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Nutrient uptake studies in barley (*Hordeum vulgare* L.) under the influence of weed control treatments and nitrogen levels

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Abstract
Results of field experiment carried out during *rabi* 2017-18 and 2018-19 at Instructional Farm, Rajasthan College of Agriculture, Udaipur, indicated various weed-management treatments significantly enhanced N, P and K uptake by barley (*Hordeum vulgare* L.) and reduced removal of nutrients by weeds as compared to weedy check at harvest. After weed free treatment maximum saving of 89.03 % nitrogen, 89.52% phosphorus and 90.21 potassium was achieved with tank mixture of pinoxaden 40.0 g ha^{-1} and carfentrazone ethyl 20.0 g ha^{-1} 35 DAS (W$^{5)}$. This treatment gave 20.43% and 20.73% more grain and straw yield, respectively, on pooled basis compared to weedy check, which was followed by tank mixture of pinoxaden 40.0 g ha^{-1} and metsulfuron methyl 4.0 g ha^{-1} 35 DAS (W_4). The yield as well as uptake of N, P and K by the crop were maximum with 90 Kg N ha^{-1} which was statistically at par with 75 Kg N ha^{-1}.

Keywords: Pinoxaden, Carfentrazone ethyl, Metsulfuron methyl, Barley, weeds

Introduction
Barley is an important cereal crop of Rajasthan during *rabi* season. Competition from weeds throughout the crop season reduces barley crop yield by 53.9% depending upon time and intensity of weed infestation (Ram and singh, 2009) [8]. Hand-weeding was formerly the most widely used and effective method of weed control, but this practice has been abandoned because it is no longer economical (Pandey *et al*., 2007) [7]. Phenoxy herbicides, such as 2, 4-D had been widely used herbicide for control of broad-leaf weeds in barley. However, 2, 4-D use is stage specific and has use restrictions, especially if broad-leaf crop is planted in nearby fields (Swan, 1975) [12]. On the other hand resistance of *Phalaris minor* to isoproturon is the most serious case of herbicide resistance (Malik and Singh, 1995) [5]. Therefore, herbicides with alternate mode of action are required to control weeds in barley. Since, no single herbicide controls either all broad-leaf weeds or grassy weeds, hence 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. Another limiting factor in low production of barley is suboptimal application of nitrogenous fertilizer. As factor productivity of cereal crops is declining therefore more inputs are needed to obtain the same yield. Along with it a sizable quantity of nitrogen is taken away by weeds thus it is imperative to use higher doses of nitrogen. In view of these facts present investigation was the reforms undertaken to study the extent of nutrient depletion by crop and weeds under various weed management treatments and nitrogen levels and to minimize these losses by controlling weeds.

Materials and Methods
The experiment was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur during *rabi* season of 2017-18 and 2018-19. The experimental soil was clay loam, slightly alkaline, medium in available nitrogen and phosphorus and high in potassium. The experiment consisted of 8 weed-management treatments, *viz.* metsulfuron-methyl 4.0 gha^{-1} (W_1), carfentrazone-ethyl 20.0 g ha^{-1} (W_2), pinoxaden 40.0 g ha^{-1} (W_3), tank mixture of pinoxaden 40.0 g ha^{-1} + metsulfuron-methyl 4.0 g ha^{-1}(W_4), tank mixture of pinoxaden 40.0 g ha^{-1} + carfentrazone-ethyl 20.0 g ha^{-1} (W_5), tank mixture of metsulfuron-methyl 4.0 g ha^{-1}+ carfentrazone-ethyl 20.0 g ha^{-1} (W_6) all applied at 35 DAS, weed free (W_7) and weedy

Check (W_8) in main plots and 3nitrogen levels *viz.* 60 kg N ha^{-1} (N_1), 75 kg N ha^{-1} (N_2) and 90 kg N ha^{-1} (N_3) in subplots. The experiment was laid out in split plot design with 3 replications. Barley variety "RD 2035" was sown at 22.5 cm row spacing using 100 $kgha^{-1}$ seed on 15^{th} and 19^{th}November and harvested on 12 and 23march in respective seasons. Application of 60 kg N and 20 kg P_2O_5 ha^{-1} was done through Urea and DAP, respectively, as recommended dose of fertilizer. As per treatment, full dose of phosphorus and 1/2 dose of nitrogen was applied through DAP and urea, respectively (after adjusting the amount of N available through DAP) at the time of sowing by drilling in furrows 5 cm below the seeding depth. The remaining ½ dose of nitrogen was applied through urea as topdressing in two equal splits *i.e.* at first and second irrigation. The size of the gross and net plots were 5.0 m x 3.15 m and 4 m x2.7mrespectively. As per treatment, herbicides (metsulfuron-methyl, carfentrazone-ethyl and pinoxaden) were sprayed 35DAS, when there was sufficient moisture in the soil. Yield data on crops and dry weight of weeds were recorded at harvest. Observations on various parameters were taken following standard procedures.

Result and Discussion

In two years field study, barley was mainly infested with mixed flora of narrow and broad-leaved weeds *viz*. *Phalaris minor* Retz, *Avena fatua* (L.), *Cynodon dactylon* (L.) Pers., *Cyperusrotundus* (L.) among narrow-leaved weeds & *Chenopodium album*, *Chenopodium murale, Convolvulus arvensis* (L.), *Fumaria parviflora* Lam., *Melilotus indica* (L.) and *Anagalis arvensis* (L.) among broad-leaved weeds.

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Dry matter of weeds

Pooled data (Table 1) revealed that all the weed- management treatments significantly reduced dry matter of narrow leaved, broad leaved and total dry matter of weeds compared to weedy check. Tank mixture of pinoxaden 40.0 g ha^{-1} + carfentrazone-ethyl 20.0 g ha^{-1}(W_5) recorded the minimum total weed dry matter (14.99 g/m^2) after weed free treatment (13.33 g/ m^2), however its effect was statistically at par with tank mixture of pinoxaden 40.0 g ha^{-1} + metsulfuron-methyl 4.0 g ha^{-1} (W_4) (16.35g/ m^2). Maximum total weed dry matter (132.11 g /m^2) was recorded in weedy check. Moreover both these treatments (W_5 and W_4) were found significantly superior to rest of the weed control treatments in reducing the total dry matter of weeds. The better weed control under these treatments ($W_5$and W_4) was because of the reason that tank mix application of herbicides with different modes of action controlled the broad spectrum of weeds *i.e*. both narrow and broad leaved weeds. The results corroborated with the findings of Khippal *et al.* (2016) [3] and Singh *et al.* (2017) [10]. Amongst the various nitrogen levels, significant increase in dry matter of both broad and narrow leaved weeds as well as total weeds at harvest was recorded at 75 Kg N ha^{-1}, however further increase in nitrogen levels could not produce perceptible results. The maximum total weed dry matter of 51.36 g/m^2 was recorded under N_3 (90 kg N ha^{-1}) which was statistically at par with $N_2$75 Kg N ha^{-1}i.e. (49.83 g/m^2) and minimum total weed dry matter was recorded under N_1 i.e. 60 Kg N ha^{-1}(45.90g/m^2). Significant increase in weed dry matter with increase in nitrogen levels may be ascribed to the fact that increasing nitrogen levels provides greater amount of nutrients to weeds which perhaps might have resulted into better growth of weeds and reflected into more dry matter accumulation by them. The observed relationship corroborate with the findings of Upasani *et al*., (2013) [13] and Kumar and Jha (2016) [4].

Grain, Stover and biological yield

All the weed management treatments significantly increased grain, straw and biological yields compared to weedy check on pooled basis (Table 1). After weed free treatment the pronounced effect of increased yield was observed with tank mixture of pinoxaden 40.0 g ha^{-1} + carfentrazone-ethyl 20.0 g ha^{-1} (W_5). This resulted in increase in grain, straw and biological yield by 25.65%, 26.17% and 25.97%, respectively compared to the corresponding weedy check treatments. The increase in yield under various weed management treatments may be attributed to significant reduction in weed dry matter (Table 1) thereby reduction in crop-weed competition which provided congenial environment to the crop for better expression of vegetative and reproductive potential. Application of 90 kg N ha^{-1} gave the highest grain (4318 kg/ha), straw (6841 kg/ha) and biological (11159 kg/ha) yields which was statistically at par with 75 Kg N ha^{-1} (grain (4238 kg/ha), straw (6710 kg/ha) and biological (10948 kg/ha) yields). The respective increase in grain, straw and biological yield under N_2 (75 Kg N ha^{-1}) was 7.13, 7.11 and 7.12 % compared to the lowest yield levels being recorded under 60 Kg N ha^{-1}. The observed increase in grain yield is a complex entity, appears to be on account of beneficial effect of N nutrition in exploiting inherent potential of the crop for vegetative and reproductive growth. The significant increase in straw yield due to nitrogen fertilization may be ascribed to its direct influence on dry matter accumulation per meter row length at various stages of crop growth and indirectly increased vegetative and reproductive parameters. Biological yield is a function of grain and straw yield. Thus, significant increase in biological yield with the application of 75 kg N ha^{-1} could be ascribed to significant increase in grain and straw yield. The results are in close conformity with the findings of Singh *et al.* (2012) [9] and Awasthi *et al.* (2017) [1].

Nutrient uptake by crop

All the weed management treatments significantly enhanced N, P and K uptake by grain, straw as well as total uptake of these nutrient by the crop over weedy check (Table 2). The highest N, P and K uptake by the grain (77.27, 19.73 and 20.93 kg/ha), straw (34.78, 12.06 and 110.34kg/ha) and total uptake 112.05, 31.78 and 131.27kg/ha) by the crop was recorded with tank mixture of pinoxaden 40.0 g ha^{-1} + carfentrazone-ethyl 20.0 g ha^{-1} (W_5) after weed free treatment which was closely followed by tank mixture of pinoxaden 40.0 g ha^{-1} + metsulfuron -methyl4.0 g ha^{-1} (W_4). This may be ascribed to decreased crop weed competition which had concurrently increased in nutrient availability, better crop growth and higher crop biomass production coupled with more nutrient content. The results confirm the findings of Devi *et al.* (2017) [2] and Singh *et al*. (2015) [10]. The highest total uptake of nitrogen (98.23kg/ha), phosphorus (28.50kg/ha) and potassium (115.11kg/ha) were recorded under N_3 (90 Kg N ha^1) which was statistically at par with N_2 (75 Kg N ha^{-1}) compared with lowest (87.16, 25.66 and 103.26kg/ha respectively) recorded under N_1 treatment. The nutrient uptake by the crops is mainly the function of crop yield. Therefore, considerable increase in N, P and K uptake by crop was attributed to higher grain and stover yield at higher nitrogen levels. The results are in close conformity with the findings of Mal *et al.* (2014) [6].

Table 1: Effect of weed control and nitrogenlevelson dry matter of weeds and yield at harvest (pooled data of 2 years)

	Weed dry matter (gm^{-2})			Yield (Kg ha^{-1})		
Treatment	**Narrow leaved**	**Broad leaved**	**Total**	**Grain**	**Straw**	**Biological**
Weed management						
Metsulfuron methyl 4.0 g ha^{-1} (W_1)	42.16	11.48	53.64	4068	6110	10178
Carfentrazone ethyl 20.0 g ha^{-1} (W_2)	42.10	11.26	53.36	4120	6342	10463
Pinoxaden 40.0 g ha^{-1} (W_3)	13.22	87.91	101.12	3868	6492	10360
Pinoxaden 40.0 g ha^{-1} + Metsulfuron methyl 4.0 g ha^{-1} (W_4)	8.78	7.57	16.35	4348	6767	11116
Pinoxaden 40.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1} (W_5)	7.59	7.40	14.99	4557	7296	11853
Metsulfuron methyl 4.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1}(W_6)	42.06	6.86	48.91	4181	6708	10889
Weed free(W_7)	6.91	6.42	13.33	4598	7340	11938
Weedy check(W_8)	43.91	88.20	132.11	3626	5783	9409
SEm±	0.79	0.62	1.10	97	158	201
CD (P=0.05)	2.30	11.48	3.18	280	456	583
Nitrogen (kg ha^{-1})						
60	19.70	26.20	45.90	3956	6264	10220
75	22.22	27.60	49.83	4238	6710	10948
90	23.35	28.50	51.36	4318	6841	11159
SEm±	0.43	0.32	0.54	44	82	92
CD (P=0.05)	1.21	0.92	1.54	125	231	259

Table 2: Effect of weed control and nitrogenlevelon nutrient uptake by weeds at harvest (pooled data of 2 years)

Nutrient uptake by weeds at harvest (Kg ha^{-1})									
	Nitrogen			**Phosphorus**			**Potassium**		
Weed management	**Narrow leaved**	**Broad leaved**	**Total weeds**	**Narrow leaved**	**Broad leaved**	**Total weeds**	**Narrow leaved**	**Broad leaved**	**Total weeds**
Metsulfuron methyl 4.0 g ha^{-1} (W_1)	4.704	1.506	6.210	0.688	0.239	0.927	1.858	1.160	3.017
Carfentrazone ethyl 20.0 g ha^{-1} (W_2)	4.682	1.476	6.158	0.681	0.232	0.913	1.840	1.135	2.975
Pinoxaden 40.0 g ha^{-1} (W_3)	1.475	11.551	13.026	0.221	1.861	2.082	0.589	8.918	9.507
Pinoxaden 40.0 g ha^{-1} + Metsulfuron methyl 4.0 g ha^{-1} (W_4)	0.976	0.994	1.970	0.139	0.153	0.292	0.377	0.759	1.136
Pinoxaden 40.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1} (W_5)	0.844	0.966	1.810	0.120	0.150	0.271	0.326	0.742	1.069
Metsulfuron methyl 4.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1} (W_6)	4.689	0.899	5.588	0.669	0.142	0.811	1.817	0.690	2.506
Weed free (W_7)	0.772	0.845	1.617	0.111	0.132	0.243	0.298	0.643	0.942
Weedy check (W_8)	4.912	11.598	16.510	0.733	1.853	2.586	1.944	8.976	10.920
SEm±	0.088	0.087	0.134	0.013	0.012	0.019	0.035	0.055	0.071
CD (P=0.05)	0.255	0.252	0.388	0.037	0.034	0.055	0.101	0.159	0.206
Nitrogen (kg ha^{-1})									
60	2.517	3.399	5.917	0.362	0.534	0.896	0.943	2.677	3.620
75	2.848	3.709	6.557	0.418	0.593	1.011	1.139	2.837	3.976
90	2.979	3.829	6.737	0.438	0.611	1.038	1.182	2.920	4.077
SEm±	0.047	0.043	0.065	0.008	0.007	0.010	0.019	0.031	0.036
CD (P=0.05)	0.133	0.122	0.182	0.022	0.020	0.029	0.053	0.087	0.103

Table 2: Effect of weed control and nitrogenlevelson nutrient uptake by barley at harvest (pooled data of 2 years)

Nutrient uptake by barley at harvest (Kg ha^{-1})									
	Nitrogen			**Phosphorus**			**Potassium**		
Weed management	**Grain**	**Straw**	**Total**	**Grain**	**Straw**	**Total**	**Grain**	**Straw**	**Total**
Metsulfuron methyl 4.0 g ha^{-1} (W_1)	58.81	25.21	84.03	16.01	9.27	25.28	16.78	82.50	99.28
Carfentrazone ethyl 20.0 g ha^{-1} (W_2)	64.00	26.51	90.51	17.21	10.08	27.29	17.29	87.18	104.47
Pinoxaden 40.0 g ha^{-1} (W_3)	53.40	26.24	79.64	14.87	9.62	24.49	15.63	85.70	101.33
Pinoxaden 40.0 g ha^{-1} + Metsulfuron methyl 4.0 g ha^{-1} (W_4)	71.32	30.15	101.48	18.31	10.83	29.14	19.84	101.50	121.34
Pinoxaden 40.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1} (W_5)	77.27	34.78	112.05	19.73	12.06	31.78	20.93	110.34	131.27
Metsulfuron methyl 4.0 g ha^{-1} + Carfentrazone ethyl 20.0 g ha^{-1} (W_6)	68.07	28.27	96.34	17.08	10.45	27.53	17.28	90.68	107.96
Weed free (W_7)	79.12	35.17	114.29	20.14	12.16	32.30	21.64	113.77	135.41
Weedy check (W_8)	49.36	21.57	70.93	12.70	7.97	20.68	13.06	67.35	80.41
SEm±	1.62	0.77	2.01	0.39	0.29	0.55	0.44	2.53	2.73

CD (P=0.05)	4.70	2.24	5.83	1.13	0.84	1.59	1.26	7.32	7.91
Nitrogen (kg ha^{-1})									
60	60.82	26.34	87.16	16.02	9.64	25.66	16.67	86.59	103.26
75	66.45	29.13	95.58	17.30	10.47	27.77	18.15	94.02	112.18
90	68.24	29.99	98.23	17.70	10.80	28.50	18.60	96.52	115.11
SEm±	0.71	0.37	0.80	0.18	0.14	0.22	0.19	1.20	1.22
CD (P=0.05)	2.02	1.06	2.26	0.50	0.39	0.63	0.52	3.39	3.46

Nutrient removal by weeds

All the weed management treatments resulted into significant reduction of nutrient removal by narrow leaved, broad leaved and total uptake of these nutrient by the weeds compared to weedy check. After weed free treatment the least drain of total N (1.810 kg/ha), P (0.271kg/ha) and K(1.069kg/ha)by weeds were observed in tank mixture of pinoxaden 40.0 g ha^{-1} + carfentrazone-ethyl 20.0 g ha^{-1} (W_5) treatment which was closely followed by tank mixture of pinoxaden 40.0 g ha^{-1} + metsulfuron -methyl4.0 g ha^{-1} (W_4) (Table1), while the maximum removal of nutrients (16.510 kg N, 2.586 kg P and 10.920 kg K/ha) was observed under weedy check. Significantly higher removal of N, P and K by narrow leaved, broad leaved and total uptake of these nutrient by the weeds were observed under $N_2$and N_3compared to N_1.Profound effect of different nitrogen levels on weed growth, development and nutrient drain has been also reported by Upasani *et al*., (2013) [13] and Kumar and Jha (2016) [4] The uptake of N and P by the crop and weeds could be mainly attributed to the extent of their dry matter production. It is apparent from table 1 and 2 that whenever the removal of nutrients by weeds was more, corresponding uptake by the crop was less and vice-versa. Therefore, for efficient utilization of applied nutrients the weeds should be kept under control.

References

1. Awasthi UD, Singh SP, Mishra PK, Prajapati B, Singh A. Productivity and profitability of rainfed barley (*Hordeum vulgare*) crop as influenced by variety, fertility and moisture conservation. International Journal of Current Microbiology and Applied Sciences. 2017;6:2952-2957.
2. Devi S, Singh J, Kamboj NK, Hooda VS. Weed studies and productivity of wheat under various planting techniques and weed management practices. International Journal of Current Microbiology and Applied Sciences. 2017;6:3279-3289.
3. Khippal A, Kharub A, Kumar D, Verma A, Kumari S, Kumar Y. Pinoxaden in combination with other herbicides against complex weed flora in barley (*Hordeum vulgare* L.) International Journal of Tropical Agriculture. 2016;34(3):805-809.
4. Kumar V, Jha P. Influence of nitrogen rate, seeding rate, and weed removal timing on weed interference in Barley and effect of nitrogen on weed response to herbicides. Weed Science. 2016;65:189-201.
5. Malik RK, Singh S. Little seed canary grass (*Phalaris minor* Retz.) resistance to isoproturon in India. Weed Technology. 1995;9:419-425.
6. Mal T, Phogat SB, Kumar S, Singh B. Effect of nitrogen on yield and quality of barley (*Hordeum vulgare*) genotypes. Indian Journal of Agronomy. 2014;59(1): 171-174.
7. Pandey IB, Dwivedi DK, Pandey RK. Efficacy of herbicides and fertilizer management on weed dynamics in wheat (*Triticum aestivum* L.). Indian Journal of Agronomy. 2007;52:49-52.
8. Ram H, Singh A. Studies on Efficacy of Tank Mix Herbicides forthe Control of Weeds in Irrigated Barley (*Hordeum vulgare* L.). Indian Journal of Weed Science. 2009;41(3&4):167-171.
9. Singh R, Shyam R, Singh VK, Kumar J, Yadav SS, Rathi SK. Evaluation of bioefficacy of clodinafop-propargyl + metsulfuron-methyl against weeds in wheat (*Triticum aestivum* L.). Indian Journal of Weed Science. 2012;44(2):81-83.
10. Singh M, Singh MK, Singh SP, Sahu R. Herbicideand nitrogen application effects on weeds and yield of wheat. Indian Journal of Weed Science. 2015;47(2):125-130.
11. Singh B, Kumar M, Dhaka AK, Lamba RAS. Efficacy of pinoxaden alone and in Combination with metsulfuron-methyl and carfentrazone-ethyl against complex weed flora in barley (*Hordeum vulgare* L.). International Journal of Current Microbiology and Applied Sciences. 2017;6:134-143.
12. Swan DG. Necessity for proper timing of applications of 2, 4-D to winter wheat. Down Earth. 1975;13:23-25.
13. Upasani RR, Thakur R, Puran AN, Singh MK. Effect of nitrogen and weed control on productivity of wheat. Indian Journal of Weed Science. 2013;45(2):106-108.