EFFECT OF LEVELS OF NITROGEN AND PHOSPHORUS ON GROWTH, YIELD AND ECONOMICS OF BARLEY (*Hordeum vulgare* L.) UNDER IRRIGATED CONDITION

Gyanendra Singh Yadav[1], Deepak Pandey[2], Sudhakar Singh[3] and Swaha Shee Chanda[4]

Department of Agronomy

Chandra Bhanu Gupta Ag. Pg. College, Lucknow, Uttar Pradesh - 226201

Corresponding author: deepakpandey.agri@gmail.com

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ABSTRACT

Field trials were held during Eid 2022-23 at Shradhay Bhagwati Singh Agricultural Research Farm (Hajipur), Chandra Bhanu Gupt Krishi Snatkottar Mahavidyalaya, and BKT Lucknow (Uttar Pradesh). The treatments contain four levels of nitrogen (0, 40, 80, 120 Kg N ha-1) and four levels of phosphorus (0, 20, 40, 60 Kg P2O5 ha-1) in three thirds increments. RBD made it, and they repeated. The test region is sandy loam soil with an average organic carbon content (0.70%), nitrogen (270 kg/ha), phosphorus (27 kg/ha), and potassium (262 kg/ha). The results reveal that applying 120 kg N ha-1 to the crop is equivalent to applying 80 kg N ha-1; nevertheless, in the absence of nitrogen fertilizer, growth and yield are best. When. Rice was requested. The maximum amount of straw manure allowed is 40 kg N ha-1. Trust. More than 40 kg N per hectare. Compared to 80 kg N ha-1 and 40 kg N ha-1 without nitrogen fertilizer, the crop growth at 120 kg N ha-1 is 2.17%, 5.96%, and 14.53%, respectively. Plant development, production characteristics, yield, and nutrition are best with 60 kg ha-1 phosphorus (40 kg/ha), 20 kg P2O5 ha-1, and zero phosphorus. As nitrogen and phosphorus levels rise, so do crop yield, yield, and B:C ratios. Crops treated with 120 kg N ha-1 and 60 kg P ha-1 produced the highest yield and B:C ratios.

Key words: Barley, Economics, Growth, Nutrient Management and Yield.

INTRODUCTION

Barley (Hordeum vulgare L.) is a grass that grows in hot areas and is assumed to have originated in Southwest Asia. Barley grains are typically prepared and sprouted using traditional procedures. According to Sinebo et al. (2003), nitrogen stress accounts for approximately 65% of the variation in barley grain production. Cantero-Martínez et al. (2016) found that barley yield was 50% lower under N and P stress compared to non-stress conditions. 2016). 2003; Atlin & Frey 1989). Barley is more resilient to harsh environments like drought, salinity, and alkalinity (FAO 2002). The barley growing area in India is roughly 0.757 hectares, with an output of 1.67 million tons and an average yield of 28.05 grams per hectare. In Uttar Pradesh, barley acreage is 156.85 (0.000 ha), yield is 487.75 (0.000 tons), and average productivity is 31.09 q/ha (Anonymous, 2021). A variety of factors influence barley production and productivity, including soil, water, and crop. This comprises, among other things, the application of water and fertilizer. It is the most essential input in determining crop yield and quality. Insufficient nitrogen application will reduce crop yield and yield, while excessive nitrogen application will cause protein deficiency. These factors affect the growth and development of seeds and have an impact on crops and crops. Navi, et al. (2012). Black et al. Kuzegaran, et al. Up to 200 kg per hectare. According to Reddy and Singh (2018), the effective number of tillers increased by m-2, panicles increased by one, and yield increased to 75 kg N ha-1. The main problem with the use of phosphate fertilizer is that phosphorus is limited and accumulates in the soil, allowing plants to use only 10-25% of their phosphorus needs. The presence of phosphorus in soil is important because some phosphorus, such as calcium phytate, phospholipids, and nucleoproteins, can only be used by plants and subsequently biomineralized by the soil, but not in the soil. Phosphorus shortage is nearly universal in Indian soils. Phosphorus deficit is caused by the elimination of numerous products in intensive agriculture, as well as an inability to add organic matter to soil. Many research on barley have found that phosphorus levels increase the number of tillers per plant, seeds per bunch, and grain and straw output. Chowdhury et al. (1971); Warsi et al. Relative population lengths and body weights in the thousands were observed at both phosphorus levels. As the phosphorus level increased from 0 to 15, 30 and 45 kg ha-1, the number of mushroom spikelets and grains also increased (Ratan Singh, M. Devender Reddy, 2020).

METHODS AND MATERIALS

During the Rabbi season of 2021-2022, field trials were conducted at the Shradhay Bhagwati Singh Agricultural Research Farm in Hajipur, which is part of Chandra Bhanu Gupta Krishi Snatkottar Mahavidyalaya in Bakshi-Ka-Talab, Lucknow. The experimental site is located at 26.50° North latitude, 80.50° East longitude, and 123 meters above sea level. The soil type in the experimental region is sandy-loam with a slightly alkaline nature (pH 8.00), containing an average organic carbon level of 0.70%, nitrogen at 270 kg ha-1, phosphorus at 27 kg ha-1, and potassium at 262 kg. The study involved testing four nitrogen levels (0, 40, 80, and 120 kg N ha-1) and four phosphorus levels (0, 20, 40, and 60 kg P2O5 ha-1) in a total of 16 treatments using a randomized block design, with three replications Nitrogen and phosphate fertilizers utilize urea and superphosphate, respectively. Half of the nitrogen is applied during planting, with the other half split between the first and second irrigations. Adequate phosphorus fertilizer should be applied at planting. For potassium chloride cultivation, a potassium fertilizer dose of 40 kg K2O ha-1 is spread across the entire soil. Harvest for the "Amber (K-71)" barley variant is scheduled for November 21, 2022, between the second week of April 2023. Planting involves using 100 kg of seeds per day with a spacing of 20 cm between rows. Plant height and tillering details are noted, and plant samples are collected, dried, and stored for analysis. Harvest yields for barley grain and straw are recorded and used for various calculations. Laboratory tests ascertain nitrogen, phosphorus, and protein content. Feed consumption is determined by relating grain and straw content to the yield. Costs are calculated based on market prices, and the data collected is not statistically analyzed for multiple reasons.

RESULTS AND DISCUSSION

On Growth

The amount of nitrogen and phosphorus applied influences the plant height, number of tillers, leaf index, and dry matter of barley (Table 1). Increase nitrogen content to 120 kg Nha-1, plant height, number of tillers, leaves, and dry matter in comparison to nitrogen level. At 120 kg N ha-1, maximum plant height (89.84 cm), leaf index (4.87), number of tillers (401.24 m-2), and dry matter (782.72 g m-2). are important. Growth cannot be improved by increasing nitrogen content; This may be because increased nitrogen content leads to higher metabolism and meristem formation, thus improving cell elongation and cell division, thus increasing plant height, leaf aggregation, leaf/plant dryness problem. and crops. These results are supported by the findings of **Alghabari F and Al-Solaimani SG. Singh, K.N. and Prashad, M. (1971).** Using 60 kg Pha-1 for phosphorus is equivalent to 40 kg P2O5 ha-1, but compared to not using phosphorus, the content in the plant is higher and the tillering rate, page index and dry matter quality are also higher. higher. Also, higher. When 60 kg P2O5 ha-1 was used, the highest plant height (87.84 cm), leaf index (4.84), number of tillers (403.97m-2) and dry matter (789.45g m-2) were obtained. The positive effect of phosphorus fertilizer on growth may be due to its role in many enzymatic reactions in different parts of the plant, resulting in higher efficiency in growth (such as hormones and protein synthesis) and metabolism of photosynthetic products. Ali et al. (2020) also obtained similar results.

Table 1. Growth Parameters of barley as affected by levels of nitrogen and phosphorus

Treatments	Plant height	Numbers of effective tillers (m^{-2})	Dry matter accumulation ($g\ m^{-2}$)	Leaf area index
		N levels (kg/ha)		
N_0 - 0	58.93	308.70	652.05	3.79
N_1 - 40	73.43	338.90	716.23	4.33
N_2 - 80	77.28	374.79	745.25	4.57
N_3 - 120	89.84	401.24	782.72	4.87
SEm±	1.35	6.33	12.45	0.08
CD (0.05)	3.92	18.30	35.98	0.23
		P_2O_5 levels (kg/ha)		
P_0 - 0	60.94	311.61	649.63	3.83
P_1 - 20	71.50	339.34	711.05	4.39
P_2 - 40	77.50	368.89	746.12	4.50
P_3 -60	87.84	403.97	789.45	4.84
SEm±	1.359	6.33	12.45	0.08
CD (0.05)	3.92	18.30	35.98	0.23

Yield attributes

The impact of nitrogen and phosphorus on various aspects such as the number of tillers per square meter, ear length in centimeters, grain per ear, weight of grain per year in grams, and total weight in grams was notable. Notably, when 120 kg of nitrogen per hectare was applied, the most significant factors contributing to the highest grain yield included tillers (401.24 m-2), panicle length (8.85 cm), grain per cluster (39.89), weight of each grain in a cluster (1.45 g), and the resulting total weight (40.33 g). The increase in production with increasing nitrogen content may be due to the increase in nitrogen, which causes the production of photosynthates and their transformation into water sinks, thereby increasing the production. Columbus et al. (2000) reported that the increase in panicle length may be due to better nutrition of panicle primordia and higher nitrogen utilization for crop growth. Increased nitrogen supply improves the performance of the spikelet and increases the transfer of assimilates to the tank. Huseyin et al. (2012) reported an increase in grain weight due to better nutrition and nitrogen fertilization at harvest, which in turn affected carbohydrate supply to the seeds. It was found that ear length (cm), core/ear, weight/ear (g) and thousand kernel weight (g) conditions were better than other methods. When 60 kg P2O5 ha-1 was used, maximum panicle length (8.84 cm), number of grains/clusters (39.40), grain weight/number of clusters (1.46 g) and thousand grain weight (39.82 g) were recorded. The beneficial effect of phosphorus application on growth may be due to its role in growth, such as in many enzymatic reactions, hormone production and protein synthesis, as well as its role in the conversion of photosynthetic material from the surface to the sink, resulting in many products. . . Ali et al. (2020) also obtained similar results.

Table 2. Yield attributes of barley as affected by levels of nitrogen and phosphorus

Treatments	Length of spike (cm)	Grains /spike	Grain weight /spike (g)	1000 grain weights (g)
		N levels (kg/ha)		
N_0 - 0	7.36	32.57	1.16	32.57
N_1 - 40	7.84	34.33	1.27	35.30
N_2 - 80	8.23	36.78	1.38	37.90
N_3 - 120	8.85	39.89	1.45	40.33
SEm$\pm$	0.140	0.616	0.023	0.64
CD (0.05)	0.44	0.77	0.067	1.84
		P_2O_5 levels (kg/ha)		
P_0 - 0	7.38	31.10	1.15	33.03
P_1 - 20	7.82	34.87	1.28	35.53
P_2 - 40	8.24	37.20	1.37	37.73
P_3 -60	8.84	39.40	1.46	39.82
SEm$\pm$	0.140	0.616	0.023	0.64
CD (0.05)	0.404	1.77	0.067	1.84

Yield studies

Compared with other nitrogen fertilizer applications, application of 0-120 kg ha-1 nitrogen fertilizer can increase height yield (q ha-1), straw yield (q ha-1) and biological performance (q ha-1). Maximum yield: Crop yield (32.85 q ha-1), straw yield (45.52 q ha-1) and total biomass yield (78.30 q ha-1) compared to residual nitrogen per 120 kg N Ha-1 It was high. But it is the same as 80 kg ha-1. Crop yield (28.68 q ha-1), straw yield (41.81 q ha-1) and total crop yield (70.42 q ha-1) were the lowest during nitrogen deficiency. Application of 0-60 kg P2O5 ha-1 phosphorus significantly increased grain, straw and biomass yield compared to other phosphorus levels. When 60 kg P ha-1 was applied, grain yield (33.57q ha-1), straw yield (47.59q ha-1) and total organic matter (81.19q ha-1) were higher than other phosphorus (except 40). Kilogram). In the absence of phosphorus, crop yield (27.90q ha-1), straw yield (39.77q ha-1) and biological material (67.67q ha-1) were lowest.

Table 3. Grain yield (q ha^{-1}), straw yield (q ha^{-1}), total biological yield (q ha^{-1}), harvest index (%) as affected by levels of nitrogen and phosphorus

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Total Biological Yield (q ha^{-1})	Harvest index (%)
		N levels (kg/ha)		
N_0 - 0	28.68	41.81	70.42	40.68
N_1 - 40	31.00	44.40	75.44	41.09
N_2 - 80	32.15	45.35	77.53	41.46
N_3 - 120	32.85	45.52	78.30	41.91
SEm±	0.55	0.79	1.29	0.70
CD (0.05)	1.60	2.99	3.74	NS
		P_2O_5 levels (kg/ha)		
P_0 - 0	27.90	39.77	67.67	41.22
P_1 - 20	30.60	43.53	74.07	41.23
P_2 - 40	32.60	46.19	78.76	41.34
P_3 -60	33.57	47.59	81.19	41.37
SEm±	0.557	0.79	1.29	0.70
CD (0.05)	1.60	2.99	3.74	NS

Nutrient uptake

Different nitrogen and phosphorus contents have a significant impact on data such as nitrogen content (%), absorption (kg ha-1) and protein content (%) in rice and straw. Nitrogen content (%) decreased with increasing nitrogen concentration and was recorded more in the nitrogen-free treatment (control) and decreased with increasing nitrogen. In comparison, nitrogen adsorbed by grains and straw increased with nitrogen content, but nitrogen adsorbed by grains and straw was the highest (49.07 kg N ha-1) and nitrogen adsorbed by straw (23.13 kg N ha-1). 1) It is 120 kg N. ha-1 respectively. In case of no nitrogen application (control), grains have the lowest nitrogen uptake (40.37 kg N ha-1) and straw has the lowest nitrogen uptake (20.2 kg N ha-1). The increase in nitrogen and phosphorus content causes the nitrogen content (%) in rice and straw to decrease. The main reason for this is the increase in dry matter, which will create a nitrogen effect. However, the high nitrogen content (%) in wheat and straw, which have low nitrogen content, is due to the dry matter. Likewise, Mina et al. Wilcox (1929) said that nitrogen concentration is inversely proportional to the dryness of the crop. Phosphorus absorption of wheat and straw is highest when below 60 kg P2O5 ha-1, and highest when 40 kg P2O5 ha-1, 20 kg P2O5 ha-1 and 0 kg P2O5 ha-1. The higher phosphorus uptake of 60 kg N ha-1 is mainly due to higher crop and hay yield. Similarly, Singh and Singh (2005) reported that phosphorus uptake of rice and straw also increased when the phosphorus content increased.

Table 4. Nutrient uptake (kg/ha) of barley as affected by levels of nitrogen and phosphorus

Treatments	**N Content (%) in grain and straw**		**N Uptake (kg/ha) through grain and straw**	
	N grain	N straw	N grain	N straw
N_0 - 0	1.49	0.51	40.37	20.2
N_1 - 40	1.47	0.50	44.99	21.92
N_2 - 80	1.44	0.49	47.62	22.81
N_3 - 120	1.40	0.47	49.07	23.13
SEm±	0.026	0.009	0.79	0.394
CD (0.05)	0.076	0.026	2.29	1.13
	P grain	P straw	P grain	P straw
P_0 - 0	1.48	0.50	39.88	19.31
P_1 - 20	1.47	0.50	44.38	21.46
P_2 - 40	1.45	0.49	47.99	23.12
P_3 -60	1.42	0.48	49.80	23.98
SEm±	0.026	0.009	0.79	0.394
CD (0.05)	0.076	0.026	2.29	1.13

Economics

Table 5 presents financial data for various treatment combinations. Increase in nitrogen content increases total revenue, profit and benefit-cost ratio. (N0P0) Combined treatment had the lowest income (Rs. 64,326 ha-1), income (Rs. 29,326 ha-1) and benefit: cost ratio (0.83). The combination of Nitrogen N3 -120 kg N ha-1 and Phosphorus P3 -60 kg P2O5 ha-1 (N3P3) provided the highest income (Rs. 96,698 ha-1) and the highest income (Rs. 54,324.94 ha-1). 1 rupee). BCR (1.28) because this treatment has lower conversion rates and better outcomes than other treatments.

Table 5. Economics of barley crop as affected by levels of nitrogen and phosphorus

Treatment combination	**Gross return (Rs. /ha)**	**Net return (Rs. /ha)**	**Benefit cost ratio (B:C)**
N_0P_0	64326.00	29326.00	0.83
N_0P_1	71118.00	33868.00	0.90
N_0P_2	77301.00	37801.00	0.95
N_0P_3	84024.35	42274.35	1.01
N_1P_0	71918.00	36364.80	1.02
N_1P_1	79457.00	41726.20	1.10
N_1P_2	85440.00	45399.00	1.13
N_1P_3	90680.00	48338.80	1.14
N_2P_0	74374.50	38292.00	1.06
N_2P_1	82385.50	44053.46	1.15
N_2P_2	89131.50	48549.46	1.19
N_2P_3	94210.80	52109.26	1.21
N_3P_0	74825.50	40302.44	1.10
N_3P_1	87414.50	48541.00	1.24
N_3P_2	92997.00	51873.94	1.26
N_3P_3	96698.00	54324.94	1.28

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