	6.16	-

recorded with T_{11}-Weed free due to complete control of weeds. Among herbicide treatments application of T_3-Chodinofop + Metsulfuron was recorded maximum harvest index (44.46%) of wheat crop. The lowest harvest index was found in T_8-Clodinafop propargyl due to less grain yield.

Conclusion

On the basis of the results obtained in this study, it is concluded that ready-mix application of Clodinafop propargyl 15% + Metsulfuron methyl 1% control weeds effectively and minimize the crop-weed competition and therefore, it should be used for obtaining higher grain yield and straw yield.

Conflict of Interest- None

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