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Ravi Mishra
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Joy Dawson
Professor and Head Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Ravi Mishra
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Effect of nutrient on growth and yield of buckwheat (*Fagopyrum esculentum* L.)

Ravi Mishra and Joy Dawson

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Abstract
The experiment was conducted during the *Rabi* season, 2024, at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, to study the "Effect of Nutrient on Growth and Yield of Buckwheat (*Fagopyum esculentum* L.) The treatments consist of different levels of Nitrogen (30, 40, 50) kg/ha through Phosphorus (15, 20, 25) kg/ha and Sulphur (20) kg/ha will be constant. The result reported that treatment 4 [Nitrogen 40 kg/ha + Phosphorus 15 kg/ha] significantly influenced the highest plant height (51.10 cm), maximum plant dry weight (5.79) g, and maximum number of achene/plant (47.20). It is also observed that the maximum seed yield (1.77) t/ha and maximum stover yield (4.33) t/ha were obtained with the application of [Nitrogen 40 kg/ha + Phosphorus 15 kg/ha]. However, the maximum gross return (106280.95 INR/ha), net return (60672 INR/ha) and benefit cost ratio (1.33) were also obtained under the use of [Nitrogen 40 kg/ha + Phosphorus 15 kg/ha].

Keywords: Economics, growth parameters, nitrogen, buckwheat, yield attributes

1. Introduction

The common buckwheat (Fagopyrum esculentum Moench; 2n = 2x = 16) is classified as a pseudo-cereal within the Polygonaceae family and holds significant importance in mountainous areas. This grain, which originated in the temperate regions of Central Asia, is cultivated over approximately 2.04 million hectares worldwide, yielding around 2.4 million tonnes each year, with an average production of 1000 kg per hectare. The main regions for buckwheat cultivation are located in the temperate zones of the Northern Hemisphere, particularly in Russia. Furthermore, it is also cultivated in various countries, including the United States, Canada, France, Germany, the United Kingdom, and several others across Europe, Asia, and beyond. Notably, Asian countries like India use buckwheat for both human consumption and animal feed.

Buckwheat is a nutrient-dense grain, comprising approximately 12% digestible protein, 2% fat, 70% starch, and 0.5% sugar. Its protein composition includes glutenins and globulins, while its fruits promote digestive health due to the presence of citric, oxalic, and malic acids. Moreover, buckwheat is a remarkable source of vital nutrients such as calcium, phosphorus, iron, and vitamins B1 and B2. It serves multiple purposes, being utilized as feed for both animals and humans, as well as a medicinal herb. In phytotherapy, the flowering tops of the plant are employed, with the fresh leaves containing around 1.8% of the flavonoid heteroside rutin, the flowers approximately 0.7%, and the stalks having minimal amounts. Flavonoids, particularly rutin, which constitutes an estimated 4 to 6% of buckwheat, are acknowledged for their capacity to diminish capillary damage and avert scurvy.

Buckwheat grains are rich in rutin, riboflavin, pyridoxine, thiamine, lysine, methionine, arginine, and threonine. Additionally, they serve as a substantial source of macro elements such as potassium (K), calcium (Ca), magnesium (Mg), and sodium (Na), along with microelements including manganese (Mn), zinc (Zn), selenium (Se), and copper (Cu). The protein levels in buckwheat grain fractions vary, with bran containing between 19.2% and 31.3%, while flour has a protein content ranging from 4.4% to 11.9%.

As noted by Xiaomei *et al*. (2018) [26], nitrogen is a vital nutrient for agricultural production, as it significantly affects photosynthetic efficiency and the development and maintenance of leaf area, which subsequently influences dry matter generation. Nitrogen, an essential element in proteins (both structural and enzymatic) and nucleic acids, impacts various processes including organ formation, root-cap development, photosynthesis, the carbon-nitrogen ratio, and source-sink dynamics. The application of nitrogen fertilizer enhances the photosynthetic rate, postpones leaf senescence, minimizes nitrogen loss from leaves post-bloom, and provides carbohydrates necessary for grain filling. A deficiency in nitrogen is a primary factor contributing to reduced crop yield and quality, hindering both crop growth and photosynthesis. Furthermore, nitrogen deficiency adversely affects the rate of leaf emergence, overall yield, and yield components such as the number of heads per plant, seeds per head, individual seed weight, and seeds per plant, while also delaying both vegetative and reproductive phenological development. Additionally, a lack of nitrogen diminishes the plant's protein content, leaf area index, dry matter allocation to reproductive structures, radiation interception, radiation use efficiency, and seed quality. The relationship between leaf photosynthesis and nitrogen fertilizer application has been found to be strongly positive.

According to Mesquita *et al*. (2018) [27], phosphorus (P) is considered a limiting nutrient for crop production. A deficiency in P impacts both nitrogen and P metabolism, as well as the accumulation of dry matter in crops, by reducing stomatal conductance and the rate of photosynthesis. Most crops find it challenging to recover additional P in the short term because P is generally immobilized in the soil. However, buckwheat roots release phosphatase and other compounds to decompose phosphate, enabling them to efficiently absorb P from the soil. The remarkable capacity of buckwheat roots to store inorganic P is enhanced by the concurrent ability of phosphate fertilizer to address nitrogen deficiencies in the soil and stimulate root growth, both of which aid in plant resilience in adverse conditions (Inamullah *et al*., 2012) [8]. The influence of phosphate fertilizer and planting density on the P uptake and utilization efficiency, photosynthetic characteristics, field microclimate, and soil water production of common buckwheat has not been extensively investigated. Common buckwheat is a crop that thrives on P and possesses a highly efficient root system for the absorption and storage of inorganic P; however, its capacity is limited when compared to other crops. Consequently, two hypotheses have been proposed: a higher planting density may elevate the demand for phosphate fertilizer while simultaneously reducing the efficiency of P utilization in common buckwheat, and as planting density rises, the quantity of phosphate fertilizer that enhances crop yield may diminish. This research seeks to evaluate the effects of phosphate fertilizer on water consumption, photosynthetic traits, and phosphorus transport in common buckwheat across various planting densities.

Considering the above facts, the experiment titled “Effect of nutrient on the growth and yield of buckwheat” was carried out during the *Rabi* season 2024-25 with the following objectives and was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, during Kharif season of 2024.

2. Materials and methods

The field experiment was carried out on Buckwheat during the Rabi season of 2024 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). The objective was to investigate the "Effect of Nutrient on Growth and Yield of Buckwheat (Fagopyrum esculentum L.)." The soil of the experimental plot was sandy loam in texture, exhibiting a neutral reaction (pH 7.8), with organic carbon content at 0.72%, available nitrogen at 178.48 kg/ha, available phosphorus at 27.80 kg/ha, and available potassium at 233.24 kg/ha. A total of 10 treatments were implemented, each replicated three times and arranged in a Randomized Block Design. The treatment combinations included treatment 1 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha), treatment 2 (Nitrogen 30 kg/ha + Phosphorus 20 kg/ha), treatment 3 (Nitrogen 30 kg/ha + Phosphorus 25 kg/ha), treatment 4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha), treatment 5 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha), treatment 6 (Nitrogen 40 kg/ha + Phosphorus 25 kg/ha), treatment 7 (Nitrogen 50 kg/ha + Phosphorus 15 kg/ha), treatment 8 (Nitrogen 50 kg/ha + Phosphorus 20 kg/ha), treatment 9 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha), and treatment 10 (N:P: K 40:20:20 kg/ha (Control)). Data were collected on various growth parameters including plant height (cm), plant dry weight (g), crop growth rate (g/m2/day), relative growth rate (g/g/day), number of achene per plant, number of seeds per achene, seed yield (t/ha), and stover yield (t/ha). These data were subjected to statistical analysis using the analysis of variance method as described by Hoult (2002) [13]. Additionally, economic evaluations were conducted, which included the cost of cultivation (INR/ha), gross returns (INR/ha), net returns (INR/ha), and benefit-cost ratio.

3. Results and Discussion

3.1 Growth attributes

3.1.1 Plant height (cm)

At 15 DAS, higher plant height (26.55) cm was recorded in T_7 (Nitrogen 30 kg/ha + Phosphorus 40 kg/ha), no significant difference was recorded among all the treatment.

At 30 DAS highest plant height (34.87) cm was recorded in T_2 (Nitrogen 30 kg/ha + Phosphorus 20 kg/ha), this was closely followed by T_4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha), T_6 (Nitrogen 40 kg/ha + Phosphorus 15 Kg/ha), T_7 (Nitrogen 50 kg/ha + Phosphorus 15 kg/ha), T_8 (Nitrogen 50 kg/ha + Phosphorus 20 kg /ha) all these treatments where found to the statically at par with T_2.

At 45 DAS higher plant height (49.76) cm was recorded in T_5 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha), T_6 (Nitrogen 40 kg/ha + Phosphorus 25 kg/ha), T_7 (Nitrogen 50 kg/ha + Phosphorus 15 kg/ha).

At 60 DAS higher plant height (51.1) cm was recorded in T_4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha), T_8 (Nitrogen 50 kg/ha + Phosphorus 20 kg /ha).

Significant and higher plant height was observed with the application of Nitrogen(50kg/h) might be due to increase yellow podsolic and a chocolate soil under field conditions produced significant increases of 136% in grain yield over the control in the grey brown podsolic soil Hoult (2002) [13].

3.1.2 Plant Dry Weight (g)

At 15 DAS, max dry weight (0.27) was recorded in T_3 (Nitrogen 40 kg/ha + Phosphors 20 kg/ha), no significant difference was recorded among all the treatment.

At 30 DAS, max dry weight (2.1) was recorded in T_8 (Nitrogen 50 kg/ha+ Phosphorus 25kg/ha), this was closely followed by T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha), T_6 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha), T_9 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) all these treatment where found to the statically at par with T_8.

At 45 DAS, max dry weight (3.6) was recorded in T_4 (Nitrogen 40 kg/ha +Phosphorus 20 kg/ha), this is closely followed by T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha), T_7 (Nitrogen 50 kg/ha + Phosphorus 15 kg/ha), T_8 (Nitrogen 50 + Phosphorus 25 kg/ha), all these treatment where found to the statically at par with T_4.

At 60 DAS, max dry weight (5.791) was recorded in T_4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha), this is closely followed by T_3 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha), T_5 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha), T_8 (Nitrogen 50 kg/ha + 25kg/ha) all these treatment where to the statically at par with T_7.

Significant and maximum dry weight was observed with the application of Nitrogen (5kg/h) Nitrogen fertilizer had significant effects on the plant height, number of branches per plant, 1000 seed weight, hectoliter weight, crude protein content and seed yield of common buckwheat.

3.1.3 Crop growth rate (g/m²/day)

The result revealed that during 45-60 DAS (Days after Sowing), no significant difference was recorded among all the treatments. Statistically higher plant crop growth rate was recorded in treatment 9 ((Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) (Table 1).

3.1.4 Relative growth rate (g/g/day)

The data showed that during 45-60 DAS, no significant difference was recorded among all the treatments. Statistically highest plant relative growth rate was recorded in T9 ((Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) (Table 1).

3.2 Yield attributes and yield

3.2.1 Number of achene/plant

T_4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha) recorded significant and maximum number of achene/plant (47.20). However, T_8 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha), T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha) and T_6 (Nitrogen 45 kg/ha + Phosphorus 20 kg/ha) were found to be statistically at par with T_7 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha). Significant and maximum number of achene/plant was observed with the application of nitrogen (50 kg/ha) might be due to Regarding the results of nitrogen fertilizer levels and leaf rutin percent, it may be seen that 50 kg of nitrogen can increase the vegetative sprouts on the branches and leaf production in the plant; in other words, the leaf rutin percent will be enhanced as compared to nitrogen treatments of 0, 50 and 100 kg. Sobhani *et.al* (2020) [12].

3.2.2 Test weight (g)

T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha) recorded significant and higher test weight (49.9). However, T_4 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha), T_1 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha) and T_6 (Nitrogen 45 kg/ha + Phosphorus 20 kg/ha) were found to be statistically at par with T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha).

Significant and higher test weight was observed with the application of nitrogen (30 kg/ha) might be due to during growth and development stages the optimal number, size, and length of achene may have stimulated the availability of more nitrogen and additionally, an increased supply of to leaf rutin percent achene allowed seeds to grow to their full potential and appeared to increase test weight.Omidbaigi *et al.* (2004) [16] reported higher number of grains plant-1and higher 1000-grain weight with higher doses of nitrogen.(Table 2).

3.2.4 Seed yield (t/ha)

T_4 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha) recorded significant and higher seed yield (1.77 t/ha). However, T_6 (Nitrogen 45 kg/ha + Phosphorus 20 kg/ha), T_7 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) and T_8 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) were found to be statistically at par with T_4 (Nitrogen 40 kg/ha + Phosphorus 20 kg/ha).

Significant and higher seed yield was observed with the application of nitrogen (40 kg/ha) might be due to Omidbaigi *et al*. (2004) [16] reported higher 1000-grain weight and higher grain yield with higher doses of nitrogen.

3.2.5 Stover yield (t/ha)

T_4 (Nitrogen 40 kg/ha + Phosphorus 15 kg/ha) recorded significant and higher stover yield (4.33 t/ha). However, T_6 (Nitrogen 45 kg/ha + Phosphorus 20 kg/ha), T_9 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha), were found to be statistically at par with T_8 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha).

Significant and higher stover yield was observed with the application of nitrogen (50 kg/ha) might be due to this was due to the fact that was highly responsive to nitrogen, phosphorus and potassium fertilizers and resulted in more vegetative growth, producing higher growth attributes such as plant height, number of leaves per plant, leaf area index and total dry matter production per plant as compared to other. Similar results were observed by Hongmei *et al.* (2003) [28].

3.2.6 Harvest Index (%)

T_2 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha) recorded significant and higher harvest index (36.06). However, T_3 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha), T_6 (Nitrogen 45 kg/ha + Phosphorus 20 kg/ha), T_9 (Nitrogen 50 kg/ha + Phosphorus 25 kg/ha) and T_1 (Nitrogen 30 kg/ha + Phosphorus 15 kg/ha).

3.3 Economic analysis

The maximum benefit cost ratio (1.33) was recorded in treatment 4 [Nitrogen 40 kg/ha + Phosphorus 15 kg/ha] (Table 3). Maximum benefit cost ratio was observed with Nitrogen 40 kg/ha + Phosphorus 15 kg/ha might be due to seed yield and stover yield output and a relatively lower investment cost compared to other treatments produced the maximum benefit cost ratio.

Table 1: Effect of nutrient on plant height (cm) of buckwheat at different days intervals.

Plant height (cm)					
Sr. No.	**Treatment combinations**	**15 DAS**	**30 DAS**	**45 DAS**	**60 DAS**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	22.4	33.35	42.43	40.40
2.	Nitrogen 30 kg/ha + Phosphorus 20 kg/ha	23.9	34.87	43.24	43.00
3.	Nitrogen 30 kg/ha + Phosphorus 25 kg/ha	26.6	33.05	44.44	39.76
4.	Nitrogen 40 kg/ha + Phosphorus 15 kg/ha	24.9	34.82	45.19	51.10
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	23.2	29.27	49.76	41.66
6.	Nitrogen 40 kg/ha + Phosphorus 25 kg/ha	21.8	34.79	49.72	41.54
7.	Nitrogen 50 kg/ha + Phosphorus 15 kg/ha	23	34.31	48.04	43.74
8.	Nitrogen 50 kg/ha + Phosphorus 20 kg/ha	22.7	34.79	44.18	47.70
9.	Nitrogen 50kg/ha + Phosphorus 25 kg/ha	22.7	33.9	40.54	43.98
10.	N:P:K 40:20:20 kg/ha (control).	26.3	27.13	30.70	47.66
	F Test	NS	S	S	S
	SEm (±)	2.00	1.69	3.42	1.90
	CD (p=0.05)	-	5.03	10.15	5.65

Table 2: Effect of nutrient on Plant dry weight (g) of buckwheat

Plant dry weight (g)					
Sr. No.	**Treatment combinations**	**15 DAS**	**30 DAS**	**45 DAS**	**60 DAS**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.18	0.45	3.66	4.21
2.	Nitrogen 30 kg/ha + Phosphorus 20 kg/ha	0.2	1.53	2.76	3.66
3.	Nitrogen 30 kg/ha + Phosphorus 25 kg/ha	0.27	0.83	3.10	4.83
4.	Nitrogen 40 kg/ha + Phosphorus 15 kg/ha	0.21	2.08	2.37	5.79
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	0.16	1.43	3.32	4.80
6.	Nitrogen 40 kg/ha + Phosphorus 25 kg/ha	0.14	1.64	3.59	5.07
7.	Nitrogen 50 kg/ha + Phosphorus 15 kg/ha	0.18	1.7	3.63	4.83
8.	Nitrogen 50 kg/ha + Phosphorus 20 kg/ha	0.21	2.16	2.88	4.78
9.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	0.16	1.70	2.54	5.30
10.	Control (RDF) - 40:20:20 NPK kg/ha	0.3	1.24	2.10	3.08
	F Test	NS	S	S	S
	S Em (±)	0.05	0.32	0.34	0.46
	CD (p=0.05)	-	0.95	1.02	1.38

Table 3: Effect of nitrogen, phosphorus and sulphur on Crop Growth Rate (g/m2/day) of buckwheat.

Sr. No.			Crop Growth Rate (g/m2/day)	
	Treatment combinations	**15-30 DAS**	**30-45 DAS**	**45-60 DAS**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.45	4.27	3.061
2.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	2.22	2.74	1.50
3.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.93	5.05	2.87
4.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	3.13	4.05	2.73
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	2.11	3.73	2.47
6.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	2.50	3.55	2.46
7.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	2.63	4.52	3.59
8.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	3.25	1.84	3.16
9.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	2.57	2.96	4.59
10.	Control (RDF) - 40:20:20 NPK kg/ha	1.145	1.91	1.62
	F Test	S	NS	NS
	SEm (±)	0.46	1.06	0.76
	CD (p=0.05)	1.37	-	-

Table 4: Effect of nitrogen, phosphorus and sulphur on Relative Growth Rate (g/g/day) of buckwheat.

Relative Growth Rate (g/g/day)				
Sr. No.	**Treatment combinations**	**15-30 DAS**	**30-45 DAS**	**45-60 DAS**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.04	0.036	0.038
2.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.1	0.039	0.019
3.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	0.06	0.04	0.03
4.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	0.12	0.04	0.025
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	0.08	0.041	0.024
6.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	0.12	0.036	0.023
7.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	0.12	0.037	0.034
8.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	0.12	0.035	0.032
9.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	0.12	0.031	0.049
10.	Control (RDF) - 40:20:20 NPK kg/ha	0.08	0.036	0.026
	F Test	NS	NS	NS
	S Em (±)	0.02	0.00	0.01
	CD (p=0.05)	-	-	-

Table 5: Effect of nitrogen, phosphorus and sulphur on growth and yield of buckwheat

		Yield and yield attributes					
Sr. No.	**Treatment combinations**	**Number of achene/plant**	**Number of Seeds/siliqua**	**Test weight (g)**	**Seed yield (t/ha)**	**Stover yield (t/ha)**	**Harvest Index (%)**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	44.80	44.13	37.23	1.53	3.35	31.63
2.	Nitrogen 30 kg/ha + Phosphorus 20 kg/ha	41.73	41.73	49.96	1.74	3.10	36.06
3.	Nitrogen 30 kg/ha + Phosphorus 25 kg/ha	46.80	43.13	38.76	1.62	4.27	27.36
4.	Nitrogen 40 kg/ha + Phosphorus 15 kg/ha	47.20	45.53	31.03	1.77	4.33	30.59
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	43.63	41.07	39.70	0.74	4.18	15.18
6.	Nitrogen 40 kg/ha + Phosphorus 25 kg/ha	43.53	43.53	37.90	1.43	3.71	28.03
7.	Nitrogen 50 kg/ha + Phosphorus 15 kg/ha	46.90	41.27	38.03	1.45	2.95	32.98
8.	Nitrogen 50 kg/ha + Phosphorus 20 kg/ha	41.73	41.73	38.40	1.48	4.09	24.80
9.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	46.60	43.00	44.53	1.61	3.69	33.21
10.	Control (RDF) - 40:20:20 NPK kg/ha	25.53	25.53	47.43	0.94	3.94	24.00
	F Test	S	NS	NS	S	S	S
	S Em (±)	3.96	4.20	6.69	0.18	0.30	3.01
	CD (p=0.05)	11.77		0.0	0.54	0.88	8.95

Table 6: Effect of nitrogen, phosphorus and sulphur on economics of buckwheat

		Economics			
Sr. No.	**Treatment combinations**	**Cost of cultivation (INR/ha)**	**Gross Return (INR/ha)**	**Net Return (INR/ha)**	**Benefit cost ratio (B:C)**
1.	Nitrogen 30 kg/ha + Phosphorus 15 kg/ha	45391.55	97411.55	52020	1.15
2.	Nitrogen 30 kg/ha + Phosphorus 20 kg/ha	45860.3	103850.3	57990	1.26
3.	Nitrogen 30 kg/ha + Phosphorus 25 kg/ha	46329.05	102615.05	56286	1.21
4.	Nitrogen 40 kg/ha + Phosphorus 15 kg/ha	45608.95	106280.95	60672	1.33
5.	Nitrogen 40 kg/ha + Phosphorus 20 kg/ha	46077.7	75891.7	29814	0.65
6.	Nitrogen 40 kg/ha + Phosphorus 25 kg/ha	46546.45	96124.45	49578	1.07
7.	Nitrogen 50 kg/ha + Phosphorus 15 kg/ha	45826.35	94846.35	49020	1.07
8.	Nitrogen 50 kg/ha + Phosphorus 20 kg/ha	46295.1	98489.1	52194	1.13
9.	Nitrogen 50 kg/ha + Phosphorus 25 kg/ha	46763.85	101915.85	55152	1.18
10.	Control (RDF) - 40:20:20 NPK kg/ha	46225.35	81607.35	35382	0.77

4. Conclusion
It is concluded that in buckwheat with the application of Nitrogen 40 kg/ha along with Phosphorus 20 kg/ha), in T_4 was recorded with higher yield attributes and benefit-cost ratio.

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