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Effect of different doses of nitrogen on growth and yield parameters of wheat (*Triticum aestivum* L.)

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Abstract
The experiment was carried out at the Agricultural Research Farm of National Post Graduate College Barhalganj, Gorakhpur, U.P. During rabi 2022-23. This experiment consisted of wheat variety PBW-343 and 7 different treatments was laid out in Randomized Block Design with 3 replications. The study was assessed different doses of nitrogen with the application of Nitrogen through Urea on yield and nutrient partitioning and accumulation in plant parts productivity, along with economics of wheat production. The results showed highest grain yield (60.32 q/ha), Straw yield (65.26 q/ha), Biological yield (125.58 q/ha) and Harvest index (48.03%) with the application of T_5 (100% Recommended dose of Nitrogen). The study revealed that soil enrichment with (100% Recommended dose of Nitrogen) resulted in highest Net returns of Rs.123841.80 ha^{-1} and maximum B:C ratio (3.06).

Keywords: Different doses of nitrogen, Urea, Variety PBW-343

Introduction
Wheat (*Triticum aestivum* L.) is the main Rabi crop in India and has played a very vital role in increasing and stabilizing the food production of the country (Bhat and Mahal, 2006) [3]. Wheat covers more cultivated land (224.72 million hectare) than any other food crop and is one of the most important (734.82 million ton). The spectacular increase in productivity of wheat crop in the country could be attributed to availability of high yielding input responsive varieties. During 2018-19, Wheat was grown over an area of 31.3 m ha with the total production of 95.8 mt with an average productivity of 3.06 t ha^{-1}. The demand of wheat in India by 2025 has been projected to be between 105-109 million tonnes as against 95.80 million tones production of present day. As per second advance estimates for the agriculture year 2022-2023 the wheat production in India is estimated at 112.18 million tones which is higher by 4.44 million tones than the production achieved during 2021-2022. In India Uttar Pradesh is leading wheat growing state with an area of 9.9 million ha. Production of 35 million metric tons and productivity of 2.7 tones/ha. Wheat productivity in the state is however far lower than that in Punjab (4.3 tonnes/ha) and Haryana (4 tonnes/ha). The productivity of a crop is controlled by many factors of which the mineral nutrition especially of nitrogen, phosphorus and potassium are by and large (Anonymous 2020) [1]. Wheat contains 12% water, 70% carbohydrates, 2% fat, 1.8% minerals and 2.2% crude fibers. Thiamin, Riboflavin, Niacin and small amounts of Vitamin A are present but the milling processes remove most of those nutrients with the bran and germ. Fertilizer application to different wheat cultivars has great influence on the growth and yield attributing characters. Nitrogen is required throughout the crop growth period from vegetative to subsequent harvesting. So, nitrogen fertilizers are applied in split application with respect to dry matter production, leaf area, number of grains per spike, and finally on quality parameters. Nitrogen is responsible for the early growth of the plant. If it is available to the plant at the time of its need, there will be positive response by the plant**.** Wheat crop shows significant response when nitrogen was applied half as a basal dose and half at first irrigation. When nitrogen is applied at the later growth stages that will improve the quality parameters of the wheat crop. Splitting of the nitrogen dressing throughout the growing season is advantageous, since it allows farmers to anticipate the actual growing conditions.

Materials and Methods
The present investigation was carried out at the Crop Research Farm of Department of Agronomy National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, during the year 2022. The experimental farm is situated at 26° 16' 45.3180" N latitude and 83° 30' 47.7360" E longitude and 71 meter (232.94 feet) elevation. The experiment was laid out n Randomized Block Design with three replications with nine treatments. The treatments were i.e. (T_1- Absolute control; T_2- 40% Recommended dose of Nitrogen; T_3- 60% Recommended dose of Nitrogen; T_4- 80% Recommended dose of Nitrogen; T_5- 100% Recommended dose of Nitrogen; T_6- 120% Recommended dose of Nitrogen and T_7- 140% Recommended dose of Nitrogen) through chemical fertilizers i.e. Urea with wheat variety PBW-343 was sown in plot size of 3mx3m, 22.5cm spacing between the rows with 1 m distance between replication and 0.3 m between the plots on 1st December 2022, seed rate 120 kg/ha. The recommended fertilizer dose of urea was applied. Half of the nitrogen and full dose of P and K was applied as basal dose at the time of sowing, while remaining half dose of nitrogen was top dressed at the time of first irrigation. The data of crop stand was collected from each plot, total number of wheat plant meter^{-1} row length were counted and recorded at 15 DAS in the experimental field. Data on plant population, plant height, dry matter accumulation were recorded, number of grains/spike, length of spike, test weight, grain yield, straw yield, biological yield, harvesting index, nitrogen content in grains, nitrogen content in straw, nitrogen uptake by grains, nitrogen uptake by straw and nitrogen uptake by total uptake were recorded by using procedure for wheat crop.

Result and Discussion
1. Growth parameters
1.1 Plant population
The maximum plant population (167) was observed with T_5 treatment. The recroded data shows that effect of nitrogen levels on initial plant population at 20 DAS was found significant.

1.2 Plant height
The maximum plant height (108.12cm) was observed with T_5 treatment which was significantly higher over the other treatment. The effect of chemical fertilizer like Urea was more pronounced with the advancement of crop growth indicating better effect on plant height of wheat. It might be attributed to improved fertility status of the soil through microbial and better utilization of plant nutrients by wheat. Similar were the results report the findings by Singh *et al.* (2017) [16].

1.3 Dry matter accumulation
This increase in dry matter of wheat is attributed due to higher plant which was produced due sufficient and adequate supply of nutrient and further these increased growth characters contributed to higher dry matter production. Such types of results have been reported by Singh *et al*. (2017) [16], Patel *et. al.* (2018) and Mohan *et al.* (2018).

Table 1: Effect of various treatment on plant population, plant height (cm), dry matter accumulation (g/m) of wheat crop at different growth stages

Treatment	Plant population	Plant height(cm)				Dry matter accumulation(g/m)			
		30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
T_1	152.00	30.23	47.52	85.78	90.45	9.15	53.95	140.29	195.18
T_2	155.00	32.15	49.26	88.26	93.48	11.42	56.26	143.82	197.36
T_3	158.00	35.65	51.16	92.15	96.78	13.56	58.43	146.19	199.20
T_4	160.00	39.15	53.98	95.45	99.65	16.28	60.74	149.62	202.34
T_5	167.00	46.23	59.48	100.26	108.12	24.52	69.12	158.91	211.13
T_6	166.00	43.26	57.56	98.28	104.22	21.35	66.92	155.31	208.17
T_7	165.00	40.96	55.48	96.78	101.26	19.68	63.27	152.45	205.74
S.Em±	0.727	0.900	0.703	0.774	0.675	0.649	0.736	0.761	0.587
CD(P≥0.05%)	2.266	2.803	2.190	2.412	2.102	2.023	2.293	2.371	1.828

2. Yield parameters
2.1 Number of grains/spike(m^{-2}), Length of spike(cm), Test weight (g)
The significantly highest number of grains/spike (42.14 m^{-2}), length of spike (18.36 cm) and test weight (40.00 g) of wheat was recorded with T_5. The was more with T_5. The significantly higher yield attribute of wheat with T_5 is due to adequate quantities and balanced proportions of plant nutrients throughout the growth stages of the crop, which further increased the yield attributing character and yield of wheat.

Table 2: Effect of various treatment on Number of grains/spike(m^{-2}), Length of spike(cm), Test weight (g) of wheat crop at different growth stages.

Treatment	Number of grains/spike (m^{-2})	Length of spike (cm)	Test weight (g)
T_1	29.10	8.19	30.12
T_2	32.19	10.26	31.52
T_3	34.11	11.53	33.29
T_4	36.29	12.17	34.50
T_5	42.14	18.36	40.00
T_6	40.41	16.10	38.12
T_7	38.17	14.26	36.62
S.Em±	0.751	0.65	0.536
CD(P≥0.05%)	2.34	2.03	1.66

2.2 Grain yield, straw yield, biological yield and harvest index
The highest grain yield (60.32 q ha^{-1}) was recorded with 100% recommended dose of nitrogen (T_5). The lowest grain yield (41.78 q ha^{-1}) was recorded with Absolute control (T_1). Results are might be due to the fact that nitrogen play a vital role in increasing sink size and playing an important role in the increase of grain yield of wheat *via.* the alteration of dry matter

partitioning into the spikes. Almost similar findings was reported by Shekoofa and Emam (2008) [19] and Barthwal *et al.* (2013) [2]. Maximum straw yield (65.26 q ha^{-1}) recorded under 100% recommended dose of nitrogen (T_5) was significantly higher over the rest of treatment. The lowest straw yield (57.15 q ha^{-1}) was recorded with Absolute control (T_1). Maximum biological yield (125.58 q ha^{-1}) recorded under 100% recommended dose of nitrogen (T_5). The lowest biological yield (98.93 q ha^{-1}) was recorded with Absolute control (T_1).

Table 3: Effect of various treatment on grain yield, straw yield, biological yield and harvest index of wheat crop at different growth stages.

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest Index
T_1	41.78	57.15	98.93	42.23
T_2	44.93	59.10	104.03	43.18
T_3	47.88	60.49	108.37	44.18
T_4	50.81	61.70	112.51	45.16
T_5	60.32	65.26	125.58	48.03
T_6	57.89	63.40	122.29	47.33
T_7	53.76	62.11	115.87	46.39
S.Em±	0.704	0.364	0.350	0.800
CD(P≥0.05%)	2.194	1.135	1.565	2.493

2.3 Nitrogen content (%) in grains and straw, Nitrogen uptake (Kg/ha) by grains, straw and total uptake

Nitrogen content includes nitrogen content (%) in grain (8.37%) and straw (7.26%) of wheat was significantly higher in treatment 100% recommended dose of nitrogen over the rest of treatment. Effect of different doses of nitrogen on N uptake by grain (60.68 Kg ha^{-1}), N uptake by straw (43.85 Kg ha^{-1}) and total N uptake by crop (104.53 Kg ha^{-1}) was found significantly higher in treatment 100% recommended dose of nitrogen over the rest treatment. This result was closely justified with report of Pandey (2003) [11] and Barthwal *et al.* (2013) [2].

Table 4: Effect of various treatment on nitrogen content (%) in grains and straw, nitrogen uptake (Kg/ha) by grains, straw and total uptake of wheat crop at different growth stages.

Treatment	Nitrogen content (%)		Nitrogen uptake (Kg/ha)		
	Grain	Straw	Grain	Straw	Total uptake
T_1	2.19	1.58	37.13	21.95	59.08
T_2	3.58	2.53	40.60	26.15	66.75
T_3	4.57	3.78	43.40	30.56	73.96
T_4	5.65	4.12	46.27	34.62	80.89
T_5	8.37	7.26	60.68	43.85	104.53
T_6	7.45	6.23	56.33	40.65	96.98
T_7	6.63	5.45	52.48	37.45	89.93
S.Em±	0.582	0.470	0.567	0.447	0.67
CD(P≥0.05%)	1.812	1.463	1.768	1.392	2.06

3. Economics

Economics of crop production is the most important aspect regarding the practical feasibility of treatments. Based on input-output analysis, Gross Return (Rs.154778.00 /ha), Net Return (Rs.123841.80/ha) and B:C ratio (3.06) were worked out to highest in treatment T_5- 100% Recommended dose of nitrogen. The lowest cost of cultivation was recorded by the treatment T_1-Absolute control.

Table 5: Effect of various treatment on total cost of cultivation (Rs./ha), gross return (Rs./ha), net return (Rs./ha) and B:C ratio of wheat crop at different growth stages.

Treatment	Total Cost of Cultivation (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B:C ratio
T_1	38380.00	113179.50	84200.00	2.19
T_2	39213.28	120533.25	91429.22	2.33
T_3	39629.92	127202.00	98345.08	2.48
T_4	40046.56	133740.25	105125.94	2.62
T_5	40463.20	154778.00	123841.80	3.06
T_6	40879.84	148927.25	121072.66	2.96
T_7	41296.48	139919.00	110718.52	2.68

Conclusion

It may be concluded that application of 100% of recommended dose of nitrogen in (T_5) resulted significantly increased all the growth attributes, yield, nitrogen content and their uptake by the wheat crop. Thus, application of 100% recommended dose of nitrogen (T_5) should be recommended for maximum production and quality wheat produce.

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