The Pharma Innovation Journal 2023; 12(10): 390-393

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 390-393

www.thepharmajournal.com
Received: 22-07-2023
Accepted: 29-08-2023

Effect of weed management practices on weed control efficiency, yield attributes, productivity and profitability of wheat

Dheeraj BK, Vishnu Moond, Jigyasa Ninama, Karanveer Saharan and Lovepreet Singh

Dheeraj BK
M.Sc. Research Scholar, Department of Agronomy, Sri Dev Suman University, Dehradun, Uttarakhand, India

Vishnu Moond
Assistant Professor, Department of Agronomy, RNT College of Agriculture, Kapasan (MPUA&T, Udaipur), Rajasthan, India

Jigyasa Ninama
Ph.D. Research Scholar, Department of Agronomy, SKRAU, Bikaner, Rajasthan, India

Karanveer Saharan
Assistant Professor, Department of Agronomy, Faculty of Agriculture, Tantia University Sriganganagar, Rajasthan, India

Lovepreet Singh
Assistant Professor, Department of Agronomy, Faculty of Agriculture, Tantia University, Sriganganagar, Rajasthan, India

Corresponding Author:
Vishnu Moond
Assistant Professor, Department of Agronomy, RNT College of Agriculture, Kapasan (MPUA&T, Udaipur), Rajasthan, India

Abstract
A field study was conducted during *rabi* 2021-22at Agronomy farm, Sai Institute of Paramedical and Allied Science, Dehradun. The research used a randomised block design with three replications and twelve weed management practises. PBW-154 variety was used as test crop of wheat. Among herbicides, post-emergences application of Clodinafop + Metsulfuron (60+4) @ 64 g *a.i.* ha^{-1} was found lowest weed index and highest weed control efficiency, yield attributes, productivity as well as profitability (net return as well as benefit cost ratio) followed by post-emergences application of Sulfosulfuron + Metsulfuron @ 30+2 g ha^{-1}.

Keywords: Wheat, yield, weed dry matter, growth parameters

Introduction
In India, wheat (*Triticum aestivum* L.), which makes up 31.5% of the nation's total food grain basket, is the second-most significant cereal crop after rice. *Phalaris minor* and *Avena* spp., which are grassy weeds, as well as *Chenopodium album, Convonvulus arvensis, Anagallis arvensis* and *Melilotus alba*, which are broad leaf weeds, commonly infest wheat. Therefore, weed control is crucial for raising wheat yield. According to Chaudhary *et al*. (2008) [1], one kg of wheat grains is lost for every kg of weeds produced.

Weed infestation affects wheat output by 37–50% (Waheed *et al*., 2009) [10], making it one of the major causes of low wheat yield worldwide as well as in India. One of the main obstacles to the cultivation of wheat is weeds. *Phalaris minor*, *Chenopodium album*, *Anagallis arvensis*, *Avena fatua*, *Convolvulus arvensis*, *Lathyrus aphaca*, *Cyperus rotundus* and *Cynodon dactylon* are some of the common weeds found in wheat fields, and they alone reduce wheat output by 33%. One of the most significant farming systems in the country's northern region is rice-wheat (Chhokar and Sharma 2008) [2]. Weeds are a major issue for wheat crops because they compete fiercely for nutrients, water, sunlight, and spacing in the early stages. However, hand weeding and herbicides can assist manage weeds. Due to labour shortages, high labour costs, and the impossibility of mechanical or manual weeding at that time, more labour is required when hand weeding. As a result, we have one option: apply herbicides. Herbicides have the advantage of controlling both interrow and intrarow weeds. During its growing cycle, this crop competes with a variety of grassy and broad-leaf weeds depending on the agronomic practises employed, soil types, the quality of the subterranean water supply, the weed control methods used, and the cropping scheme followed. By implementing effective weed management practises, it is possible to minimise weed-related losses to a higher extent depending on the kind, abundance, and environmental factors. In order to increase the production of the wheat crop, an effort was undertaken to determine the effect of weed management practices on weeds and productivity as well as profitability of wheat (*Triticum aestivum* L.).

Materials and Methods
A field study was carried out at Agronomy farm, Sai Institute of Paramedical and Allied Science, Dehradun during *rabi* 2021-22. Twelve practices of weed management were used for research with three replications in randomized block design. With an elevation of 650 metres above mean sea level, this area has a subtropical climate and is located at 30°2 North latitude and 77°93’ East longitude. During the experiment, 61.5 mm of rain fall on this area. The maximum and minimum temperatures, respectively, are averaged at 37.8 °C and 3.5 °C.

The soil at the test site was a silty loam with good drainage capabilities and a pH reaction of 8.5, low organic carbon (0.32%), low nitrogen availability (180.00 kg ha^{-1}), medium phosphorus availability (14.70 kg ha^{-1}) and high potassium availability (280.5 kg ha^{-1}). Twelve treatments *i.e.* Sulfosulfuron @ 25 g *a.i.* ha^{-1}, Metsulfuron @ 4 g *a.i.* ha^{-1}, Clodinafop @ 60 g *a.i.* ha^{-1}, Metribuzin @ 210 g *a.i.* ha^{-1}, Sulfosulfuron + Metsulfuron (30+2) @ 32 g *a.i.* ha^{-1}, Sulfosulfuron + Metribuzin (25+210) @ 235 g *a.i.* ha^{-1}, Clodinafop + Metsulfuron (60+4) @ 64 g *a.i.* ha^{-1}, Fenoxaprop –p – ethyl @ 120 g *a.i.* ha^{-1}, Fenoxaprop-p-ethyl + Metsulfuron (120+4) @ 124 g *a.i.* ha^{-1}, two hand weeding (20 and 40 DAS), weedy check and weed free were used in the trial. To make sure the outcomes were reliable, three replications were used. All treatments were applied according to plan, *i.e.*, hand weeding was done 20 and 40 days after sowing, and all herbicides were treated as post-emergence at 30 DAS using a knap-sack sprayer and a flat-fan nozzle with a 250 L ha^{-1} water spray volume.

With the aid of a cultivator, planking and two rounds of harrowing, the field's seed bed was thoroughly ground. The plots were then demarcated using the layout plan and thoroughly levelled with a spade. In the form of urea, di-ammonium phosphate, and muriate of potash, respectively, 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} of fertiliser were applied uniformly to the experimental crop. As a base dressing, a third dose of nitrogen and the full doses of phosphate and potassium were applied. After the initial irrigation and panicle start stage, the remaining two thirds of the nitrogen through urea dose were top dressed in two equal splits. On November 28, 2018, crop wheat of the variety PBW-154 was seeded using a seed drill at a distance of 20 cm and a seed rate of 100 kg ha^{-1}. For optimal germination and well establishment, one irrigation pre-sown was used. Five irrigations were used in a stressed situation (no water stress) after seeding. Crop was harvested on April 18, 2019, after it reached full maturity, or a light brown colour.

By evaluating the dry weight of weeds in the treated plot to the dry weight of weeds under unweeded control at the 60 and 90 DAS stages, the effectiveness of weed control was calculated. By establishing an angle of ear heads were counted at harvest from selected 1.0 x 1.0 m space in each plot and expressed as number of spikes m^{-2}. At harvest, ten randomly selected wheat spikes were measured length from the lower spikelet's base to the spikelet's tip, average and expressed in cm. The number of spikelets from the 10 spikes for each plot was selected, average and expreseed as spikelets $spike^{-1}$. The grains were threshed, cleaned and counted from the 10 wheat spikes that were selected, average and expressed grains $spike^{-1}$. A random sample of grains was taken from the grain yield of each plot after threshing and weighing. 1000 grains were randomly selected from this sample, weighing and expressed as g. Produce from each net plot was threshed apart and clean grains were sun dried to preserve 12% moisture after weighing the total biomass. The grain yield was calculated using kg $plot^{-1}$ and converted to q ha^{-1}. Prior to threshing, the weight of the total product net $plot^{-1}$ was recorded. The weight of the total produce from the net plot was used to compute the straw yield, which was stated in q ha^{-1}. Product was sun dried for a week after the crop was harvested, after which the weight of all the product collected from the net plot area of each plot was recorded and converted to q ha^{-1}. Using the support price of outputs, the monetary worth of the grain and straw yield was calculated in rupees. The total return was calculated by summing the grain and straw monetary values. By subtracting the cost of cultivation from the corresponding grass return, the net return for each treatment combination was determined.

Net Return (Rs ha^{-1}) = Gross return – Cost of cultivation

Using the fallowing formula, the net benefit-cost ratio was calculated for the crop and the system.

$$\text{Benefit} - \text{cost ratio} = \frac{\text{Gross return (Rs ha}^{-1})}{\text{Cost of cultivation (Rs ha}^{-1})}$$

According to Gomez and Gomez (1984), the data collected from various observations were statistically analysed using the analysis of variance (ANOVA) method. When the F-test indicated a significant result, a critical difference at 0.05 probability level was calculated to compare the treatments. Standard error of the mean (S.Em±) and crucial differences (CD) are to be computed in each significant case in the manner specified below.

Results and Discussion

Effect of weed management practices on weed control efficiency

The effectiveness of the management techniques used depends on the range of weeds present. The maximum weed control efficiency was achieved following post application emergence of Clodinafop + Metsulfuron @ 60+4 g ha^{-1} (90.90%), followed by post application emergence of Sulfosulfuron + Metsulfuron @ 30+2 g ha^{-1} (90.14%). This was mostly caused by the lowest weed dry weight under the influence of the aforementioned therapy. Meena and Singh (2011) [6], Tomar and Tomar (2014) [9] and Li *et al*. (2016) [4] all reported on a related finding.

Effect of weed management practices on weed index

Weed index is a measurement of yield decline brought on by weed infestation and is closely connected to weed dry matter and density. In comparison to weedy check (38.89%), the post-emergence treatment of Clodinafop + Metsulfuron at 60 +4 g ha^{-1} recorded the lowest weed index of 2.67%, followed by post-emergence application of Sulfosulfuron + Metsulfuron at 30 +2 g ha^{-1} of 4.58%. This may be mostly because herbicidal treatment, which results in higher yields while weed control results in lower yields, is less competitive with agricultural weeds.

Effect of weed management practices on yield attributes

All the yield attributes *i.e.*, effective tillers m^{-2}, length of spike, number of spikelets $spike^{-1}$ and grain $spike^{-1}$ considerably increased with weed control practises over weed check. The significantly highest values of all the yield-contributing characters were found in the weed-free condition. These values were comparable to those of the post-emergence applications of Clodinafop + Metsulfuron @ 60 + 4 g ha^{-1} and Sulfosulfuron + Metsulfuron @ 30 + 2 g ha^{-1}, while being significantly higher than those of the other weed management techniques. This may be because there was improved access to nutrients, moisture, space and light, which led to better plant growth and development, similar to the findings Singh *et al*. (2011) [6].

Effect of weed management practices on yield

The weed-free plot produced the highest grain, straw and biological yield, followed by two hand weeding sessions at 20 and 40 DAS, which were similarly noticeably superior to the other weed control strategies. This yield was similar to that obtained by two-hand weeding, Clodinafop + Metsulfuron @ 60 +4 g ha^{-1} and Sulfosulfuron + Metsulfuron @ 30 +2 g ha^{-1} post-emergence applications. It can be as a result of the suffocating effects of the various weed management strategies. This increased the yield by moving more food in an ethical manner from the point of origin to the washbasin. Nearly comparable results were found by Malik *et al*. (2013) [5] and Tomar & Tomar (2014) [9].

Effect of weed management practices on economics

The maximum cost of cultivation (Rs 48204 ha^{-1}) occurred under weed-free conditions, while the weedy check conditions had the lowest cost of cultivation (Rs 37704 ha^{-1}). Higher gross returns, net returns and benefit cost ratio than weedy checks were observed for all weed management practices. Clodinafop + Metsulfuron @ 60 + 4 g ha^{-1} (Rs 120708 ha^{-1}) fatched highest gross return (Rs 124312 ha^{-1}) and weedy check fatched the lowest (Rs 80343 ha^{-1}) gross revenue. Clodinafop + Metsulfuron @ 60 +4 g ha^{-1} was recorded highest net return (Rs 81054 ha^{-1}) followed by Sulfosulfuron + Metsulfuron @ 30+2 g ha^{-1} (Rs 79178 ha^{-1}). Maximum Clodinafop + Metsulfuron @ 60 + 4 g ha^{-1} treatments recording the highest benefit cost ratio of (2.04), followed by Sulfosulfuron + Metsulfuron @ 30 + 2 g ha^{-1}. Due to the significant cost associated in maintaining the plots free of weeds, the weed free was not determined to be cost-effective in compared to alternative herbicidal treatments. The lower rise in cultivation costs with these treatments compared to weed free was the key factor in the herbicides' greater net return and net return per rupee invested. Singh and Saha (2009) [8] and Rana *et al*. (2021) [7] revealed results that were all quite similar.

Table 1: Effect of weed management practices on weed density in wheat crop

Treatment	Yield attributes					Yield (q ha^{-1})		
	No. of spike (m^{-2})	Length of Spike (cm)	Number of spikelets Spike^{-1}	Grain ear head^{-1} (m^{-2})	Test Weight (g)	Grain	Straw	Biological
Sulfosulfuron @ 25 g *a.i.* ha^{-1}	358.72	8.69	14.17	37.40	34.51	46.20	60.45	106.65
Metsulfuron @ 4 g *a.i.* ha^{-1}	345.49	8.67	14.10	37.00	34.47	45.80	59.10	104.90
Clodinafop @ 60 g *a.i.* ha^{-1}	335.00	8.51	13.41	36.40	34.47	44.50	58.20	102.70
Metribuzin @ 210 g *a.i.* ha^{-1}	340.25	8.61	13.65	36.51	34.41	45.00	58.75	103.75
Sulfosulfuron + Metsulfuron (30+2) @ 32 g *a.i.* ha^{-1}	374.82	9.15	16.00	41.70	35.15	50.20	64.50	114.70
Sulfosulfuron + Metribuzin (25+210) @ 235 g *a.i.* ha^{-1}	362.28	8.87	14.25	38.10	33.43	47.10	61.15	108.25
Clodinafop + Metsulfuron (60+4) @ 64 g *a.i.* ha^{-1}	375.00	9.38	16.05	41.41	35.45	51.10	64.10	115.20
Fenoxaprop –p – ethyl @ 120 g *a.i.* ha^{-1}	326.85	8.35	12.70	36.00	34.15	43.18	58.65	101.83
Fenoxaprop-p-ethyl + Metsulfuron (120+4) @ 124 g *a.i.* ha^{-1}	375.50	8.90	14.55	38.15	34.97	47.50	61.50	108.65
Two hand weeding (20 and 40 DAS)	367.50	9.45	15.98	38.83	35.05	49.80	64.95	114.75
Weedy check	260.10	6.74	12.15	34.31	32.80	32.50	47.90	80.40
Weed free	379.10	9.73	16.48	43.10	36.32	52.50	66.45	118.95
SEm±	1.5	0.41	0.65	1.60	1.06	1.33	1.03	1.48
CD (P ≥0.05%)	4.45	1.21	1.90	4.69	NS	3.98	2.98	4.33

Table 2: Effect of weed management practices on weed density in wheat crop

Treatment	Economics (Rs ha^{-1})				Weed control efficiency	Weed index
	Gross	Cost of cultivation	Net return	BC ratio		
Sulfosulfuron @ 25 g *a.i.* ha^{-1}	110382	38594	71788	1.86	87.25	13.63
Metsulfuron @ 4 g *a.i.* ha^{-1}	109013	38654	70359	1.82	84.55	14.62
Clodinafop @ 60 g *a.i.* ha^{-1}	106307	38804	67504	1.73	83.02	15.23
Metribuzin @ 210 g *a.i.* ha^{-1}	107450	38604	68846	1.78	83.38	14.28
Sulfosulfuron + Metsulfuron (30+2) @ 32 g *a.i.* ha^{-1}	118722	39544	79178	2.00	90.14	4.58
Sulfosulfuron + Metribuzin (25+210) @ 235 g *a.i.* ha^{-1}	112994	39494	72800	1.84	85.92	11.46
Clodinafop + Metsulfuron (60+4) @ 64 g *a.i.* ha^{-1}	120708	39654	81055	2.04	90.90	2.67
Fenoxaprop –p – ethyl @ 120 g *a.i.* ha^{-1}	104242	38824	65418	1.68	81.71	17.90
Fenoxaprop-p-ethyl + Metsulfuron (120+4) @ 124 g *a.i.* ha^{-1}	113162	39674	73489	1.85	78.74	9.50
Two hand weeding (20 and 40 DAS)	117378	44750	72674	1.62	85.93	5.14
Weedy check	80343	37704	42640	1.13	0	38.89
Weed free	124312	48204	76109	1.57	100	0

Conclusion

Based on the findings of this study, the best herbicide combination like Clodinafop + Metsulfuron @ 60 + 4 g ha^{-1} followed by post emergence application of Sulfosulfuron + Metsulfuron @ 30 + 2 g ha^{-1} can be suggested for wheat in enhancing productivity in terms of high weed control efficiency and low in weed index ultimately leading to higher profitability (net return and benefit cost ratio).

References

1. Chaudhary SU, Hussain M, Ali MA, Iqbal J. Effect of weed competition period on yield and yield components of wheat. Indian Journal of Agriculture Research. 2008;46:47-53.
2. Chhokar RS, Sharma RK. Multiple herbicide resistance in little seed canary grass (Phalaris minor): A threat to wheat production in India. Weed Biology and Management. 2008;8:112-123.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research (2 ed.). John wiley and sons, New York; c1984. p. 680.
4. Li M, Gao XX, Fang F, Li J, Wu J, Lee M. Weed control effect and safety to crops of a mixed formulation (halauxifen-methyl 10% + florasulam 10%). Acta Phytophylacica Sinica. 2016;43(3):514-522.
5. Malik RS, Yadav A, Kumar R. Ready mix formulation of clodinafop-propargyl + metsulfuron-methyl against complex weed flora in wheat. Indian Journal of weed science. 2013;45(3):179-182.
6. Meena RS, Singh MK. Weed management in late sowing zero-till wheat (*Triticum aestivum*) with varying seed rate. Indian Journal of Agronomy. 2011;56(2):127-132.
7. Rana SS, Raj P, Kumar R, Singh K, Verma H, Pal RK. Influence of different weed management practices on broad leaf weeds and their effect on economics of wheat (*Triticum aestivum* L.). Biological Forum – An International Journal. 2021;13(3a):605-610.
8. Singh RK, Saha V. A Studies on herbicide mixtures in wheat. Indian Journal of Weed Science. 2009;38(4):1-4.
9. Tomar SK, Tomar TS. Effect of herbicides and their tank mix mixture on weed dynamics and yield of zero-tilled wheat (*Triticum aestivum*) under rice – wheat cropping system of eastern Utter Pradesh. Indian Journal of Agronomy. 2014;59(4):624-628.
10. Waheed AR, Qureshi, Jakhar GS, Tareen H. Weed community Adynmics in wheat crop of district Rahim Yar khan, Pakistan. Pakistan Journal of Botany. 2009;41(1):247-254.