



ISSN (E): 2277-7695  
 ISSN (P): 2349-8242  
 NAAS Rating: 5.23  
 TPI 2023; 12(5): 4368-4370  
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Received: 08-02-2023

Accepted: 12-03-2023

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## Effect of different post emergence herbicides on weeds and yield of black wheat

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### Abstract

A field experiment was conducted at Research Farm of College of Agriculture, Gwalior during *rabi*, 2020-21 and 2021-22 to find out the suitable post emergence herbicides or their combinations on productivity and profitability of Black wheat. The experiment was laid out in randomized block design with sixteen treatments *viz*: T<sub>1</sub>: Sulfosulfuron @ 30 g/ha, T<sub>2</sub>: metsulfuron @ 4g/ha, T<sub>3</sub>: Sulfosulfuron + Metsulfuron @ 32 g/ha, T<sub>4</sub>: Clodinafop @ 60 g/ha, T<sub>5</sub>: Clodinafop @ 60 g/ha fb Metsulfuron @ 4g/ha, T<sub>6</sub>: 2,4-D @ 500 g/ha, T<sub>7</sub>: Clodinafop @ 60 g/ha fb 2,4-D @ 500 g/ha, T<sub>8</sub>: Metribuzin @ 210 g/ha, T<sub>9</sub>: Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha, T<sub>10</sub>: Pinoxaden @ 45 g/ha, T<sub>11</sub>: Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha, T<sub>12</sub>: Pyroxasulfone @ 127.5 g/ha, T<sub>13</sub>: Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4g/ha, T<sub>14</sub>: Pinoxaden @ 45 g/ha fb 2,4-D @ 500 g/ha, T<sub>15</sub>: Weed free (two hand weeding 20, 40 DAS), T<sub>16</sub>: Weed check. Hand weeding twice at 20 and 40 DAS recorded the lowest total weed density and total weed dry weight (0.0 no/m<sup>2</sup> and 0.0 g/m<sup>2</sup>) with higher weed control efficiency (%) followed by Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha (23.8 no./m<sup>2</sup> and 9.9 g/m<sup>2</sup> respectively) and these treatments significantly reduced the density and dry weight of total weeds over rest of the herbicidal treatments and weedy check. Other post emergence; herbicides significantly reduced the weed dry weight over alone application of herbicides. Among the weed control treatments pooled values of hand weeding twice at 20 and 40 DAS recorded higher grain and yield (50.1 and 73.8 q/ha). However, lower grain and straw yield was recorded in weedy check (21.5 and 37.4q/ha) followed by pinoxaden @ 45 g/ha. Alone application of herbicides i.e. Clodinafop @ 60 g/ha, Pyroxasulfone @ 127.5 g/ha, metribuzin @ 210 g/ha and 2, 4-D @ 500 g/ha increase grain yield (q/ha). However, Pooled value of Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha recorded significantly higher grain yield (49.3 q/ha) followed by Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha, Sulfosulfuron + Metsulfuron @ 32 g/ha.

**Keywords:** Sulfosulfuron, metsulfuron, clodinafop, 2, 4-d, metribuzin, pinoxaden, pyroxasulfone, weed control efficiency, weed flora

### Introduction

Wheat (*Triticum aestivum* L.) belongs to family "Poaceae" and genus "Triticum". It is an essential grain food component and is a very important commodity among cereal crops. It is one of the main staple crop foods in India. It is widely cultivated, produced and used throughout the world. India is the second largest producer of wheat in the world. It is grown during the *rabi* season in temperate regions and also at high altitude in tropical climates zones in winter. Wheat grains contain starch (60-68%), protein (10-12%), fat (1.5%), cellulose (2.0-2.5%), minerals (1.8%) and vitamins but black wheat is gaining importance due to its health benefit and support to human immunity in presence conditions black wheat contains antioxidants, vitamin B, folic acid, selenium, manganese, zinc, calcium, Iron, copper potassium, fibre and amino acids, which make this wheat rich in nutrients. The species of wheat are introduced year ago but after research of many years. The black wheat was produced in the National Agro-food biotechnology institute University, Mohali Punjab, in 2017. The weed is one of the major constraints in black wheat production. The presence of mixed weed flora was controlled through integrated use of chemical control measures. This indicated the need for integration of herbicides with different mode of action in the rotation or sequential application for control of complex weed flora in wheat. Tank-mix or pre-mix use of different herbicide chemistries or sequential application of pre-and post-emergence herbicides at different times showed effective weed control (Choudhary *et al.* 2016) [2]. Besides managing mixed weed flora, the integrated use of herbicides may help in managing herbicide resistance problems.

Therefore present study, “Effect of post emergence herbicides in weeds, yield and economics of black wheat under grid zone of Madhya Pradesh “with the objective of to assess the effect of various post emergence herbicide on weed flora in black wheat crop.

### Materials and Methods

Field studies were conducted during Rabi season of 2020-21 and 2021-22 at the research farm of College of Agriculture, Gwalior. The soil of the experimental unit was sandy loam in texture, neutral in reaction (pH 7.10) having medium in organic carbon (0.54%) and available N (393.0 kg/ha) and medium in phosphorus (17.44 kg/ha) whereas it was high in available K (296 kg/ha). The total rainfall received during growing season was 62 and 45 mm. The experiment consisted of sixteen treatments in randomized block design with three replications. Black wheat was sown in row 22.5 cm apart, using 100 kg/ha seeds. Crop was fertilized 120 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 40 kg K<sub>2</sub>O as basal dose through urea, single super phosphate (SSP) and muriate of potash, respectively.

Sulfosulfuron, Metsulfuron, Clodinafop, 2, 4-D, Metribuzin, Pinoxaden, Pyroxasulfone were applied alone and sequential application as a post emergence with hand knapsack sprayer fitted with flat fan nozzle at spray volume of 500 l/ha. Weed density and weed dry weight were recorded at 40 DAS with the help of 1 x 1 m quadrat by throwing randomly at three places in each plot. Weeds were removed and species wise weed dry weight was recorded after drying in hot air oven (60±1 °C for 24 hours). Weed control efficiency was also calculated at harvest.

### Results and Discussion

#### Effect on weeds

Wheat crop grown in *rabi* season was infested by wide range of monocot, dicot weeds and sedges at 40 DAS. Among the dicot weeds *Rumex dentatus*, *Melilotus indicus*, *Chenopodium album*, *Convolvulus arvensis*, *Phalaris minor*, *Avena ludoviciana* and *Cyperus rotundus* were predominant as they attained higher values of relative density of weeds at 40 DAS. Similar, trend was recorded Sahu *et al.* (2019)<sup>[8]</sup>.

**Table 1:** Effect of weed management practices on weed density, weed dry weight and weed control efficiency at 40 DAS (Pooled value)

Treatments	Weed density no./m <sup>2</sup>	Weed dry weight g/m <sup>2</sup>	WCE (%)
Sulfosulfuron @ 30 g/ha	7.1(49.3)	4.4(19)	71.80
Metsulfuron @ 4 g/ha	5.9(35.2)	3.7(13.8)	79.89
Sulfosulfuron + Metsulfuron @ 32 g/ha	5.2(26.9)	3.4(11.1)	84.59
Clodinafop @ 60 g/ha	7.1(49.8)	4.4(19.2)	71.50
Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha	4.9(23.8)	3.2(9.9)	86.37
2,4-D @ 500 g/ha	10.81(116.3)	7.8(60.8)	66.21
Clodinafop @ 60 g/ha fb 2, 4-D @ 500 g/ha	6.1(37.3)	3.9(14.8)	78.65
Metribuzin @ 210 g/ha	7(49.9)	4.4(19.1)	71.45
Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha	5.6(31.1)	3.6(12.4)	82.22
Pinoxaden @ 45 g/ha	12.3(152)	7.4(55.1)	13.10
Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha	6(35.2)	3.8(13.9)	79.87
Pyroxasulfone @ 127.5 g/ha	7.4(54.6)	4.6(20.9)	68.79
Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha	6(35.3)	3.9(14.4)	79.84
Pinoxaden @ 45 g/ha fb 2, 4-D @ 500 g/ha	5.9(35)	3.8(13.9)	79.99
Weed free (two hand weeding 20, 40 DAS)	0.7(0)	0.7(0)	100.00
Weed check	13.2(174.8)	7.9(62.8)	0.00
SEm±	0.52	0.30	
CD 5% (P=0.05)	1.55	0.87	

**Table 2:** Effect of weed management practices on test weight, grain yield and straw yield (Pooled value)

Treatments	Test Weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
Sulfosulfuron @ 30 g/ha	40.68	42.8	65.9
Metsulfuron @ 4 g/ha	40.64	44.5	68.6
Sulfosulfuron + Metsulfuron @ 32 g/ha	40.59	49.0	72.1
Clodinafop @ 60 g/ha	40.55	44.2	67.6
Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha	40.50	49.3	72.9
2,4-D @ 500 g/ha	40.46	39.1	60.7
Clodinafop @ 60 g/ha fb 2,4-D @ 500 g/ha	40.41	45.1	67.8
Metribuzin @ 210 g/ha	40.39	42.3	66.0
Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha	40.37	44.8	67.3
Pinoxaden @ 45 g/ha	40.39	34.6	54.8
Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha	40.41	46.3	69.8
Pyroxasulfone @ 127.5 g/ha	40.43	41.6	64.2
Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha	40.45	46.5	70.0
Pinoxaden @ 45 g/ha fb 2,4-D @ 500 g/ha	40.48	45.8	69.2
Weed free (two hand weeding 20, 40 DAS)	40.50	50.1	73.8
Weed check	40.52	21.5	37.4
SEm±	0.041	1.16	1.21
CD 5% (P=0.05)	0.1195	3.36	3.51

Density of total weeds in wheat was significantly influenced by different treatments at 40. Among the weed control treatments pooled values of hand weeding twice at 20 and 40 DS recorded significantly lower density and dry weight of total weeds (0.0 no./m<sup>2</sup> and 0.0 g/m<sup>2</sup>) at 40. However, maximum density of total weeds was recorded in weedy check (178.8 no./m<sup>2</sup> and 62.8 g/m<sup>2</sup>) due to uninterrupted growth of weeds. Alone application of herbicides *i.e.* Clodinafop @ 60 g/ha, Pyroxasulfone @ 127.5 g/ha, Metribuzin @ 210 g/ha minimize density of total weeds at different stages. However, Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha recorded significantly lower density and dry weight of total weeds (23.8 no./m<sup>2</sup> and 9.9 no./m<sup>2</sup>). 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 (Sahu *et al.* 2020 and Jha *et al.* 2023) [6, 3]. It was at par with Sulfosulfuron + Metsulfuron @ 32 g/ha, Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha, Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha, Clodinafop @ 60 g/ha fb 2,4-D @ 500 g/ha, Pinoxaden @ 45 g/ha fb 2,4-D @ 500 g/ha and Metsulfuron @ 4 g/ha.

The weed control efficiency of various treatments against weedy check was worked out on the basis of weed dry weight at harvest on the basis of Table 1. At 40, Weed control Efficiency (%) of total weeds was affected by various herbicidal treatments. Among the herbicides Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha recorded significantly higher Weed control efficiency (%) of total weeds (86.38%) at 40 DAS. It was similar Sulfosulfuron + Metsulfuron @ 32 g/ha, Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha, Clodinafop @ 60 g/ha fb 2,4-D @ 500 g/ha and Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha. Single application of herbicides also increases weed control efficiency at different stages except Pinoxaden @ 45 g ha. Among the weed control treatments hand weeding twice at 20 and 40 DS recorded significantly higher weed control efficiency (100%) at 40 DAS Due to illumination of all types of weeds during critical crop weed competition (Sahu *et al.*, 2020 and Jha *et al.*, 2023) [6, 3].

### Effect on crop

Test weight of wheat was significantly affected by various herbicidal treatments. Among the herbicides Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha recorded significantly higher pooled values of test weight in wheat (40.50 g) due less crop weed competition during critical period resultant more accumulation of photosynthetic material in grain (Kaur *et al.* 2017) [4]. It was at par with Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha, Sulfosulfuron + Metsulfuron @ 32 g/ha, Clodinafop @ 60 g/ha fb 2,4-D @ 500 g/ha and Metribuzin @ 210 g/ha fb Clodinafop @ 60 g/ha. However, lower test weight was recorded in weedy check plots. Alone application of herbicides increase test weight of wheat. Among the weed control treatments, pooled value of hand weeding twice at 20 and 40 DAS recorded higher maximum test weight of wheat (40.50 cm) because illumination of all types of weed during critical period resultant more sink was accumulated by plants in the form of grain (Table 2).

Grain and straw yield of wheat was significantly affected by different treatments. Among the weed control treatments pooled values of hand weeding twice at 20 and 40 DAS

recorded higher grain yield (50.1 and 73.8 q/ha). However, lower grain and straw yield was recorded in weedy check (21.5 and 37.4 q/hag) followed by Pinoxaden @ 45 g/ha. Alone application of herbicides *i.e.* Clodinafop @ 60 g/ha, Pyroxasulfone @ 127.5g/ha, Metribuzin 210 g/ha and 2,4-D @ 500 g/ha increase grain yield (q/ha) (Cheema and akhtar 2005 and Sahu *et al.* 2022) [1, 7]. However, Pooled value of Clodinafop @ 60 g/ha fb Metsulfuron @ 4 g/ha recorded significantly higher grain and straw yield (49.3 and 72.1 q/ha) at par with Sulfosulfuron + Metsulfuron @ 32 g/ha. followed by Pinoxaden @ 45 g/ha fb Metsulfuron @ 4 g/ha Pyroxasulfone @ 127.5 g/ha fb Metsulfuron @ 4 g/ha.

### Conclusion

Clodinafop @ 60 g a.i./ha followed by Metsulfuron @ 4 g a.i./ha and Sulfosulfuron + Metsulfuron @ 32 g/ha are the better treatment in terms of weed control and yield enhancement of black wheat.

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