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Impact of integrated nutrient management treatments on yield and uptake of nutrients by barley fodder (Hordeumvulgare L.) Crop

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Abstract

A field experiment was conducted at the agriculture research farm of R.B.S. College, Bichpuri, Agra during rabi season of 2017-18 to study the impact of integrated use of inorganic fertilizers and organic manure on yield, nutrient composition, and their uptake by barley fodder. The integrated nutrient management approach brought about a positive influence on plant growth,crop yield, nutrient content, and uptake of nutrients by barleycrops. Combined application of 75% NPK+10 t FYM ha^{-1} resulted in the highest grain (27.6%) and dry matter yield (4.75%) and uptake of nitrogen (84.07 kg ha^{-1}), phosphorus (25.65 kg ha^{-1}), and potassium (35.62 kg ha^{-1}) by barley fodder.

Keywords: Integrated nutrient management, crop yield, nutrients uptake

Introduction

Barley is the world's fourth most important cereal crop after wheat,rice, and maize. It is grown thought the temperate and tropical regions of the world. It is usually used as food for human beings and feed for animals and poultry. It is also valuable input for industries for extracting malt because of its lower cost of cultivation and low input demand. It is preferred by the resources of poor farmers in the area. Barley grain contains 12.5% moisture, 11.5% albuminoids, 70.0% carbohydrates, 1.3% fat, 3.9% crude fiber and 1.5 % minerals. Intensive agriculture involving exhaustive high-yielding varieties barley has led to heavy drawl of nutrients from the soil so. It is time to look for measures to stimulate sustainability in production in cereals on a long-term basis. The soil is not an in exhaustive source to supply nutrients regularly tothe ever-growing crops. The farm production at the present level depleted every year about 20-30 million tonnes of nutrients in addition to 8.4 million tonnes of nutrients lost through soil erosion alone. Soil fertility surveys indicate that nitrogen deficiency is universal in most Indian soils. The deficiency of phosphorus is next in order. Application of phosphorus has been avoided for a long period in many soils of the Indogenetic plains because of the miraculous nature of soil clay. Potassium is also becoming limiting in this highly productive region. At every harvest of crops deficiency of N, P, K and micro-nutrients are incurred in the soil, which needs to be augmented continuously efficient nutrient management strategies. Hence, Keeping the above aspects in view, the present study has been undertaken to find out the Impact of integrated nutrient management treatments on the yield and uptake of nutrients by barley fodder.

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Materials and Methods

A field experiment was conducted during the rabi season of 2017-18 at Agriculture Research Farm of R.B.S College, Bichpuri, Agra. The soil of the experimental field was sandy loam with pH 8.6, EC (1:2.5) 1.23 dSm^{-1}, and organic C 0.34 %, calcium carbonate 1.25%, the amount of available N,P,K, and Zn was 171,12.5,171.0, and 0.65 kg ha^{-1} respectively. The experiment was laid out in a completely randomized design (R.B.D) with four replications and seven levels of treatments. The recommended seven levels of treatment were T_1 control, T_2 10 t FYM ha^{-1}, T_3 50%

NPK recommended, T_4 50% NPK + 10 t FYM ha^{-1}, T_5 75% NPK recommended, T_6 75% NPK +10 t FYM ha^{-1}, T_7 100 % NPKrecommended. The observations such as plant height (cm), No. of leavesplant^{-1}, green fodder yield (kg ha^{-1}), and dry matter yield (kgha^{-1}) for quality purpose quality parameters i.e. crude protein % was estimated. The mechanical composition of soil sample was known by adopting the Bouyoucos hydrometer method as described by Piper (1950) and reported as a percentage.Available N, P, and K in soil was determined by adopting standard procedures. Available nitrogen in the soil sample was determined by the alkaline permanganate method of Subbiah and Asija (1956) and reported in kg ha^{-1}. The phosphorus content of the soil was estimated following Olsen et al., (1954) extraction procedure as described by Black (1965) and developing the color in the extract (Murphy and Riley, 1962) using "Spectrophotometer" for color measurement and reported as P k ha^{-1}. Availability of potash in soil sample was determined by extracting with neutral (pH 7.0) and normal (1N) ammonium acetate with the help of Flame Photometer" and reported as K in kg ha-^{1} as described by Hanway and Heidel (1952). Availability of zinc in soil sample was determined by extracting soil (10 g) with (20 ml) DTPA extractant soil (10 g) with (20 ml) DTPA extractant (0.005 M DTPA+ 0.1 M TEA +0.1 M $CaCl_2$, pH 7.3) described by Lindsay and Norvell (1978) using AAS. The finely ground plant material was then subjected to chemical analysis for nitrogen (N), phosphorus (P), and contents and uptake of these nutrients by sorghum was the workout. The nitrogen content was determined by Kjeldahl's method. Phosphorus was described by Jackson (1967). The potassium content in extract was estimated by flame photometer as described by Black (1965).

Results and Discussion

It is evident from Table 1 indicate that the plant height of Barley increased significantly with the application of various INM treatments as compared to control T_1. The treatments T_6 (66.31 cm) and T_7 (65.36 cm) proved better in comparison to the rest of the treatments concerning plant height. Irrespective of treatments, the superiority of INM treatments may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ with regards to a plant height of barley.

Table 1 reflects that INM treatments significantly increased the number of leaves/plants as compared to control (T_1). The maximum number of leaves plant^{-1} were noted under T_6 (75% NPK recommended + 10 t FYM ha^{-1}) treatments combinations. Irrespective of the treatments, the superiority of the INM treatments may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ in case of several leaves plant^{-1} of Barley fodder crop. Similar to these results by Das and Ram (2005).It is inferred from table 2 that the green fodder yield of barley was improved significantly with INM treatments. This increase in yield was significant for each level of INM treatment over control (T_1). The maximum green fodder yield was recorded with T_6 (75% NPK + 10 t FYM ha^{-1}) treatment. The increase in the green fodder yield with T_2, T_3, T_4, T_5, T_6, and T_7 was 26.6, 27.0, 27.2, 27.3, 27.6 and 26.9 percent over control, respectively. Irrespective of the treatments, the superiority of INM

Table 1: Effect of different INM treatments on plant height (cm) and the number of leaves/plant of the barley crop

Treatments	Plant height(cm)	No. of leaves plant^{-1}
T1	56.35	9
T2	58.41	10
T3	60.63	11
T4	62.41	13
T5	64.63	15
T6	66.31	17
T7	65.36	15
S.Em±	0.20	.0171
C.D. at 5%	0.57	0.49

Table 2: Effect of different INM treatments on green fodder yield and dry matter yield (q ha^{-1}) of barley

Treatments	Green fodder yield (q ha^{-1})	Dry matter yield(q ha^{-1})
T1	26.3	4.12
T2	26.6	4.23
T3	27.0	4.41
T4	27.2	4.68
T5	27.3	4.70
T6	27.6	4.75
T7	26.9	4.39
S.Em±	1.40	0.377
C.D. at 5%	3.99	1.07

treatments may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ concerningthe green fodder yield of barley. Similar results were also reported by Yaduvanshi and Sharma (2007) and Singh et al. (2008).

It is evident from table 2 that the dry matter yield of barley enhanced significantly with different INM treatments over control (T_1). The increase in the dry matter yield with T_2, T_3, T_4, T_5, T_6, and T_7 over control was 4.23, 4.41, 4.68, 4.70, 4.75, and 4.39 percent respectively. The treatment T_6 and T_7 proved better in enhancing the dry matter yield of barley. The T_6 (75% NPK + 10 t FYM ha-^{1}) treatment gave maximum dry matter yield of barley. The table 3 reflects that the nitrogen contents increased significantly with various INM treatments over control. The treatment T_6 gave a significantly better response over the rest of the treatments in the case of nitrogen content in a barley crop. The superiority of INM treatments may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ concerning nitrogen content in barley plants. It might be concluded from the above findings that nitrogen content in barley at T_6 and T_7 treatments enhanced by the application of organic with inorganic fertilizer in this investigation, maybe due to gradual mineralization formation of more humus colloidal complex coupled with higher nutrient contents along with increased moisture. The gradual release and steady supply of nutrients from humus/organics throughout the growth and development of barley crops, besides it, the nitrogen fertilization might have resulted in the utilization of carbohydrates for protein synthesis. Similar observations were also reported by Das and Ram (2005) and Brahamchariet et al. (2005).

All the INM treatments gave a significantly better response in comparison to control (T_1) in the case of phosphorus content of barley crop table 3. Overall, the treatments T_6 and T_7 proveda better response over the test of the treatments regarding phosphorus content of barley crop. Similar results were obtained by Das and Ram (2005). INM treatments affected significantly the potassium content in barley crops. The T_6 (75% NPK + 10 t FYM ha^{-1}) and T_7 (100 % recommended) treatment combinations proved significantly performance over other treatment combinations in the case of potassium content in a barley crop. Similar results were obtained by Das and Ram (2005) and Brahamchari et al. (2009). Table 4 reflects that the nitrogen utilization by barley fodder crop increased significantly by INM treatments over

Table 3: Effect of different INM treatments on nitrogen, phosphorus, and potassium content (%) ofthe barley crop.

Treatments	Nitrogen content(%)	Phosphorus content(%)	Potassium content(%)
T1	1.64	0.43	0.61
T2	1.68	0.45	0.63
T3	1.72	0.48	0.65
T4	1.75	0.51	0.66
T5	1.79	0.54	0.71
T6	1.82	0.57	0.75
T7	1.80	0.56	0.70
S.Em±	0.006	0.001	0.01
C.D. at 5%	0.04	0.006	0.04

control. The maximum increase in nitrogen uptake by barley crop was recorded with T_6 treatment.

The nitrogen uptake significantly increased with T_6 treatment over control (T_1). The superiority of these treatment combinations may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ in case of nitrogen uptake by barley fodder crop. The enhanced nitrogen content and dry matter yield due to the use of FYM coupled with inorganic fertilizer may be a possible reason for increasing nitrogen uptake by barley crops similar to these findings Nagdive et al., (2007) and Singh and Singh (2007). It is evident from table 4 that INM treatments significantly enhanced the uptake of phosphorus by Barley over control. The treatment T_6 and T_7 treatment gave significantly better results over the rest of the treatments in the case of phosphorus uptake by the Barley fodder crop. The superiority of the treatments may be arranged as $T_6>T_7>T_5>T_4>T_3>T_2>T_1$ concerning phosphorus uptake by the Barley crop. The enhanced phosphorus content and dry matter yield by using INM treatment (organic & inorganic) may be the possible season or increasing phosphorus uptake by Barley fodder crop. Similar to these findings Nagdive et al., (2007) and Singh and Singh (2007). The potassium utilization increased significantly by INM treatments over control. The maximum potassium uptake was obtained under the T_6 treatment in comparison to the rest of the treatment combinations.It may be summarized from the above findings that greater potassium content due to application of FYM and inorganic fertilizer and enhanced by matter yield of Barley crop caused the

Table 4: Effect of different INM treatments on nitrogen, phosphorus, and potassium uptake (kg ha^{-1}) by Barley crop

Treatments	Nitrogen uptake	Phosphorus uptake	Potassium uptake
T1	65.50	16.48	25.13
T2	68.94	17.76	26.64
T3	73.64	19.84	28.66
T4	79.56	22.46	30.88
T5	81.78	23.97	33.37
T6	84.07	25.65	35.62
T7	76.82	23.26	30.73
S.Em±	3.43	4.41	2.34
C.D. at 5%	9.85	12.66	6.66

greater uptake of potassium. Similar findings were drawn by Singh et al.(2007)The results obtained from the present investigation indicated that integrated treatments involving combined application of inorganic fertilizer and farmyard manure had pronounced influence in improving the crop yield status as compared to control and inorganic alone. The better production of barley fodder crop could be achieved by adopting integrated nutrient management treatment combination as 75% NPK recommended + 10 t FYM ha^{-1}.

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