Himachal Journal of Agricultural Research 50(2): 220-223 (2024)

Short communication

Efficacy of carfentrazone ethyl for managing broad-leaved weeds in wheat

Kusum Sharma, Suresh Kumar, Sandeep Manuja, Manish Kumar, Shagun Shukla and Shivalika
Department of Agronomy, College of Agriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176062, India.
*Corresponding author e-mail: skg_63@yahoo.com
Manuscript received: 4.7.2023; Accepted:12.6.2024

Abstract

A field experiment was conducted during *rabi* 2021-22 at the Experimental Farm of Department of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur with nine weed control treatments *viz*., carfentrazone-ethyl at 16, 25, 31.25, 34 and 50 g/ha, carfentrazone-ethyl (market sample) 25 g/ha, 2,4-D Na salt 1.0 kg/ha, hand weeding (weed free), and weedy check following Randomized Block Design with three replications. Grassy weeds were controlled by the uniform spray of clodinafop propargyl 60 g/ha. Carfentrazone-ethyl 25 g/ha, being statistically at par with carfentrazone-ethyl 34 g/ha, and carfentrazone-ethyl (market sample) 25 g/ha resulted in significantly lower population of *Vicia sativa, Anagallius arvensis, Lathyrus aphaca, Chenopodium album, Coronopus didymus* and *Medicago denticulata* and consequently significantly lower total weed dry weight over other treatments. The significantly highest grain and straw yield of wheat were recorded with the application of carfentrazone-ethyl 25 g/ha which was closely followed by carfentrazone-ethyl 34g/ha and 31.25 g/ha.

Keywords: Broad leaf weeds, carfentrazone-ethyl, 2,4-D Na salt, dry weight, total weed count, wheat

Wheat (*Triticum aestivum* L.) is the most frequently cultivated food crop in the world and is India's second most important staple food, after rice. Globally, it is grown on an area of about 217.02 million hectares with a production of 766.5 million tonnes (FAO 2020). India is the principal wheat producing and consuming country in the world. It contributes about 13.74% of global wheat production from an area of 30.54 million hectares with a production of 106.41 million tonnes (Anonymous 2022). Wheat is also an important winter cereal crop of Himachal Pradesh covering an area of 333.0 thousand hectares with a total production of 570.0 thousand tones and productivity of 1712 kg/ha (Anonymous 2022). Weeds are the major bottlenecks in realizing the potential yield of wheat. Uncontrolled weeds are reported to cause upto 66% reduction in wheat grain yield (Angiras *et al*. 2008; Kumar *et al*. 2009; Kumar *et al.* 2011).

Continuous use of isoproturon, clodinafop-propargyl and pinoxaden herbicides for the last many years, has resulted in the shift of weed flora in wheat to broad-leaf weeds. Sulfosulfuron recommended controlling grassy weeds *viz*., *Phalaris minor* and *Avena ludoviciana* etc. provides marginal control of broad-leaf weeds. 2,4-D is not effective against certain broad-leaf weed species such as *Rumex dentatus, Malva parviflora, Convolvulus arvensis, Cirsium arvensis* and *Lathyrus aphaca.* Metsulfuron and 2,4- D are being widely used, but these herbicides do not provide any control of *Convolvulus arvensis, Solanum nigrum* and *Malva parviflora* for which carfentrazone is very effective (Punia et al. 2006; Walia and Singh 2007). Moreover, combination of 2, 4-D with recommended herbicides like clodinafop and fenoxaprop results in antagonism. Secondly many wheat cultivars show malformed spikes due use of 2, 4-D. Hence, there is a strong need for identifying a herbicide which can provide effective control of broad-leaf weeds in wheat.

Carfentrazone-ethyl is a contact, non-residual, translocated herbicide of aryl triazolinone family,

which has been found to be effective in controlling broad-leaf weeds in wheat (Singh *et al*. 2004). This herbicide acts by inhibiting activity of protoporphyrinogen oxidase in chlorophyll biosynthetic pathway (Witkowski and Halling 1989) mainly in broad-leaf weeds. Keeping this in view, the present investigation was conducted to study the efficacy of carfentrazone ethyl in controlling broad-leaf weeds in wheat.

A field experiment was conducted during *rabi* season of 2021-2022 at the Experimental Farm of Department of Agronomy, CSKHPKV Palampur. The experimental site is situated at 32° 6′ N latitude, 76° 3′ E longitude and at an altitude of 1290.8 metres above mean sea level in the North-West Himalayan region. The area represents the mid-hills sub-humid zone of Himachal Pradesh and is characterized by wet temperate climate. The soil of the experimental field was silty clay loam in texture, acidic in reaction (pH 5.8), low in available nitrogen (237 kg/ha), medium in available phosphorus (23 kg/ha) and potassium (247 kg/ha). The crop was sown on 30th October 2021 and was harvested on 5th May 2022. Application of 120 kg N, 60 kg P_2O_5 and 30 kg K_2O per hectare was made through urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O), respectively. The field experiment consisted of nine treatments *viz*., carfentrazone-ethyl 16 g/ha, carfentrazone-ethyl (market sample) 25 g/ha,carfentrazone-ethyl 34 g/ha, carfentrazone-ethyl 25 g/ha, 2,4-D Na salt 1.0 kg/ha, hand weeding, weedy check, carfentrazone-ethyl 31.25 g/ha and carfentrazone-ethyl 50 g/ha. The latter two treatments being tested only for studying its phytotoxicity on wheat crop as well as its effect on succeeding soybean crop. All the post-emergence herbicides were applied at 2-3 leaf stage of weeds by knapsack sprayer fitted with flat fan nozzle using spray volume of 750 liters. Data on weed count and weed dry weight were recorded from two spots using a quadrat of 0.50 × 0.50 m and expressed as number and g/m^2, respectively. Weed count and dry weight data showed wide variation, therefore data were subjected to square root transformation ($\sqrt{x+1}$).

The predominant weed flora present in the experimental field was *Chenopodium album, Coronopus didymus, Vicia sativa, Lathyrus aphaca, Anagallius arvensis,* and *Medicago denticulata*. Besides these numbers of grassy weeds were also observed in experimental plots, which were controlled by the uniform spray of clodinafop propargyl 60 g/ha.Different weed control treatments significantly influenced the total weed count and total weed dry weight at all the stages of observation (Table 1 & 2). A perusal of the data revealed that significantly highest

Table 1. Effect of weed management treatments on total weed count (No./m^2)at different stages of observation

Treatment	Dose	Stages of observation				
	(g/ha)	60DAS	90DAS	120DAS	150DAS	At Harvest
Carfentrazone-ethyl	16 g	4.84 (22.7)	6.06(36.0)	7.80 (60.00)	7.28 (52.0)	5.53 (30.67)
Carfentrazone-ethyl	25 g	1.00 (0.00)	3.58 (12.0)	4.66 (21.33)	4.66 (21.3)	3.74 (14.67)
Carfentrazone-ethyl	34 g	1.00 (0.00)	2.08 (4.00)	3.32 (10.67)	3.32 (10.7)	2.45 (6.67)
Carfentrazone-ethyl (MS)	25 g	2.54 (6.67)	3.27 (10.67)	4.76 (22.7)	4.76 (22.7)	4.06 (16.00)
2,4-D Na Salt	1.0 kg	5.60(30.67)	6.56(42.67)	8.03(64.00)	8.03(64.0)	6.03(36.00)
Carfentrazone-ethyl	31.25 g	1.00 (0.00)	2.08(4.00)	3.32(10.67)	3.32 (10.7)	2.45 (84.00)
Carfentrazone-ethyl	50 g	2.49 (5.33)	2.08(4.00)	3.32(10.67)	3.32 (10.7)	2.45 (6.67)
Weed free	-	1.00 (0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Weedy check	-	9.15 (82.67)	10.56(110.67)	12.09(145.33)	11.64(134.7)	9.21(36.00)
SEm ±		0.32	0.49	0.49	0.50	0.75
LSD		0.95	1.51	1.48	1.49	2.26

MS - Market sample, DAS: Days after sowing

Values given in parentheses are the mean of original values, Data subjected to $\sqrt{x-1}$ transformation

Table 2. Effect of weed management treatments on total weed dry weight (no./m^2)at different stages of observation

Treatment	Dose(g/ha)	Stages of observation				
		60 DAS	90 DAS	120 DAS	150 DAS	At Harvest
Carfentrazone-ethyl	16 g	2.76(6.67)	3.15(8.97)	3.64(12.29)	3.76(13.14)	3.72(13.20)
Carfentrazone-ethyl	25 g	1.00(0.00)	1.30(0.75)	1.83(2.56)	1.83(2.56)	1.67(2.31)
Carfentrazone-ethyl	34 g	1.00(0.00)	1.30(0.75)	1.83(2.56)	1.83(2.56)	1.67(2.31)
Carfentrazone-ethyl (MS)	25 g	1.00(0.00)	1.30(0.75)	1.83(2.56)	1.83(2.56)	1.67(2.31)
2,4-D Na Salt	1.0 kg	3.01(8.12)	3.48(11.19)	3.96(14.76)	3.98(14.90)	4.17(16.63)
Carfentrazone-ethyl	31.25 g	1.60(1.69)	1.82(2.51)	2.25(4.24)	2.25(4.24)	2.18(4.50)
Carfentrazone-ethyl	50 g	1.71(2.21)	1.96(3.10)	2.35(5.13)	2.35(5.13)	2.49(5.59)
Weedy free	-	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Weedy check	-	4.79(21.94)	5.50(29.29)	6.17(37.09)	6.26(38.14)	6.42(40.36)
SEm ±		0.17	0.22	0.29	0.29	0.46
LSD		0.52	0.65	0.88	0.87	1.37

MS - Market sample, DAS: Days after sowing

Values given in parentheses are the mean of original values, Data subjected to $\sqrt{x+1}$ transformation

total weed count and total weed dry weight was recorded in untreated check. Removing the weeds whenever they appear under the weed free treatment resulted in complete elimination of weed competition as evident from this treatment that weed free resulted in lowest total weed count and total weed dry weight. Among herbicide treatments, carfentrazone-ethyl 25 g/ha, behaving in a statistically similar manner with carfentrazone-ethyl 34 g/ha, resulted in significantly lower total weed count as well as total weed dry weight compared to other treatments. The market sample of carfentrazone-ethyl 25 g/ha and higher doses i.e. 31.25 g/ha and 50 g/ha, also provided effective weed control, though not significantly better than the standard doses. In contrast, 2, 4-D Na salt 1.0 kg/ha was less effective, showing higher weed counts and dry weights than the carfentrazone-ethyl treatments. Singh *et al*. (2005) have also documented the superiority of carfentrazone-ethyl in controlling broadleaf weeds.

Data pertaining to grain yield, straw yield and harvest index of wheat has been presented in Table 3. All the weed control treatments were significantly

Table 3. Effect of weed management treatments on grain, straw yield (q/ha) and harvest index of wheat

Treatment	Dose (g/ha)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index
Carfentrazone-ethyl	16 g	32.21	47.75	40.15
Carfentrazone-ethyl	25 g	36.63	52.23	41.50
Carfentrazone-ethyl	34 g	36.46	51.35	41.99
Carfentrazone-ethyl (MS)	25 g	35.21	51.13	40.78
2,4-D Na Salt 80%	1.0 kg	33.48	49.15	40.52
Carfentrazone-ethyl	31.25 g	36.39	51.35	41.91
Carfentrazone-ethyl	50 g	36.14	51.35	41.63
Weedy free	-	37.26	53.18	41.20
Weedy check	-	25.95	40.80	38.95
SEm ±		0.42	0.79	0.45
LSD		1.26	2.38	1.35

MS - Market sample, DAS: Days after sowing

Values given in parentheses are the mean of original values, Data subjected to $\sqrt{x+1}$ transformation

superior to the untreated check in terms of grain and straw yield. The superiority of chemical weed control was also reported in pea, potato and rajmash (Rana *et al*. 2004). Application of carfentrazone-ethyl 25 g/ha, behaving statistically alike with carfentrazone-ethyl 34g/ha resulted in significantly higher grain and straw yield. The magnitude of increase in grain yield of wheat due to the application of carfentrazone-ethyl 25 g/ha and 34g/ha was recorded to the tune of 41.15 % and 40.05% over untreated plots. Carfentrazone-ethyl 31.25 g/ha was the next best treatment among weed control treatments and recorded an increase of 40.02 in grain yield of wheat.

The highest harvest index (41.99 %) was recorded with the application of carfentrazone-ethyl at 34 g/ha, indicating that this treatment was particularly effective in enhancing grain production relative to straw yield. Other treatments with notable harvest index values included carfentrazone-ethyl at 25 g/ha (41.50 %) and carfentrazone-ethyl at 31.25 g/ha (41.91 %), both of which also demonstrated efficient biomass partitioning. In contrast, the untreated weedy check exhibited the lowest harvest index (38.95%), reflecting reduced grain yield efficiency due to the competitive effects of weeds.

Conclusion

Carfentrazone-ethyl 25 g/ha is effective herbicide for the control of broad-leaf weeds in wheat.

Acknowledgements: The authors are thankful to Agro-Allied Venturus Pvt Ltd for providing the herbicides for testing.

Conflict of interest: Authors declare no competing interest.

References

Angiras NN, Kumar S, Rana SS and Sharma N 2008. Standardization of dose and time of application of clodinafop-propargyl to manage weeds in wheat.Himachal Journal of Agricultural Research **34(2):** 15-18.

Anonymous 2022. ICAR-IIWBR 2022. Director's Report of AICRP on Wheat and Barley 2021-2022, eds Singh GP. ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana, India, p 83.

Food and Agriculture Organization of the United Nations 2020. *FAO Statistical Yearbook*. World Food and Agriculture.http://www.fao.org/statistics/yearbook

Kumar S, Angiras NN and Rana SS 2011 Effect of doses and time of application of Affinity® on weeds and wheat yield under mid hill conditions of Himachal Pradesh. Himachal Journal of Agricultural Research **37 (2):** 131-137.

Kumar S, Angiras NN, Rana SS and Sharma N 2009. Alternative methods of isoproturon application in wheat. Himachal Journal of Agricultural Research **35 (1):** 31-33.

Punia SS, Singh S, Malik RK and Yadev D 2006. Studies on herbicide mixtures in wheat. Indian Journal of Weed Science **38:** 1-4.

Rana MC, Kumar N, Sharma A and Rana SS 2004. Effect of weedicides and fertility levels on rajmash (*Phaseolus vulgaris* L.) and associated weeds under dry temperate high hills of Himachal Pradesh. Indian Journal of Weed Science **36:** 227-230.

Rana MC, Rana RS, Sharma A and Rana SS 2004. Management of complex weed flora in seed potato with herbicidal mixture under dry temperate high hills of Himachal Pradesh. Indian Journal of Weed Science **36 (3&4):** 231-235.

Rana MC, Sharma GD, Sharma A and Rana SS 2004. Management of complex weed flora in pea with herbicidal mixture under Lahaul valley conditions of Himachal Pradesh. Indian Journal of Weed Science **36 (1&2):** 68-72.

Singh G, Singh VP and Singh M 2004. Effect of carfentrazone-ethyl on non-grassy weeds and wheat yield. Indian Journal of Weed Science **36(1&2):** 19-20.

Singh G, Singh VP and Singh M 2005. Effect of fenoxaprop-p-ethyl (Puma Super 10 EC) with and without surfactant (Power Activator) on weeds and wheat yield. Indian Journal of Weed Science **37:** 13-16.

Walia US and Singh B 2007. Performance of triasulfuron and carfentrazone-ethyl against broadleaf weeds in wheat. Indian Journal of Weed Science **35(3&4):** 169-172.

Witkowski DA and Halling BP.1989. Inhibition of plant protophyrinogen oxidase by the herbicide acifluorfenmethy L. Plant Physiology **90:** 1239.