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Different Combination Herbicides Weed Management Practices On Wheat [*Triticum aestivum* (L.)]

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ABSTRACT

An investigation on "Different Combination Herbicides Weed Management Practices on Wheat [Triticum aestivum (L.)]" under adoptic and climatic condition of northern part of Madhya Pradesh was carried out during Rabi season 2015-16 at the Research Farm, Directorate of Weed Science Research (DWSR), Centre for College of Agriculture(RVSKVV), Gwalior (M.P.). The experiment was laid out in randomized block design (R.B.D.) replicated three timed with 12 treatments, namely T1 (Pendimethalin 0.75 kg/ha), T_2 (Sulfosulfuron 0.025 kg/ha), T_3 (Metribuzin 0.21 kg/ha), T_4 (Clodinafop 0.06 kg/ha), T_5 (Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha), T_6 (Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha), T_7 (Sulfosulfuron 0.03 kg/ha + Metsulfuron 0.002 kg/ha), T_8 (Pinoxaden 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_9 (Mesosulfuron 0.012 kg/ha + Iodosulfuron + 0.0024 kg/ha), T_{10} (Clodinafop 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_{11} (Two hand weeding at 30 and 60 DAS), T_{12} (Weedy check) wheat variety MP4010 was grown up adopting recommended package of practices except weed control measures which were applied as per treatments. The lowest weed population was obtained from two HW at 30 and 60 DAS (T11) which was superior over other treatments. Application of Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha, Pendimethalin 0.75 kg/ha) and Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha gave better control of Cyperus rotundus, Chenopodium album, Phalaris minor, Convolvulus arvensis, Anagallis arvensis, spergula arvensis and Melilotus indica. Lower weed dry weight was noted under the application of treatment T11 (two HW at 30 and 60 DAS) followed by Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha and Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha similar trend were obtained in respect of weed control efficiency. Weed index under the pre emergence application of Pendimethalin 1.0 kg/ha + post emergence application of Sulfosulfuron 0.018 kg/ha was noted minimum, giving the best performance followed by Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha. Among all treatment, Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha gave the maximum net return (₹64921/ha) and B:C ratio (3.02) also.
***Key words**: Yield attributing characters, Cultural practice, Herbicides, Weed Intensity, Weed Control Efficiency, Weed Index.*

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INTRODUCTION

Wheat [*Triticum aestivum*(L.)] is one of the most important cereal crops in India as well as of world. During the green revolution phase of Indian agriculture, there was tremendous increase in area, production and productivity of this crop. It occupies second position both in terms of area and production in our country. It is cultivated in area of 31.19 million hectares with annual production of 95.91 million tonnes and productivity of 3075 kg/ha in 2014-15, whereas, in Madhya Pradesh, it is cultivated in 5.79 million ha land with an annual production of 13.93 million tonnes with productivity of 2405 kg/ha (Anonymous , 2015). In the northern part of Madhya Pradesh, under irrigated condition, wheat is generally preferred to grow in multiple cropping system during *Rabi* season due to delay in harvesting of *Kharif* crops. Among various factors responsible for low yield, weeds infestation and their management is one of the important factors. Weed competes with crop plants for water, nutrients, space and solar radiation resulting in reduction of yield by 20 to 50% (Bhan, 1998). In order to sustain global agriculture food production, the importance of protecting arable crops against negative yield effect from weeds is well recognized. Cultural, mechanical and chemical methods are commonly used for controlling weeds.

Unavailability of manual labour in peak season and unfavourable weather do not permit timely control of weeds. Therefore, weed control by mechanical means alone is not feasible. Hand or manual weeding though very effective and commonly adopted in India is expensive, tedious, time consuming and many a times become uneconomic. Further, manual weeding is not feasible in all situations and had many problems with varying crops and soil types. Chemical weed control is an important alternative. Herbicide have shown to be beneficial and very effective means of controlling weeds in wheat because they are quite effective and efficient (Azad *et al.,* 1997). In economic terms, the value of grassy herbicide portion of the total herbicide market is estimated to be around 70%. This clearly reflects the importance of successfully managing grassy weed infestation in cereal crops. Clodinafop and sulfosulfuron were recommended as alternative herbicides against isoproturon resistant *Phalaris minor*. But resistance against these herbicides was also reported (Dhawan *et al.,* 2009), necessitating the search for new herbicide molecules. Pinoxaden is a new selective post-emergence herbicide belonging to phenyl-pyrazolin group with acetyl-COA-carboxylase (ACCase) has inhibiting action (Hoffer *et al.,* 2006) and being developed for the control of annual grassy weeds in cereal crops including wheat and barley. In view of the above facts, the present investigation was conducted to weed management requirement of wheat through hand weeding and chemical weed control under the current scenario.

MATERIALS AND METHODS

The investigation compiled here was carried out at the Directorate of weed science Research (DWSR), Centre for College of Agriculture (RVSKVV) Gwalior (M.P.) during the *rabi* season of 2015-2016. Gwalior is located at 26°13' north latitude and 78°14' east longitude and 206 meters above sea mean level. It lies in the north tract of M.P. enjoying subtropical climate. The soil was silt (17.20), clay (22.30), sand (59.50) with pH 7.59 and EC 0.73 dS/m, being low in organic carbon (0.44%) and available nitrogen (155.59 kg/ha), medium in available phosphorus (17.51 kg/ha) and high in available potassium (245.13 kg/ha) and 1.31 g/m^3, 2.54 g/m^3 and 46.59 % in case of bulk density, particle density and water holding capacity, respectively. The experiment was laid out in randomized block design with 3 replications. There were 12 treatments, *viz.* namely T1 (Pendimethalin 0.75 kg/ha), T_2 (Sulfosulfuron 0.025 kg/ha), T_3 (Metribuzin 0.21 kg/ha), T_4 (Clodinafop 0.06 kg/ha), T_5 (Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha), T_6 (Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha), T_7 (Sulfosulfuron 0.03 kg/ha + Metsulfuron 0.002 kg/ha), T_8 (Pinoxaden 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_9 (Mesosulfuron 0.012 kg/ha + Iodosulfuron + 0.0024 kg/ha), T_{10} (Clodinafop 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_{11} (Two hand weeding at 30 and 60 DAS), T_{12} (Weedy check) wheat variety MP4010 was grown up adopting recommended package of practices except weed control measures which were applied as per treatments. The nutrients were applied @ 120 kg N, 60 kg P_2O_5 and 40 kg K_2O. The nitrogen was applied through urea containing 46 per cent N. The half dose of nitrogen with full dose of P_2O_5 and K_2O were drilled 8 cm deep in the field (at the time of sowing), as a basal dose. The half dose of nitrogen applied after first irrigation. The counting of species wise weeds was done randomly by quadrate of one square meter from each plot. Three quadrates were thrown in each plot and then averages were worked out. The observations were recorded at 25, 50 days after sowing (DAS) and harvest. The sampled plants were carefully dunged up, the roots thoroughly washed under running water, put in labeled envelop bags and taken to the laboratory where the growth and yield parameters were recorded. The plant samples were partitioned into various plant fractions and after sun drying sample were subjected to oven-drying at 62°C until a constant weight was attained. Completely dried samples were weighed and the Dry Matter (DM) content of different plant parts was measured and expressed in g/plant. Growth parameter and yield attributes were recorded at 30, 60, 90 DAS and harvest. Economics was worked out taking both variable and fixed costs into account. Data were analyzed as per standard procedure with 5% probability level.

RESULTS AND DISCUSSION

Effect on weed:

The perusal of revealed that population of total weeds/m^2 significantly affected by different weed control treatments at 25, 50 DAS and harvest. All the weed control treatments reduced the density of total weed significantly over weedy check. Two HW at 30 and 60 DAS was found to be a superior method of weed management to any of the herbicidal treatment. Among the herbicidal treatments, T_6 (Pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha) recorded lowest population of total weed followed by T_3 and T_5 and all these treatments were at par at 50 and harvest. Lowest weed population of weeds was recorded in T_{11} (two HW at 30 and 60 DAS) treatment. Among the herbicides, pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha, clodinafop 0.06 kg/ha, clodinafop 0.06 kg/ha + metsulfuron 0.004 kg/ha, pinoxaden 0.06 kg/ha + metsulfuron 0.04 kg/ha and sulfosulfuron 0.03 kg/ha + metsulfuron 0.002 kg/ha (Table 1) were found effective control of broad leaf as well as narrow leaf weeds reported by Singh and Kundra (2003), Punia *et al.* (2006).

A reference to population of broad leaf weed showed significant differences due to weed control treatments at 25 DAS, where lowest population was recorded with pendimethalin 1.0 kg/ha followed by pendimethalin 0.75 kg/ha at 50 DAS and both dose of pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha at harvest over rest of the treatment (Table 1). The highest population of broad leaf was recorded under weedy check which was comparable with T_8 and T_4 where as metribuzin 0.21 kg/ha, and pendimethalin 1.0 kg/ha + metribuzin 0.175 kg/ha found effectively controlling broad leaf weeds reported by Nariyal *et al.* (2007).

A reference to population of narrow leaf weeds reveals that all weed control treatments except both dose of pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 significantly reduced the population of narrow leaf weeds over weedy check at 50 DAS and harvest. The lowest count of narrow leaf weeds throughout the crop growth cycle was under two HW at 30 and 60 DAS fallowed by T_6, T_3 and T_9 and all these treatment were at par with each other at 50 DAS (Table 1). The population of narrow weed species, viz. *Cyperus rotundus* and *Phalaris minor* and broad leaf weeds, *viz.*, *Chenopodium album, Anagallis arvensis, Convolvulus arvensis* and *Fumeria parviflora* were reduced drastically with use of herbicides at all the stages of the crop. The superiority of clodinafop, sulfosulfuron and new herbicide like pinoxaden in respect of controlling the weed especially narrow leaf was reported by Brar *et al.* (2002), Chahal *et al.* (2003).

Revealed that population of other weeds (*Parthenium histeroforus, fumeria parviflora, Lunea pinnetifolia, Vicia sativa*) differed significantly among various weed control treatments at all stage of crop growth. At 25 DAS, minimum population of other weeds (1.33/m^2) was registered in pendimethalin 1.0 kg/ha + metribuzin 0.018 kg/ha (T_5) which was significantly lower than T_3, T_6, T_2, T_{11}, T_1, and T_8 at par with rest of other treatments. The maximum population of other weeds (10.67/M^2) was recorded in T_{10} (Table 1). At 50 DAS and harvest all weed control treatments significantly reduced the population of other weeds over weedy check. In case of application of clodinafop 0.06 kg/ha and pinoxaden 0.06 kg/ha + metsulfuron 0.04 kg/ha was found effective in suppressing narrow leaf weed rather than broad leaf weeds reported by Chokkar *et al.* (2008), Yadav *et al.* (2009) and in respect of broad leaf weeds 2,4-D and metribuzin also reported by Sardana *et al.* (2001).

The weed dry weight/m^2 at all the stages of observations was significantly influenced by various weed control measures. At 25 DAS, the significantly minimum weed dry weight (11 g/m^2) was recorded under the influence of treatment T_1 (pendimethalin 0.75 kg/ha), Closely followed by T_5, T_{11}, T_6, T_3 and T_7 and all these treatments were at par with each other (Table 2). The maximum weed dry weight (38.67 g/m^2) was found under T_{10} (clodinafop 0.06 kg/ha + metsulfuron 0.004 kg/ha). At 50 DAS, all the weed control treatments resulted in significant reduction in weed dry weight over weedy check. Among the weed control treatments, T_{11} being at par with T_9, T_4, T_8 and T_1 which resulted in significantly lowest weed dry weight. The weed dry weight/m^2 was significantly influenced by all weed control treatments at all stages of observation. At 25 DAS, the lowest weed dry matter was registered under pendimethalin 0.75 kg/ha, which gave highest weed control efficiency two HW at 30 and 60 DAS (94.70%). Pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha, pendimethalin 1.0 kg/ha + metribuzin 0.175 kg/ha, metribuzin 0.21 kg/ha and clodinafop 0.06 kg/ha + metsulfuron 0.004 kg/ha were next in order of superiority after two HW at 30 and 60 DAS. Weed biomass per hectare recorded at harvest was also significantly reduced by all the weed control treatments over weedy check. This was mainly due to lowest population count of narrow and broad leaf weeds under these treatments. Similar results were also obtained by Zand *et al.* (2007) in case of metsulfuron methyl + Sulfosulfuron and Bahart and Kachroo (2007) in case of pinoxaprop + metribuzin.

All the weed control treatments significantly lowered the weed. Among different treatments, two HW at 30 and 60 DAS significantly recorded lower weed biomass per hectare, which was at par with pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha, pendimethalin 1.0 kg/ha + metribuzin 0.175 kg/ha, metribuzin 0.21 kg/ha and clodinafop 0.06 + metsulfuron 0.004 kg/ha. The maximum weed biomass was recorded under weedy check (Table 2), reported by Yadav *et al.* (2009).

The data on weed control efficiency is revealed that at 60 DAS. The maximum weed control efficiency (94.70%) was recorded in T_{11} (two HW at 30 and 60 DAS). The next effective weed control treatments was T_6 followed by T_5, T_2, T_1 and T_3 recording 86.35, 83.50, 83.09, 79.22 and 79.01per cent weed control efficiency, respectively (Table 2), reported by Yadav *et al.* (2009).

Weed index may be termed as the competition index. It indicates the reduction in yield due to weed competition and is presented in percentage (Table 2). Pre emergence application of pendimethalin 1.0 kg/ha + post emergence application of sulfosulfuron 0.018 kg/ha recorded lowest weed index (1.25%), followed by T_1 (9.34%), T_7 (10.52%), T_4 (15.61%) and T_2 (20.57%). Weedy check resulted in maximum weed index (41.75%) followed by T_3 (28.03%) and T_8 (25.45 %). Two HW at 30 and 60 DAS treatment recorded lowest weed index, followed by Pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha, pendimethalin 0.75 kg/ha, sulfosulfuron 0.03 kg/ha + metsulfuron 0.002 kg/ha, clodinafop 0.06 kg/ha and sulfosulfuron 0.025 kg/ha. The highest weed index was observed in weedy check, reported by Bahart and Kachroo (2007).

Intensity (%) of weeds varied due to different weed control practices of different stages of crop growth. Major 2 species of weeds in the experimental plot were identified. Their occurrence and intensity varied in different treatments. Maximum weed infestation was observed in weedy check and the dominant weeds were *Phalaris minor* (37.99%) and *Chinopodium album* (34.07%). The contribution of other weeds like *Cyperus rotundus*, *Anagallis arvensis*, *Convolvulus arvensis* was less than 27.94% per cent to total weed infestation (Table 2). Among various limiting factors responsible for low yield at wheat, heavy weed infestation may be one of them. Annual Grasse weeds are more aggressive in their competitiveness effect than broad leaf weeds on wheat yield and its components (Shaban *et al.* 2009). The experimental field was found to be infested with narrow and broad leaf weeds included *Phalaris minor*, *Cyperus rotundus* and *Chinopodium album*, *Anagallis arvensis, Convolvulus arvensis* and *Anagallis arvensis*, respectively.

Economics of treatments:

All the weed control treatments resulted more benefit: Cost ratio over weedy check. The maximum benefit cost ratio of 3.02 was recorded with treatment T_6 (pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha), followed by T_1 (pendimethalin 0.75 kg/ha), T_3 (clodinafop 0.06 kg/ha), T_7 (sulfosulfuron 0.03 kg/ha + metsulfuron 0.002 kg/ha) and T_{11} (Two HW at 30 and 60 DAS) the best treatments recording 2.81, 2.79, 2.71 and 2.67 while minimum B: C ratio with weedy check (2.10).

The choice of any weed control method ultimately depends on economics and efficiency in controlling weeds. The cost of chemical weed control is actually less than that of manual weeding. This has been a major incentive to many farmers for switching over to herbicides. Performed the highest benefit cost ratio of 3.02, whereas, minimum benefit cost ratio was obtained in untreated check. Next in decreasing order of benefit cost ratio, treatment were a pendimethalin 0.75 kg/ha, clodinafop 0.06 kg/ha, sulfosulfuron 0.03 kg/ha + metsulfuron 0.002 kg/ha, and mesosulfuron 0.012 kg/ha + iodosulfuron 0.0024 kg/ha. Among all treatment, pendimethalin 1.0 kg/ha + sulfosulfuron 0.018 kg/ha was most effective weed control treatment in recorded higher yield and weed control efficiency, also recorded higher benefit cost ratio. Similar finding were also reported by Jat *et al.* (2003), Gopinath *et al.* (2007), Yadav *et al.* (2009) and Sharma and Singh (2011).

CONCLUSION

It may be concluded from the one year experiment pre-emergence application of pendimethalin @ 1.0 kg/ha with post-emergence application sulfosulfuron @ 0.018 kg/ha and pre-emergence application pendimethalin @ 0.75 kg/ha are most effective weed control measures for controlling grassy and broad leaf weeds in wheat under sandy clay loam soils of Northern Madhya Pradesh**.**

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Table 1: Effect of different weed control measures on population at successive crop growth stages.

Treatments	Total weeds/m²			Broad leaf weeds/m²			Narrow leaf weeds/m²			Other Weeds population/m²		
	25 DAS	50 DAS	Harvest	25 DAS	50 DAS	Harvest	25 DAS	50 DAS	Harvest	25 DAS	50 DAS	Harvest
T_1	2.18 (177.67)	2.20 (189.00)	2.15 (171.33)	0.92 (16.33)	0.66 (7.33)	0.92 (16.33)	2.14 (161.33)	2.17 (181.67)	2.12 (166.33)	1.81 (3.00)	1.56 (2.00)	1.56 (2.00)
T_2	2.59 (400.00)	2.63 (425.00)	2.58 (379.33)	2.40 (266.67)	2.40 (253.67)	2.37 (235.00)	2.12 (133.33)	2.20 (158.00)	2.16 (144.33)	1.64 (2.33)	2.02 (3.67)	1.86 (3.00)
T_3	2.29 (199.67)	2.27 (195.33)	2.13 (136.33)	1.32 (21.33)	1.63 (55.33)	1.66 (54.00)	2.24 (178.33)	2.07 (123.33)	1.89 (85.67)	1.46 (1.67)	2.20 (4.33)	2.03 (3.67)
T_4	2.85 (716.00)	2.74 (561.67)	2.71 (523.00)	2.65 (474.67)	2.54 (365.33)	2.46 (294.33)	2.34 (241.33)	2.27 (229.67)	2.29 (228.67)	2.36 (5.33)	1.88 (3.33)	1.94 (3.33)
T_5	2.16 (154.67)	2.21 (182.67)	2.21 (183.33)	0.20 (1.00)	0.35 (3.33)	0.32 (2.67)	2.15 (153.67)	2.21 (186.00)	2.20 (180.33)	1.34 (1.33)	1.93 (3.33)	1.60 (2.33)
T_6	1.99 (107.00)	1.42 (38.33)	1.42 (37.33)	0.00 (0.00)	0.33 (1.67)	0.30 (1.33)	1.99 (107.00)	1.72 (59.33)	1.56 (38.33)	1.46 (1.67)	2.00 (3.67)	1.90 (3.33)
T_7	2.85 (716.67)	2.67 (473.00)	2.67 (467.67)	2.49 (322.33)	2.35 (225.33)	2.35 (223.00)	2.60 (394.33)	2.37 (249.00)	2.36 (244.67)	2.11 (4.00)	2.03 (4.00)	1.93 (3.33)
T_8	2.88 (788.33)	2.73 (544.67)	2.72 (538.33)	2.65 (505.33)	2.56 (398.33)	2.55 (395.00)	2.44 (283.00)	2.10 (146.33)	2.09 (143.33)	1.93 (3.33)	2.28 (5.00)	1.77 (2.67)
T_9	2.77 (626.00)	2.67 (470.00)	2.64 (437.00)	2.71 (581.33)	2.53 (338.67)	2.52 (331.00)	2.03 (109.33)	2.05 (131.33)	1.94 (106.00)	2.11 (4.00)	1.77 (2.67)	2.02 (3.67)
T_{10}	2.88 (783.00)	2.31 (204.33)	2.31 (203.00)	2.74 (551.33)	1.70 (50.00)	1.67 (45.67)	2.28 (230.33)	2.19 (154.33)	2.20 (157.33)	3.34 (10.67)	2.00 (3.67)	2.47 (5.67)
T_{11}	2.94 (655.67)	1.73 (54.33)	1.73 (54.33)	2.16 (186.33)	1.30 (19.67)	1.09 (11.67)	2.37 (269.33)	1.37 (36.33)	1.38 (36.00)	1.64 (2.67)	1.05 (0.67)	1.05 (0.67)
T_{12}	3.07 (764.00)	2.91 (879.00)	2.90 (871.33)	2.75 (602.33)	2.56 (416.00)	2.55 (412.00)	2.69 (527.00)	2.64 (463.00)	2.64 (459.33)	2.29 (5.00)	3.39 (11.00)	3.29 (10.33)
S.E.(m)±	0.11	0.12	0.12	0.18	0.15	0.17	0.12	0.17	0.17	0.24	0.26	0.21
C.D. (at 5%)	0.27	0.36	0.34	0.52	0.45	0.49	0.36	0.50	0.49	0.71	0.77	0.63
Transformation	Log(X)	Log(X)	Log(X)	Log(x+1)	Log(x+1)	Log(x+1)	Log(X)	Log(X)	Log(X)	$\sqrt{x+0.5}$	$\sqrt{x+0.5}$	$\sqrt{x+0.5}$

Table 2: Effect of different weed control measures on weed control efficiency, weed biomass, Weed dry weight, weed index and B:C Ratio.

Treatments	**Weed dry weight (g/m²)**			**Weed biomass (kg/ha)**	**WCE at 50 DAS (%)**	**Weed index (%)**	**B:C Ratio**
	25 DAS	**50 DAS**	**Harvest**				
Pendimethalin @ 0.75 kg/ha	11.00	37.33	43.33	434	79.22	9.34	2.81
Sulfosulfuron @ 0.025 kg/ha	26.00	34.67	48.67	487	83.09	20.57	2.55
Metribuzin @ 0.21 kg/ha	17.67	34.33	41.33	414	79.01	28.03	2.49
Clodinafop @ 0.06 kg/ha	19.00	68.67	74.33	744	58.04	15.61	2.79

Pendimethalin+Metribuzin @ 1.0 + 0.175 kg/ha	12.00	27.00	35.33	354	83.50	22.86	2.40
Pendimethalin fb Sulfosulfuron @ 1.0 + 0.018 kg/ha	16.00	4.67	16.67	167	86.35	1.25	3.02
Sulfosulfuron+Metsulfuron (Premix) @ 0.03 + 0.002 kg/ha	18.33	40.33	53.33	534	71.48	10.52	2.71
Pinoxaden+Metsulfuron (Premix) @ 0.06 + 0.004 kg/ha	24.67	46.00	62.00	620	64.76	25.45	2.47
Mesosulfuron+Iodosulfuron (Premix) @ 0.012 + 0.0024 kg/ha	26.67	76.33	72.00	720	53.35	18.79	2.57
Clodinafop + Metsulfuron (Premix) @ 0.06 + 0.004 kg/ha	38.67	22.33	42.33	424	83.14	16.29	2.54
Two hand weeding at 30and 60 DAS	21.65	8.67	10.00	100	94.70	--	2.67
Weedy check	23.00	137.00	183.67	1837	--	41.75	2.10
S.E.(m)±	9.34	8.91	10.02	100.21			
C.D. (at 5%)	26.82	26.27	29.53	295.33			

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