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Effect of different herbicide on yield and NPK uptake and content by Barley (*Hordeum vulgare* L.)

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Abstract

The present study was aimed to estimate the Effect of different herbicide on yield and NPK uptake and content by Barley (*Hordeum vulgare* L.)". The growth and yield parameters were recorded and analysed by applying two-way Factorial ANOVA using statistical software OPSTAT. The statistical significance was set comparing calculated 'F' value with tabulated F values at 5% level. The maximum values of yield attributes *viz.*, number of spikes m^{-1} row length, spike length and number of grains $spike^{-1}$ were obtained with combined application of Pinoxaden @ 40 g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) which was closely followed by T1, T2, T6 and T9 but significantly higher than T4, T5, T7 and T8. However, the lowest values of yield attributes were observed in weedy check treatment (T1). The test weight was not influenced significantly due to various treatment combinations. Marked rise in grain, straw and biological yield were obtained with application of different herbicide treatment. The application of Pinoxaden @ 40 g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) recorded significantly higher grain, straw and biological yield of barley which was significantly superior to all other treatments except T1, T2, T6 and T9. While, minimum grain, straw and biological yield were recorded in weedy check plot. The harvest index of barley was not influenced significantly due to various treatment combinations.

Keywords: Weed, NPK uptake, grain yield, herbicides

Introduction

Barley (*Hordeum vulgare* L.) is the world's fourth most important cereal crop after wheat, rice, and maize. It is an annual plant of Poaceae family. Barley requires less water for its growth. Barley is notably susceptible to heat stress at meiosis and anthesis stages (Sakata *et al.*, 2000) [11] the area under barley in the world was 51.6 million hectares in 2021 with the production of 147.05 million metric tonnes (Shahbandeh, 2022) [12]. In India barley was grown on 590 thousand hectares area producing 1720 thousand tonnes in 2020. The major producing states in India are Rajasthan, Uttar Pradesh, Haryana and Punjab. In India, Rajasthan amounts for about 40-50% and U.P for 25-30% of total production. Barley was cultivated on 6.2 thousand hectares with a production of 23.4 thousand tonnes and average yield of 37.81 quintals per hectare in Punjab during 2019-20. In State-wise of India, Rajasthan has highest production of 855.02 thousand tonnes in area of 266.62 hectares area and in U.P production of barley is 422.16 thousand tonnes in area of 151.20 million hectares. During the year 2019, in Punjab, barley was grown in an area of 7.60 thousand hectares with the production of 28.55 thousand tonnes. Barley is an excellent source of fibre ranging from 17–30%, the highest among all grains. Today, 98% of the barley grown in the United States is used for malting and livestock feed production. Barley flour provides about 511 calories per cup (148 g) serving. There are 110 grams of carbohydrates, 14.9 grams of fiber, 15.5 grams of protein, and 1.18 grams of sugar in that serving size. Most of the fat is polyunsaturated (0.33 g) with some coming from monounsaturated fat (0.09 g) and some from saturated fat (0.15 g). It contains about 3.6 grams of protein per one-cup cooked serving.

Isoproturon was nationwide recommended herbicide in wheat. However, continuous reliance on isoproturon resulted in a heavy build-up of *Phalaris minor* (Malik and Singh 1995) [8]. Pinoxaden, belonging to phenylpyrazolin group with acetyl-COA-carboxylase (ACCase) has inhibiting action (Hoffer *et al*. 2006) [3].

Pinoxaden 40-60 g ha^{-1} is very effective against *Avena ludoviciana* and *Phalaris minor* without any phytotoxicity, but is ineffective against broad-leaf weeds (Chhokar *et al*., 2008) [2]. Phenoxy herbicides, such as 2, 4-D is a widely used herbicide for control of broadleaf weeds in barley after first. However, 2, 4-D use is stage specific and has use restrictions. Metsulfuron-methyl is a sulfonylurea herbicide and has both, pre and post emergence activity for control of broadleaf weeds and can suppress some annual grasses (Tewari *et al*., 1998) [13] and studies found barley can metabolize metsulfuron-methyl (Anderson *et al*. 1989) [1] thus reducing the phytotoxicity on plant. However, it has been reported that the herbicide failed to control some of the broad leaf weeds like *Fumaria parviflora* in winter cereals. Consequently, Carfentrazone-ethyl, another post-emergence herbicide which is effective against broad leaf weeds including other problematic weeds was evaluated to manage complex broad leaf weeds infestation. Carfentrazone-ethyl is a contact herbicide used to control broadleaf and sedges in cereals. It is applied as foliar spray and is absorbed through leaves. Since, no single herbicide controls all broadleaved weeds efforts should be made to use a suitable combination of more than one herbicide to combat noxious weeds and to prevent weed shift. Moreover, herbicide rotation and use of herbicide mixtures are two important strategies to prevent the development of resistant biotypes and problems of weed shift.

Material and Method

Experiment was conducted at Agriculture Research Farm RIMT University, Mandi Gobindgarh, Punjab in Rabi season of 2021. Soil of field was medium in organic carbon (0.48%), low in available nitrogen (150 kg N/ha), medium in phosphorus (18 kg P_2O_5/ha) and high in potassium (167 kg K2O/ha). The soil pH and electrical conductivity values were within normal range. The experimental site (Mandi Gobindgarh) is situated in Punjab at 30.6642° N latitude and 76.2914° E longitude at an altitude of 268 meters above mean sea level. It was located at a distance of 35 km from Patiala and 48 km from Chandigarh. The climate of the location is denominated as sub-tropical to semi-arid with hot and dry summer (April to June), hot and humid monsoon period (July to September), mild winter (October to November) and cold winter (December to February). The maximum temperature mostly overcome 40 °C during summer and the minimum temperature fall below 6 °C with some frostily spells of 8-10 days during the winter months of December and January. The average annual rainfall of Mandi Gobindgarh is 730.2 mm. Very little rainfall is received during winter months of December, January and February. Experimental Details (T1) Pinoxaden (40 g a. i ha^{-1}), (T2) Pinoxaden (40 g a. i ha^{-1}) + Metsulfuron-methyl (4 g a. i ha^{-1}), (T3) Pinoxaden (40 g a. i ha^{-1}) + Carfentrazone-ethyl (20 g a. i ha^{-1}), (T4) Carfentrazone-ethyl (20 g a. i ha^{-1}), (T5) Metsulfuron-methyl (4 g a. i ha^{-1}), (T6) Pinoxaden (40g a. i ha^{-1}) + 2, 4-D (500 g a. i ha^{-1}), (T7) 2, 4-D (500g a. i ha^{-1}), (T8) Weed Check and (T9) Weed Free. PL 807 variety of barley was used for this experiment.

Result and Discussion

The data regarding to grain yield of barley are given in table1. The different herbicide combinations had significant influence on grain yield of barley. The application of Pinoxaden @ 40g a.i ha^{-1} + Carfentrazone-ethyl @ 20g a.i ha^{-1} (T3) recorded significantly higher grain yield (4639 kg ha^{-1}) of barley which was significantly superior to all other treatments except T1, T2, T6 and T9. While, minimum seed yield (3185 kg ha^{-1}) of barley was found in weed check (T8). The increase in grain yield due to application of Pinoxaden @ 40g a.i ha^{-1} + Carfentrazone-ethyl @ 20g a.i ha^{-1} (T3) was 20.43, 18.58, 21.62 and 46.89% over T4, T5, T7 and T8, respectively. Results obtained in present investigation are strongly supported with the finding of Puniya *et al*. (2016) [9], Rana *et al*. (2016) [10], Jena *et al*. (2017) [4], Verma *et al*. (2018) [14] and Kumar *et al*. (2019) [19] in barley crop. A critical examination of data (Table. 1). It showed that different treatment combinations had significant influence on nutrient (N, P and K) content in grain and straw of barley. The significantly higher nitrogen content in grain and straw of barley was obtained with application of Pinoxaden @ 40 g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) which was closely followed by T1, T2, T6 and T9 but significantly higher than T4, T5, T7 and T8. Similarly, it was also observed from the data that the phosphorus and potassium content in grain and straw of barley was significantly increased due to application of weed management treatment. Application of Pinoxaden @ 40 g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) was recorded significantly higher phosphorus and potassium content in grain and straw of barley over T4, T5, T7 and T8 but remained at par with T1, T2, T6 and T9. A close perusal of data revealed that nutrient (N, P and K) uptake by grain and straw of barley was significantly improved with the application of all treatments of weed management. The Significantly higher nitrogen, phosphorus and potassium uptake by grain and straw of barley was recorded with the application of Pinoxaden @ 40g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) which was closely followed by Pinoxaden (40 g a.i ha^{-1}), Pinoxaden (40 g a.i ha^{-1}) + Metsulfuron-methyl (4 g a i ha^{-1}) and Pinoxaden (40 g a.i ha^{-1}) + 2, 4-D (500 g a.i ha^{-1}) and significantly higher than Carfentrazone-ethyl @ 20g a.i ha^{-1}, Metsulfuron-methyl (4g a i ha^{-1}), 2, 4-D (500 g a.i ha^{-1}) and weed check treatment. However, the minimum nitrogen, phosphorus and potassium uptake by grain and straw of barley was observed in check plot (T8). Such findings have also been reported by Kanojia and Nepalia (2006) [5], Khokhar and Nepalia (2010) [6] and Verma *et al*. (2015) [15] in Barley.

Table 1: Yield and NPK Uptake and content by barley crop and influenced by various weed management treatments.

S. No.	Treatment	Grain yield (q/ha)	Nutrient content in Barley grain (%)			Nutrient Uptake by Barley grain		
			N Content	P Content	K Content	N Content	P Content	K Content
T1	Pinoxaden (40 g a. i ha-1)	42.67	1.60	0.536	0.482	68.35	33.69	20.56
T2	Pinoxaden (40 g a. i ha^{-1}) +Metsulfuron-methyl (4g a. i ha^{-1})	46.04	1.64	0.543	0.488	75.55	37.15	22.49
T3	Pinoxaden (40 g a. i ha^{-1}) +Carfentrazone-ethyl (20 g a. i ha^{-1})	46.39	1.66	0.546	0.490	76.94	37.90	22.75
T4	Carfentrazone-ethyl (20 g a. i ha^{-1})	38.85	1.44	0.481	0.432	55.71	27.53	16.82
T5	Metsulfuron-methyl (4g a. i ha^{-1})	39.46	1.46	0.485	0.436	57.64	28.22	17.24
T6	Pinoxaden (40 g a. i ha^{-1}) + 2, 4-D(500 g a. i ha^{-1})	45.70	1.62	0.540	0.485	73.82	36.54	22.17
T7	2, 4-D(500 g a. i ha^{-1})	38.48	1.42	0.478	0.425	54.73	26.90	16.39
T8	Weed Check	31.85	1.28	0.425	0.377	40.76	19.80	12.01
T9	Weed Free	46.79	1.67	0.552	0.492	78.39	38.82	22.98
S.Em±		171	0.04	0.014	0.013	3.72	2.06	1.06
CD(P = 0.05)		513	0.13	0.042	0.039	11.16	6.17	3.17

Conclusion

On the basis of field experiment conducted during rabi season 2021-2022 following conclusion could be drawn. Marked rise in grain, straw yield was obtained with application of different herbicide treatment. The application of Pinoxaden @ 40 g a.i ha^{-1} + Carfentrazone-ethyl @ 20 g a.i ha^{-1} (T3) recorded significantly higher grain yield of barley which was significantly superior to all other treatments except T1, T2, T6 and T9. While, minimum grain yield was recorded in weedy check plot. The harvest index of barley was not influenced significantly due to various treatment combinations.

References

1. Anderson JJ, Priester TM, Shalaby LM. Metabolism of metsulfuron-methyl in wheat and barley. Journal of Agricultural and Food Chemistry. 1989;37:1429-1434.
2. Chhokar RS, Singh S, Sharma RK. Herbicides for control of isoproturon- resistant little seed canary grass (Phalaris minor) in wheat. Crop Protection. 2008;27(3):719-726.
3. Hoffer U, Muehlebach M, Hole S, Zoschke A. Pinoxaden– for broad spectrum grass weed management in cereal crops. Journal of Plant Disease and Protection 2006;20(5):989-995.
4. Jena T, Singh RK, Bisen N. Surfactant influence on efficacy of herbicides in barley. Indian Journal of Weed Science. 2018;50(1):56-58.
5. Kanojia Y, Nepalia V. Effect of chemical weed control on nutrient uptake by wheat and associated weeds. Agricultural Science Digest. 2006;26:141-143.
6. Khokhar AK, Nepalia V. Effect of herbicides and nutrient management on weed flora, nutrient uptake and yield of wheat (*Triticum aestivum*) under irrigated conditions. Indian Journal of Weed Science. 2010;42:14-18.
7. Kumar S, Vivek Rana NS, Kumar R, Naresh RK, Dhyani BP. Effect of Weed and Nutrient Management on the Growth and Yield of Barley (*Hordeum vulgare* L.) and Associated Weeds. International Journal of Current Microbiology and Applied Sciences. 2019;8(02):993-1001.
8. Malik RK, Singh S. Little seed canary grass (*Phalaris minor*) resistance to isoproturon in India. Weed Technology. 1995;9(3):419-425.
9. Puniya MM, Yadav SS, Bajya DR, Kumar A. Influence of weed management and nitrogen fertilization on weed dynamics, nutrient depletion by weeds, productivity and profitability of barley (*Hordeum vulgare*) in hot semi–arid region of western India. Indian Journal of Agricultural Sciences. 2016;86(9):1151-1157.
10. Rana MC, Rajni Sharma, Rana SS. Evaluation of Combinations of Herbicides to Manage Mixed Weed Flora in Wheat. International Journal of Advances in Agricultural Science and Technology. 2016;3(6):40-48.
11. Sakata T, Takahashi H, Nishiyama I, Higahsitani A. Effect of high temperature on the development of pollen mother cells and microspores in barley (*Hordeum vulgare* L.). Journal on Plant Research. 2000;113(5):395-402.
12. Shahbandeh M. Barley production worldwide 2008/2009-2021/2022. Statista Research Department; c2022.
13. Tewari AN, Rathi SK, Singh B. Efficacy of metsulfuron methyl on associated weeds in wheat (*Triticum aestivum*). Indian J Agric. Sci. 1998;68:121e122.
14. Verma G, Vivek RK, Jat L, Sachan DK, Tiwari R. Effect of weed management on weed dynamics, growth and yield of barley (*Hordeum vulgare* L.) under inceptisol of western Uttar Pradesh. International Journal of Chemical Studies. 2018;6(6):249-259.
15. Verma SK, Singh SB, Prasad SK, Meena RN, Meena RS. Influence of irrigation regimes and weed management practices on water use and nutrient uptake in wheat (*Triticum aestivum* L. Emend. Fiori and Paol.). Bangladesh Journal of Botany. 2015;44(3):437-442.