Journal of Crop and Weed, 17(1): 217-221 (2021) ISSN- O : 2349 9400 ; P : 0974 6315

http://cwssbckv.org
www.cropandweed.com

Evaluation of herbicides for control of broad-leaved weeds in barley (*Hordeum vulgare* L.)

J. CHOUDHARY, K. S. PRUTHVIRAJ, S. L. MUNDRA AND SOMDUTT

Department of Agronomy, Rajasthan College of Agriculture,
Maharana Pratap University of Agriculture and Technology, Udaipur 313 001 (Rajasthan)

Received : 20.07.2019 ; Revised : 27.11.2020 ; Accepted : 04.01.2021

DOI : https://doi.org/10.22271/09746315.2021.v17.i1.1427

ABSTRACT

A field experiment was conducted during rabi 2017-18 at Rajasthan College of Agriculture, MPUAT, Udaipur (Rajasthan) to study the response of barley (Hordeum vulgare L.)to different herbicidal treatments. The experimental results revealed that application of pre-mix herbicide halauxifen + florasulam + polyglycol at 32 days after sowing recorded the maximum degree of reduction in the density as well as dry matter of broad-leaved weeds at 30 days after spray compared to the remaining treatments. Ready mix herbicide, halauxifen + florasulam + polyglycolalso recorded the maximum plant height, dry matter accumulation and maximum values of yield attributes viz. effective tillers 0.5 metre^{-1} row length (39.33), grains ear^{-1} (28.33), grain weight ear^{-1} (1.26 g), ear length (7.77 cm) and test weight (44.52 g) which ultimately reflected into more economic yield (3846 kg ha^{-1}). As a consequence, statistically superior net return (Rs. 40,930 ha^{-1}) and B-C ratio (2.35) were recorded under this treatment as compared to weedy check.

Keywords : Herbicidal treatments, net return, B-C ratio

Barley (*Hordeum vulgare* L.) is an ancient cereal grain, whose domestication has evolved largely as a food grain, feed and malting grain. Barley can be grown in a wide range of environments than any other cereal crops, including extremes of latitude and longitude. It is described as the most cosmopolitan of the crops and also considered as poor man's crop because of the low input requirements and better adaptability to drought, salinity, alkalinity and marginal lands. This crop has fourth place in the world amongst cereals after wheat, rice and maize with a share of 7 per cent global cereal production. Barley is being cultivated in marginal and problematical lands as rainfed crop consequently resulting to lower yield. As the crop is having high industrial importance, the agronomic aspects need specific attention to address the increased productivity of the crop (Devi *et al*., 2018).

Globally barley is cultivated in nearly 49.00 million hectare area with a production of 137.47 million metric tonnes (2017-18). In India, during 2017-18, barley occupied nearly 0.677 million ha area producing nearly 1.788 million tonnes grain, with a productivity of 2641 kg ha^{-1} whereas, Rajasthan has 0.281 million ha area, 0.8564 million tonnes production with the productivity of 3046 kg ha^{-1} (Directorate of Economics and Statistics, India, 2017-18). However, during early nineties, due to economic liberalization, the industrial demand for barley increased and presently 25-30 per cent of total barley produced is used in the manufacturing of malt extract, which is further utilized for brewing, distillation, baby foods, coco-malt drinks and medicinal syrups. Lack of effective weed control measures and basic knowledge of weed management in barley have emerged as one of the limiting factors in barley production.

Losses caused by weeds in Indian agriculture are estimated to be 33% as compared to 26% by insects, 20% by disease and 21% by other biotic factors. (Upasani and Barla, 2019)

Hand-weeding was formerly a most widely used and effective method of weed control, but this practice was abandoned because of its practical and economic feasibility owing to unfavorable climatic and soil conditions, unavailability of labour during critical period of weeding and also high wages of labour (Pandey *et al.,* 2007).

Herbicide combination is the only way to control all broad-leaved weed flora effectively. Herbicide combination, which contains two or more herbicides with different mode of action is used to combat noxious weeds and to prevent weed shift. Besides this, herbicide rotation and use of herbicide mixtures are two important strategies to prevent the development of resistant biotypes and problems of weed shift. Recently, *Rumex dendatus* has evolved resistance against metsulfuron, pyroxsulum and metsulfuron+iodosulfuron in wheat. Therefore, proactive action by using herbicide mixture with different mode of action is an effective way to avoid evolution of resistance in predominant weed biotypes (Jena *et al.*, 2018).

Email: jaggiudr@gmail.com

MATERIALS AND METHODS

The experiment was conducted at Udaipur (Rajasthan) during *rabi* 2017-18 to assess the effect of herbicides on broad-leaved weed flora in barley.The soil of the experimental site was clay-loam in texture and slightly alkaline in reaction pH (8.1), medium in available nitrogen (295.30 kg ha^{-1}), organic carbon (0.65%) and phosphorus (18.40 kg ha^{-1}), while high in available potassium (292.70 kg ha^{-1}). Barley variety BH 959 was sown at 20.00 cm row spacing on 14th November, 2017 and the crop was cultivated as per package of practices recommended for this zone. The treatments comprised of 11 treatments *viz.* T_1: 2, 4-D Na salt 500 g ha^{-1}, T_2: 2, 4-D Ester 500 g ha^{-1}, T_3: carfentrazone 20 g ha^{-1}, T_4: metsulfuron methyl + surfactant 4 g ha^{-1}, T_5: 2, 4-D Na + carfentrazone 400 + 20 g ha^{-1}, T_6: 2, 4-D Ester + carfentrazone 400 + 20 g ha^{-1}, T_7: metsulfuron + carfentrazone + surfactant 4 + 20 g ha^{-1}, T_8: halauxifen-methyl ester + florasulam + polyglycol 12.76 g ha^{-1}, T_9: halauxifen methyl + florasulam+ carfentrazone + surfactant 10.21 + 20 g ha^{-1}, T_{10}: weedy check and T_{11}: weed free were laid out in randomized block design with 3 replications. Herbicides as per treatments were sprayed at 32 days after sowing (DAS) using 500 litre ha^{-1} water by knapsack sprayer after calibration which was fitted with flat-fan nozzle. Weed density and their dry weight was recorded periodically using 0.5 m quadrate.The dry weight of weeds was recorded for the counted weeds from each plot.

RESULTS AND DISCUSSION

Effect on weeds

Herbicidal treatments significantly reduced density as well as dry matter accumulation of weeds at 30 days after spray compared to weedy check. The experimental results revealed that application of halauxifen + florasulam + polyglycol (12.76 g ha^{-1}) at 32 DAS recorded significantly lower density, dry matter accumulation of weeds and gave the maximum weed control efficiency at 30 days after herbicide spray. Consequently, superior weed index was recorded.

Effect on growth parameters

All the weed control treatments showed significant increase in the plant height and dry matter accumulation of crop at 30 days after spray and at harvest over weedy check. Data in table 1 indicated that the post-emergence application of halauxifen + florasulam + polyglycol observed with the maximum plant height at 30 days after herbicide spray and at harvest. At the same time, halauxifen + florasulam + polyglycol treated plots recorded with the highest dry matter accumulation at 30 days after herbicide spray and at harvest.

Field data (Table 1) further indicated that application of ready mixed of halauxifen + florasulam + polyglycol recorded the highest number of tillers 0.5 m^{-1} row length due to effective weed control in the treated plot. It seems to be on account of their direct effect through least crop-weed competition. However, indirect effect was found due to the least competition for basic plant growth inputs *viz*. light, space, water and nutrients etc. Therefore, the above results were affirmed with the aid of similar research work done by Hada *et al.* (2013) and Puniya *et al.* (2015).

Effect on yield attributes and yield

Amongst yield attributing characters *viz.* effective tillers 0.5 $metre^{-1}$ row length (39.33), grains ear^{-1} (28.33), ear length (7.77 cm), grain weight ear^{-1} (1.26 g) and test weight (44.52 g) were recorded maximum under halauxifen + florasulam + polyglycol (Table 2). It is reflected through the maximum grain yield (3846 kg ha^{-1}). The effect of this ready mix herbicide was found superior over weedy check while, the maximum grain yield was obtained under completely weed free plots right from sowing to harvesting of crop.

The performance of the crop plants relevant to the yield attributes might be poor by the greater reduction in the dry matter accumulation due to the crop-weed competition. Amongst all the herbicidal treatments, there was a significant degree of expression of yield attributing characters recorded under application of halauxifen + florasulam + polyglycol. It is well known fact that this treatment resulted a positive impact on crop yield, due to the better availability of basic needs *i.e*. water, space, sunlight and nutrients. The results so obtained are affirmed with the findings of Kumar *et al.* (2010), Mahmoud *et al.* (2016), Rana *et al.* (2017 and Sivran *et al*., (2020).

Data in Table 2 indicated that the maximum grain, straw and biological yields were recorded under weed free, which was statistically at par with halauxifen + florasulam + polyglycol, halauxifen + florasulam + carfentrazone + surfactant, 2, 4-D E + carfentrazone, metsulfuron + carfentrazone + surfactant and 2, 4-D Na + carfentrazone.

Positive and significant correlation between grain yield and yield attributing characters such as effective tillers 0.5 $metre^{-1}$ row length ($r = 0.817$), grains ear^{-1} ($r = 0.978$), grain weight ear^{-1}($r = 0.949$), ear length ($r = 0.935$) and test weight ($r = 0.865$) also validated the present findings.

Effect on economics

Data (Table 2) indicates that the maximum net return (₹. 40930 ha^{-1}) was recorded with the application of halauxifen + florasulam + polyglycol, which was

Table 1: Effect of herbicides on weeds and plant growth of barley

Treatments	Growth parameters				Weed studies			
	Plant height (cm)		Dry matter ($g\ m^{-1}$ row length)		Weed density ($0.5\ m^{-2}$)	Weed dry matter ($g\ 0.5\ m^{-2}$)	Weed control Efficiency (%)	Weed index
	30 days after spray	At harvest	30 days after spray	At harvest	30 days after spray	30 days after spray	30 days after spray	At harvest
2,4-D Na salt	70.00	84.67	163.00	283.67	6.15*(37.33)	24.24	61.57	21.45
2,4-D Ester	72.00	85.67	168.00	292.33	5.28(27.34)	20.19	71.24	14.53
Carfentrazone	63.33	85.00	152.67	287.33	5.28(37.33)	22.33	62.95	19.78
Metsulfuron + Surfactant	71.00	85.33	168.00	296.33	5.31(27.66)	20.93	69.21	17.87
2,4-D Na + Carfentrazone	66.50	86.33	158.33	299.33	4.95(24.00)	19.54	73.27	14.03
2,4-D E + Carfentrazone	67.00	87.33	155.00	308.33	3.72(13.33)	15.62	80.64	13.33
Metsulfuron + Carfentrazone+ Surfactant	70.00	86.67	160.00	302.00	4.67(21.35)	17.03	74.99	13.29
Halauxifen + Florasulam+ Polyglycol	76.33	92.11	183.00	311.33	3.19(9.67)	13.20	84.69	5.85
Halauxifen + Florasulam + Carfentrazone + Surfactant	69.50	89.67	168.67	310.00	3.19(9.67)	14.39	84.55	8.53
Weedy Check	62.00	79.67	123.00	201.67	6.70(44.33)	100.50	0.00	33.29
Weed Free	79.17	95.33	190.00	315.67	0.71(0.00)	0.00	100.00	0.00
SEm±	**3.68**	**2.40**	**2.46**	**2.03**	**0.71**	**1.42**	**-**	**-**
CD (P=0.05)	**10.87**	**7.08**	**7.26**	**5.98**	**2.11**	**4.19**	**-**	**-**

*Transformed values using * $\sqrt{x + 0.5}$ and the original values are in br***ackets**

Table 2: Effect of herbicides on yield attributes, yield and economics of barley

Treatments	Yield attributes					Yield (kg ha^{-1})			Economics	
	Effective tillers (0.5 m^{-1} row length)	No. of grains ear^{-1}	Grain weight ear^{-1} (g)	Ear length (cm)	Test weight (g)	Grain	Straw	Biological	Net return (₹. ha^{-1})	B-C ratio
2,4-D Na salt	35.66	26.00	1.15	7.66	44.20	3007	4329	7336	28929	1.98
2,4-D Ester	36.33	26.33	1.16	7.70	44.17	3250	4950	8200	31181	2.04
Carfentrazone	36.00	26.33	1.16	7.67	44.23	3018	4601	7619	29953	2.00
Metsulfuron + Surfactant	36.20	26.67	1.18	7.73	44.32	3201	4832	8033	31801	2.06
2,4-D Na + Carfentrazone	37.00	27.00	1.20	7.73	44.33	3550	5150	8700	34375	2.14
2,4-D E + Carfentrazone	37.00	27.50	1.22	7.76	44.33	3590	5200	8790	35475	2.17
Metsulfuron + Carfentrazone+ Surfactant	37.00	27.00	1.20	7.74	44.47	3581	5164	8745	34955	2.15
Halauxifen + Florasulam+ Polyglycol	39.33	28.33	1.26	7.77	44.52	3846	5750	9596	40930	2.35
Halauxifen + Florasulam + Carfentrazone + Surfactant	38.33	28.00	1.25	7.76	44.50	3769	5508	9277	39412	2.29
Weedy Check	25.00	24.00	1.02	7.50	42.32	2381	4040	6421	21694	1.74
Weed Free	40.33	28.67	1.29	7.90	44.95	3950	5850	9800	40735	2.15
SEm±	**0.54**	**0.47**	**0.03**	**0.048**	**0.15**	**142**	**247**	**378**	**426**	**0.07**
CD (P=0.05)	**1.61**	**1.40**	**0.08**	**0.14**	**0.45**	**419**	**727**	**1116**	**1258**	**0.21**

statistically at par with weed free. Both these treatments were statistically higher ₹. 39412 ha^{-1} and ₹. 40735 ha^{-1} respectively over weedy check (₹. 21694 ha^{-1}). Consequently, the highest B-C ratio of 2.35 was obtained under halauxifen + florasulam + polyglycol, which was statistically at par with halauxifen + florasulam + carfentrazone + surfactant (2.29), 2, 4-D E + carfentrazone (2.17), metsulfuron + carfentrazone + surfactant (2.15), weed free (2.15) and 2, 4-D Na (2.14). These results clearly showed that halauxifen + florasulam + polyglycol were statistically superior over the remaining treatments in respect of economics because of less expenditure on the treatment.

CONCLUSION

Nowadays it is cumbersome to control weeds manually in barley cultivation. So, based on one year experimentation, it can be concluded that the maximum crop yield as well as net return and B-C ratio can be obtained by the application of halauxifen + florasulam + polyglycol (12.76 g ha^{-1}) at 32 DAS with the effective control of broad-leaved weeds.

REFERENCES

Devi, K.P., Mitra, B., Paul, T., Das, S., Roy, S.S. and Roy, A.K.S. 2018. Evaluation of barley (*Hordeum vulgare* L.) cultivars under different dates of sowing in Terai zone of West Bengal. *Journal of Crop and Weed* **14**(1): 185-187.

Directorate of Economics and Statistics, Ministry of Agriculture and Farmers welfare (MoAFw) India, 2017-18. (www.dandcnet.in retrieved on dated - 01/01/2019).

Hada, N., Nepalia, V. and Tomar, S.S. 2013. Influence of balanced nutrition, weed control and sowing methods of yield and nutrient uptake by durum wheat. *Annals of Plant and Soil Research* **15**(1): 19-22

Jena, T., Singh, R.K. and Bisen, N. 2018. Surfactant influence on efficacy of herbicides in barley. *Indian Journal of Weed Science* **50**(1): 56.-58.

Kumar, S., Bhattoo, M.S., Punia, S.S. and Singh, S. 2010. Evaluation of Pinoxaden in combination with 2, 4-D against complex weed flora in barley. *Indian Journal of Weed Science* **42**(1 & 2): 120-122.

Mahmoud, S. M., Soliman, F. S. and Elsheik, M. 2016. Combination of halauxifen – methyl and florasulam with other grassy herbicides against complex weed flora in wheat and barley. *Journal of Plant Protection and Pathology* **7**(5): 315-320.

Pandey, I.B., Dwivedi, D.K. and Pandey, R.K. 2007. Efficacy of herbicides and fertilizer management on weed dynamics in wheat (*Triticum aestivum* L.). *Indian Journal of Agronomy* **52**(1): 49-52.

Puniya, M.M., Yadav, S.S. and Shivran, A.C. 2015. Productivity, profitability and nitrogen use efficiency of barley (*Hordeum vulgare* L.) as influenced by weed management and nitrogen fertilization under hot semiarid ecologies of Rajasthan. *Indian Journal of Agronomy* **60**(4): 564-569.

Rana, S.S., Badiyala, D. and Brari, P. 2017. Evaluation of herbicides combination for controlling complex weed flora in wheat. *Indian Journal of Weed Science* **49**(4): 335-340.

Sivran, A.C., Choudhary, J. and Sarita. 2020. Efficacy of herbicides on broad- leaved weed and yield of wheat (*Triticum aestivum* L.). *International Journal of Chemical Studies* **8**(2): 180-184.

Upasani, R.R. and Barla, S. 2019. Relevance of weed science in modern agriculture. *Journal of Crop and Weed* **15**(3): 174-177.