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Impact of STCR based application of organic and inorganic nitrogen on growth, productivity and profitability of wheat [*Triticum aestivum* (L.)] in Eastern IGP of India

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Abstract
A field experiment was conducted during the winter season of 2017-18 at the student's instructional farm of research farm, SHUATS, Prayagraj (U.P.), to find a suitable combination of inorganic and organic nitrogen sources for wheat (*Triticum aestivm* L.). The experiment was laid out in a randomized block design with 12 treatment combinations, consisting of three nitrogen levels (100,125 and 150 kg N ha^{-1}) on soil test basis (STB) compared to farmer practice (FP) and nitrogen management *viz.* 100% N through urea, 75% N through urea + 25% N through vermin-compost with *Azotobacter* (seed inoculation).The growth and yield attributes *viz.* plant height (22.0 cm), dry matter production (198.2 g m^{-2}), tillers (204.4 m^{-2}), crop-growth rate (2.78 g m^{-2} day), and yield attributes *viz.* grains spike^{-1} were recorded significantly higher with 150 kg N ha^{-1} (farmer practice) when applied 100% N through urea over the treatments. Similarly, highest grain yield (45.6 q ha^{-1}) and harvest index also recorded with T11. However, leaf area index (1.59), effective tillers, straw yield (76.3 q ha^{-1}) and biological yield recorded significantly higher in T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermin-compost with *Azotobacter* (seed inoculation)}. The experimental result reveals this saving of nitrogen by 17 to 32 kg ha^{-1} through soil test based application, while without any significant effect on growth and yield of wheat was noticed. The lowest cost of cultivation recorded with T1 (Rs 28,560 ha^{-1}) {100 kg N ha^{-1} (STB) 100% N through urea, whereas higher in T12. Net returns found higher with T11 (Rs 58,290 ha^{-1}) and found at par with T5 {150 kg N ha^{-1} (STB) 100% N through urea} and T9 {150 kg N ha^{-1} (STB) 100% N through urea.

Keywords: integrated nitrogen management, vermicompost, profitability, growth and yield

Introduction

Wheat (*Triticum aestivum* L.) is one of the major cereal crops grown worldwide and one of the important staples of nearly 2.5 billion (36%) of world population and improvement in its productivity has played a key role in making the country self-sufficient in food grains. Worldwide, it provides nearly 55% carbohydrates and 20% food calories. Wheat consumed mostly in the form of bread-Chapati and its straw was used for feeding the animals or cattle's. It is second most important staple food crop which produce at the global level after rice (Sharma and Sendil, 2016).The cultivation of wheat crop about 30 m ha (14% of global area) and produce highest output of 99.70 m tonnes of wheat (13.64% of world) with the average productivity of 3371 kg ha^{-1} (MoA&FW, 2018) [12]. In India, Uttar Pradesh (32.59 m tonnes) is highest producer of wheat followed by Madhya Pradesh (19.61 Mt), Punjab (17.57 Mt) etc. (Agricultural Statistics at a Glance, 2020) [1]. The nutrients (NPK) are the major elements for getting higher yield and better quality of wheat crop (Gaj *et al.*, 2013) [3]. However, nitrogen (N) is important metabolic element for growth and development of plant. It is considered as essential for synthesis of quality like protein and others biochemical products of plant such as protoplasm, which is the basic part of plant lifecycle. Nitrogen is subjected to different kinds of losses through denitrification, leaching and volatilization which cause the environmental threats. In which, nitrous oxide alone contributed more than 300 times to the global warming potential of CO_2, and emissions affect through poor N management in intensive crop production (Jat *et al.*, 2014) [8]. Farmers have to use more and more fertilizer year after year to obtain optimum yield, but due to this fertility of soil was declining more (Hobbs *et al.*, 1990). These excessive and imbalance use of inorganic fertilizer also reported to be the major constraint of declining productivity of rice-wheat cropping system (Hobbs, 1994).

Integrated nutrient management (INM) is the basic principles to maintenance and possibly improvement of soil fertility for sustaining crop productivity on long term basis. This may be achieved through combined use of sources of nutrients specially nitrogen and their management for optimum growth, yield and quality of different crops (Patel *et al.*, 2017) [16]. Also, the cost of fertilizers due to its increasing demand of conjunctive use of organics along with inorganic sources of nutrients for providing better and healthier soil environment to plants. The use of conventional and easily available sources like vermi-compost (VC) or other biodegradable waste which help in elevating the status of the organic soil, and also an indirect effect on the soil physical properties and maintenance of soil productivity (Lado, Paz and Ben-Hur 2004). Ensuring optimum nutrient availability through effective nutrient-management practices requires knowledge of the interactions between the soil, plant and environment. In this experiment use of some tools for in season nitrogen management like Site-specific nutrient management (SSNM) through soil-test crop response (STCR) in fulfilling the crop nutrient requirement with less environmental footprints (Jat *et al.*, 2014; Kumar *et al.*, 2014) [8] was planned to see the effect of integrated nitrogen management on soil test basis on growth and yield of wheat. Therefore, the continuous availability of N to wheat during various phases of its growth and development is important factors which influence the growth, yield and improve the productivity of wheat.

Materials and Methods

Experimental site

The present study was carried out for winter 2017-28 at students' instruction at crop research farm of the Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Science, Paryagraj (24° 43′ N latitude, 50° 56′ E longitude) and at the altitude of 98 meters above the mean sea level (MSL).The climate of Paryagraj is sub-humid, sub-tropical climate with hot dry summer and severe cold in winter. The mean annual precipitation of the district is about 1042 mm which is mostly received in the month of July to mid-September with occasional few showers of cyclonic rains during December and January. The soil of the experimental field is given in Table 1.

Experimental details and description of treatments

The treatments in the experiment included three nitrogen levels and two sources of nitrogen *viz*., T1-{100 kg Nitrogen ha^{-1} (Soil test based; STB)} 100% N through Urea, T2-{100 kg N ha^{-1} (STB)} 75% N through Urea + 25% N through vermi-compost (VC) + *Azotobacter* (Seed Inoculation), T3-{125 kg N ha^{-1} (STB)}100% N through Urea, T4-{125 kg N ha^{-1} (STB)} 75% N through Urea + 25% N through VC + *Azotobacter* (SI), T5-{150 kg N ha^{-1} (STB)}100% N through Urea, T6-{150 kg N ha^{-1} (STB)} 75% N through Urea + 25% N through VC + *Azotobacter* (SI), T7-{100 kg N ha^{-1} (Farmer Practice) 100% N through Urea}, T8-{100 kg N ha^{-1} (FP)} 75% N through Urea + 25% N through VC + *Azotobacter* (SI), T9-{125 kg N ha^{-1} (FP)} 100% N through Urea, T10-{125 kg N ha^{-1} (FP)} 75% N through Urea + 25% N through VC + *Azotobacter* (SI), T11-{150 kg N ha^{-1} (FP)} 100% N through Urea, T12-{150 kg N ha^{-1} (FP)] 75% N through Urea + 25% N through VC + *Azotobacter* (SI)**,** laid out in a Randomized Block Design with twelve treatment combinations which replicated thrice. The variety of wheat 'HUW 234' variety was sown 23rd of November in 2017.

Fertilizer and weed management

In each treatment, nitrogen (N) was applied 50% as basal and full dose of phosphorus (P) and potassium (K) was applied uniformly in all the plots through Urea, Di-ammonium phosphate (DAP) and Murate of potash (MOP), respectively at the time of sowing. In farmer's practice (FP) treatments, remaining half dose of N given through urea, vermicompost and *Azotobacter* seed inoculation (SI) which applied in two splits as top dressing at crown root initiation (CRI) and tillering stage. Whereas, in soil test based (STB) treatments, N given through vermicompost, *Azotobacter* (SI) and urea (based on available N in soil) in each required treatment. The total N in each treatment was given in Table 2. Vermi-compost (VC) is applied 15 days before sowing in required treatments. The weed was controlled by tank mix solution of Pinoxaden 5% EC (50 g a.i. ha^{-1}) or Clodinafop ethyl + Metsulfuron (60+4 g a.i. ha^{-1}) was applied at 30-35 DAS to control all types of grassy and broadleaf weeds.

Growth, yield attributes, yield and net returns

All the growth and yield attributes were recorded using standard procedure and grain yield was calculated at 12% moisture content. The crop growth rate (CGR) was calculated using the standard procedure and formulae. The leaf-area index (LAI) was calculated by dividing leaf area with ground area available for each plant.The wheat crop was harvested and threshed either manually at ground level. At maturity, the grain and straw yields of wheat was determined on a total area of 3 m^2 by sampling from three locations of 1 m^2 each. The data on crop management inputs such as number of tillage, fuel consumption, irrigation amount, herbicide, seed rate, labour use, pesticide application and their costs under each treatment were recorded for each crop using a standard data recording format. The fertilizers cost of cultivation is given in Table 2. All these costs were summed up to calculate the total cost of production. Net returns were calculated by deducting the total cost of cultivation from the gross returns over the study year.

Statistical analysis

The data collected during the experimental period on various character were statistically analysis by adopting 'Analysed of variance techniques' as described by Gomez and Gomez, (1984) [4]. The critical difference (CD) value was computed whereas the variance ratio ('f') was found to be significant.

Results and Discussion

Growth attributes

Among N-management practices in wheat, T11 {150 kg N ha^{-1} (farmer practice) 100% N through urea} produced significantly higher plant height (22.02 cm) at 60 DAS (days after sowing) as compared to rest of the treatments. However, T5 {150 kg N ha^{-1} (STB) 100% N through urea} and T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermicompost (VC) + *Azotobacter* (seed inoculation)} also recorded almost similar plant height, but lower to T11 and higher to over the treatments. It might be due to the fact that integrated use of fertilizers increases the height of wheat plants in comparison to other levels of fertilizer. Similar results have also been reported by Chaturvedi *et al.*, (2006) [2]. No. of productive tillers and dry matter accumulation were influenced significantly due to layering of different N-management practices at 60 DAS (Table 1). Higher tillers (204.4 m^{-2}) and dry matter accumulation (198.2 g m^{-2}) were recorded higher with T11 {150 kg N ha^{-1} (farmer practice) 100% N through urea} over the treatments, whereas T5 {150 kg N ha^{-1} (STB) 100% N through urea} and T6 {150 kg N ha^{-1} (STB) 75% N through urea + 25% N through vermicompost (VC) + *Azotobacter* (seed inoculation)} were also higher tillers (202.9 m^{-2}) and dry matter production (190.5 g m^{-2}), respectively as compared to other treatments. It may be attributed to higher availability of nutrients in vermicompost, increased availability in both native and applied nutrients. It is a better source and sink relationship that contributed to better dry-matter production of crops leading to the production of favourable yield components. Meena *et al.,* (2013) [11] also reported that higher dry matter accumulation due to the fact that balance use of organic and inorganic fertilizers increased the total leaf area.

The crop growth rate (CGR) was found higher in T11 {150 kg N ha^{-1} (farmer practice) 100% N through urea} (2.78 g m^{-2} day^{-1}) and found at par with T2, T5, T6 and T12 at 40-60 DAS during the year of study. The results of the present investigation are in close conformity with those of Singh *et al.* (2007) [23] and Singh *et al.* (2013) [21]. Leaf area index (1.59) was significantly higher with T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermicompost (VC) + *Azotobacter* (seed inoculation)} and found at par with T6, T11 and T10 over the treatments. Kumawat *et al.* (2006) [10] and Khandwel *et al.* (2006) [9] have also reported better response of integrated nutrient management by crops. Integrated nitrogen management leads to higher leaf-area index (LAI), leading to higher photosynthetic rate and accumulation of more assimilates which in turn increased the sink size. Similar findings were reported to by Verma *et al*. (2016) [26]. The lowest plant height, no. of tillers, and dry matter production and CGR were recorded with T9, T3, and T1, respectively as compared to other treatments.

Yield attributes

Data pertaining in Table 1 revealed that layering of different N-management practices significantly influenced the spike length (cm), number of grains per spike and 1000-grain weight (g) of wheat. The tillers at harvesting stage/effective tillers recorded significantly higher with T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermicompost + *Azotobacter* (Seed inoculation) and it was found at par with T5 and T11 over the treatments. The results are in close agreement with the findings of Singh *et al*. (2011) [24] and Prajapat *et al*. (2014) [17]. Higher spike length was recorded with T9 (11.53 cm), whereas T4, T5, T6, T11 and T12 as compared to rest of the treatments. Similar findings were also reported by Gupta *et al*. (2007) [5]. However, grains per spike was recorded higher with T11 {150 kg N ha^{-1} (farmer practice) 100% N through} and found at par with T5, T6, T9, T10 and T11, whereas lowest grains recorded with T1 {100 kg N ha^{-1} (STB) 100% N through} over the treatments. The 1000-grain weight recorded higher with T5 (42.35 g) {150 kg N ha^{-1} (STB) 100% N through Urea}, whereas T12 and T6 also higher and lower to T5 in 1000-grains weight as compared to other treatments. Patel *et al.* (2018) [15] concluded that the increase in test weight of wheat with recommended dose of fertilizer including organic manure had consequence of an adequate amount of nutrient supply which increased the photosynthetic activities and translocated more photosynthates in the reproductive stages of the crop, thereby promoting growth and increased the test weight of wheat.

Fertilizer-N use efficiency

The index of N use efficiency (NUE) is partial factor productivity of N (PFP_N), which was higher in the T8 {100 kg N ha^{-1} (FP)} 75% N through Urea + 25% N through VC + *Azotobacter* (SI) compared to their respective treatments during the year of study (Fig 1). However, The highest (39.4 kg grain kg^{-1} N applied) PFP_N in wheat was also recorded with T4 followed by T2 (39.3 kg grain kg^{-1} N applied) and lowest was in T3 and T12 (30.0 kg grain kg^{-1} N applied). The T4 and T2 treatments improved the PFP_N by 17.2% compared to farmer practice (FP) except T8 in wheat.

Crop yield and harvest index

The grain, straw, biological yield and harvest index significantly influenced by layering of different N-management practices during the year are given in Table 2. The grain yield (45.67 q ha^{-1}) recorded significantly higher with T11 {150 kg N ha^{-1} (farmer practice) 100% N through urea} and found at par with T4, T5, T6, T8, T10 and T12, whereas lowest yield was recorded in T1 {100 kg N ha^{-1} (STB) 100% N through urea} over the treatments. It may be due to cumulative effect of growth and yield-attributing characters owing to fertilization. Greater availability of metabolites (photosynthates) and nutrients to developing reproductive structures seems to have resulted in increase in all the yield-attributing characters which ultimately improved the yield of the crop. Similar findings were also reported by Singh *et al.* (2010) [22], Tripathi *et al.* (2013) [25] and Pandey *et al*. (2006) [14]. However, the straw yield recorded higher (76.33 q ha^{-1}) in T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermicompost + *Azotobacter* (Seed inoculation) and it was at par with T4, T5, T6, T9 and T10 as compared to rest of the treatments. The integrated use of organic and inorganic source of nutrients might have supplied readily available nutrients to crop which resulted in greater assimilation; production and partitioning of dry-matter to yield. Similar findings also reported were found by Verma *et al*. (2016) [26] and Singh *et al*. (2016). The biological yield recorded higher with T12 (121.33 q ha^{-1}) and it was found at par with T4, T5, T6 and T10 as compared to rest of the treatments. The lowest grain, straw and biological yield recorded in T1 {100 kg N ha^{-1} (STB) 100% N through urea} over the treatments. However, harvest index of wheat crop recorded significantly higher with T11 and found at par with T7 and T8 as compared to other treatments.

Economics

Data pertaining in Table 2 revealed that layering of different N-management practices significantly influenced the cost of cultivation and net returns of wheat. The highest cost of cultivation significantly recorded with T12 {150 kg N ha^{-1} (farmer practice) 75% N through urea + 25% N through vermicompost + *Azotobacter* (Seed inoculation) and found at par with T6 {150 kg N ha^{-1} (STB) 75% N through urea + 25% N through vermicompost + *Azotobacter* (Seed inoculation), whereas lowest was recorded with T1 over the treatments. The net returns of wheat crop recorded significantly lowered with T1 and T2. However, highest was found with T11 {150 kg N ha^{-1} (farmer practice) 100% N through urea} and it was at par with T5 and T9 as compared to rest of the treatments during the study. The net returns was in order of T11>T5>T9>T12>T4>T6>T7>T8>T10>T3>T2>T1. It is because of the appropriate dose of NPK could make better combination for completion of prominent process like chlorophyll synthesis, promotion of healthy root growth, translocation of photosynthates, enzymes activation for biochemical reaction within plant tissue, wherein the plant get good opportunity for nutrient uptake which results in higher plant growth and development as well as yield. Similar results were also reported by Pandey and Sinha (2006) [14]. Net returns increased with increase in fertilizer dose and maximum net returns were observed at recommended fertilizer dose similar report was found by Gupta *et al.* (2011) [6], Yadav and Kumar (2009) [27] and Gupta *et al.* (2007) [5].

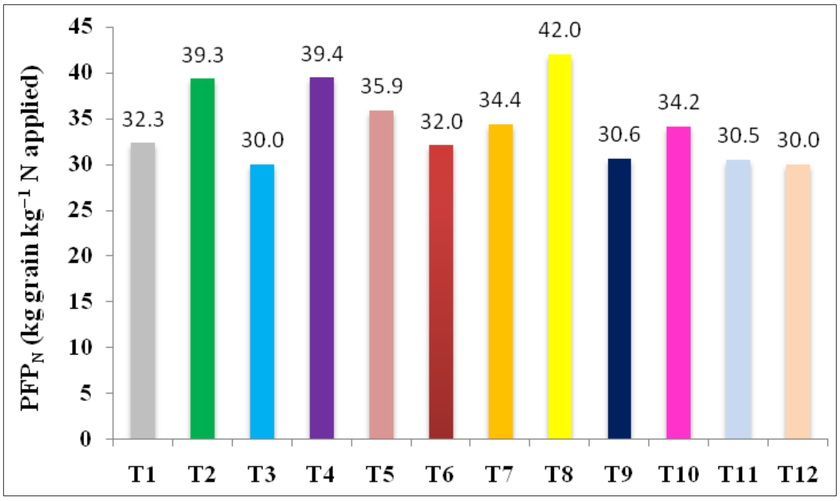

Fig 1: Partial factor productivity of N (PFP$_N$) influenced by different N-management practices in wheat crop

Table 1: Initial physico-chemical properties of soil

Parameter	Value (unit)	Method (references)
Available phosphorus (kg ha^{-1})	14.81	Olsen's method (Olsen *et al.*, 1954) [13]
Available potassium (kg ha^{-1})	232.73	Flame photometric method (Jackson, 1973) [7]
Organic carbon (%)	0.31	Wet digestion method (Walkley and Black, 1973)
pH (1:2 soil:water)	7.6	Glass electrode pH meter method (Richards, 1954) [18]
Electrical conductivity (ds m^{-1}) (1:2 soil:water)	0.13	Conductivity bridge method (Richards, 1954) [18]
Soil texture	Sandy loam	International pipette method (Piper, 1966)

Table 2: Application and amount of nitrogen through different sources in wheat crop

Treatment	N through Urea (kg ha^{-1})	N through Vermicompost (kg ha^{-1})	Total N applied (kg ha^{-1})
T1	84	-	84
T2	61	20	81
T3	99	-	99
T4	76	25	101
T5	118	-	118
T6	100	33	133
T7	100	-	100
T8	75	25	100
T9	125	-	125
T10	94	31	125
T11	150	-	150
T12	113	37	150

Table 3: Growth and yield attributes of wheat crop influenced by different practices

Scenarios	Growth attributes						Yield attributes			
	Plant height (cm)	No. of tillers (m^{-2})	Dry weight (g m^{-2})	CGR (g m^{-2} day^{-1})	RGR (g g^{-1} day^{-1})	Leaf area index (LAI)	Effective tillers (m^{-2})	Spike length (cm)	No. of grains spike^{-1}	1000-grains weight (g)
T1	20.63^{E}	179.24^{G}	83.40^{L}	1.11^{F}	0.12	1.16^{C}	250.70^{F}	8.90^{E}	46.70^{D}	39.61^{I}
T2	19.73^{H}	176.31^{I}	149.85^{E}	2.11^{ABCD}	0.15	1.22^{C}	264.00^{EF}	10.00^{CD}	51.47^{BC}	39.89^{H}
T3	21.11^{D}	170.36^{L}	106.05^{I}	1.48^{DEF}	0.14	1.13^{C}	265.50^{E}	9.73^{CDE}	50.03^{CD}	39.44^{L}
T4	19.16^{J}	176.31^{H}	135.45^{G}	1.91^{CDE}	0.15	1.16^{C}	284.00^{C}	10.50^{ABCD}	50.33^{CD}	40.46^{F}
T5	21.75^{B}	202.98^{B}	175.50^{D}	2.46^{ABC}	0.15	1.26^{BC}	318.67^{A}	10.70^{ABC}	54.70^{AB}	42.35^{A}
T6	19.72^{I}	198.53^{D}	190.50^{B}	2.65^{AB}	0.14	1.57^{A}	302.90^{B}	11.23^{AB}	57.33^{A}	41.78^{C}
T7	20.39^{G}	170.36^{K}	96.00^{J}	1.33^{EF}	0.13	1.04^{C}	261.33^{EF}	9.57^{DE}	50.07^{CD}	39.47^{J}
T8	18.94^{K}	173.33^{J}	87.45^{K}	1.17^{F}	0.12	1.26^{BC}	269.33^{DE}	9.70^{CDE}	51.43^{BC}	39.46^{K}
T9	18.03^{L}	179.24^{F}	145.50^{F}	2.05^{BCD}	0.15	1.18^{C}	280.07^{CD}	11.53^{A}	54.67^{AB}	40.40^{G}
T10	20.61^{F}	180.76^{E}	110.85^{H}	1.53^{DEF}	0.13	1.29^{ABC}	285.33^{C}	10.33^{BCD}	55.00^{AB}	40.63^{E}
T11	22.02^{A}	204.44^{A}	198.15^{A}	2.78^{A}	0.15	1.56^{AB}	320.10^{A}	11.50^{A}	58.03^{A}	41.61^{D}
T12	21.59^{C}	200.00^{C}	181.95^{C}	2.54^{ABC}	0.14	1.59^{A}	306.67^{AB}	11.43^{A}	57.70^{A}	42.12^{B}
P-value	<.0001	<.0001	<.0001	0.0002	0.1702	0.0091	<.0001	0.0004	0.0001	<.0001
LSD at 5%	2.2002	4.1403	7.0452	0.7097	NS	0.3037	13.759	1.0977	4.1936	0.55

Table 4: Yield and Economics of wheat crop influenced by different practices

Scenarios	Yield				Economics	
	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest Index (%)	Cost of cultivation (x1000 INR ha^{-1})	Net returns (x1000 INR ha^{-1})
T1	27.00^{E}	50.33^{C}	77.33^{G}	35.16^{EF}	28.56^{L}	25.83^{E}
T2	31.83^{DE}	57.67^{BC}	89.50^{EFG}	35.58^{DEF}	37.55^{F}	26.33^{E}
T3	29.67^{DE}	61.50^{BC}	91.17^{DEFG}	32.53^{F}	28.80^{K}	31.90^{DE}
T4	39.67^{ABC}	70.17^{AB}	109.83^{ABC}	36.11^{CDEF}	39.76^{D}	39.59^{CD}
T5	42.33^{AB}	75.50^{A}	117.83^{AB}	35.98^{DEF}	29.09^{I}	55.69^{AB}
T6	42.67^{AB}	75.67^{A}	118.33^{AB}	36.04^{DEF}	43.39^{AB}	41.99^{CD}
T7	34.33^{CD}	51.00^{C}	85.33^{FG}	40.21^{ABC}	28.81^{J}	38.41^{CD}
T8	42.00^{AB}	57.33^{BC}	99.33^{CDEF}	42.61^{AB}	39.69^{E}	41.78^{CD}
T9	38.17^{BC}	65.50^{AB}	103.67^{BCDE}	36.93^{CDE}	29.19^{H}	46.85^{ABC}
T10	42.67^{AB}	65.00^{AB}	107.67^{ABCD}	39.62^{BCD}	42.47^{BC}	41.31^{CD}
T11	45.67^{A}	57.50^{BC}	103.17^{BCDE}	44.31^{A}	29.57^{G}	58.29^{A}
T12	45.00^{A}	76.33^{A}	121.33^{A}	37.03^{CDE}	45.25^{A}	44.27^{BC}
P-value	<.0001	0.0013	0.0003	0.0003	<.0001	0.0004
LSD at 5%	6.1686	12.84	17.412	4.1227	2.059	10.977

Conclusion

On the behalf of our findings, it can be concluded that for obtaining growth attributes i.e. plant height, dry matter production, CGR and yield attributes i.e. grains per spike were found to be the best treatment 150 kg N ha^{-1} (farmer practice) when applied 100% N through Urea without soil test in wheat variety HUW-234 (Malviya). The grain yield also recorded with similar treatment with higher net profitability than others. The experimental result reveals this saving of nitrogen by 17 to 32 kg ha^{-1} through soil test based application, while without any significant effect on growth and yield of wheat was noticed. These findings are based on 1 season; therefore, further trials may be required for considering it for recommendation.

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References

1. Agricultural Statistics at a Glance. Directorate of Economics and Statistics, Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation, New Delhi, 2020.
2. Chaturvedi I. Effects of phosphorus levels alone or in combination with phosphate-solubilizing bacteria and farmyard manure on growth, yield and nutrient up-take of wheat (*Triticum aestivum*). J of Agric. and Social Sciences. 2006;2(2):96-100.
3. Gaj Renata, Górski Dariusz, Przybył Jacek. Effect of differentiated phosphorus and potassium fertilization on winter wheat yield and quality. Journal of Elemntology, 2013.
4. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research.2nd ed. John Wiley and Sons, New York, 1984.
5. Gupta M, Bali AS, Sharma BC, Kachroo D, Rajeev. Productivity, nutrient uptake and economics of wheat (*Triticum aestivum*) under various tillage and fertilizer management practices. Indian Journal of Agronomy. 2007;52(2):127-130.
6. Gupta M, Bali AS, Kour S, Bharat R, Bazaya BR. Effect of tillage and nutrient management on resource conservation and productivity of wheat (*Triticum aestivum*). Indian Journal of Agronomy. 2011;56(2):116-120.
7. Jackson ML. Soil chemical analysis, Prentice Hall of India Pvt. Ltd., New Delhi, 1973, 38-43.
8. Jat ML, Bijay-Singh, Gerard Bruno. Nutrient management and use efficiency in wheat systems of South Asia. Advances in Agronomy. 2014;125:171-259.
9. Khandwel R, Sharma RC, Pannase S. Effect of vermicompost and NPK on wheat yield in agri-silviculture system under Satpura plateau of Madhya Pradesh. International Journal of Agricultural Sciences. 2006;2(2):297-298.
10. Kumawat PD, Jat NL, Yadav SS. Effect of organic manure and nulsogen fertilization on growth yield and economics of barley (*Hordeum vulgare*). Indian Journal of Agricultural Sciences. 2006;76(4):226-269.
11. Meena VS, Maurya BR, Verma R, Meena R, Meena RS, Jatav GK, *et al*. Influence of growth and yield attributes of wheat (*Triticum aestivum* L.) by organic and inorganic sources of nutrients with residual effect under different fertility levels. The bioscan. 2013;8(3):811-815.
12. MoA & FW. Ministry of Agriculture and Farmers Welfare, Government of India [Internet], 2018. Available from: https://eands.dacnet.nic.in/Advance_Estimate/4th_Adv_Estimates2017-18_Eng.pdf
13. Olsen SH, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Department of Agriculture Circular. 1954;939:1-9.
14. Pandey IB, Dwivedi DK, Prakash SC. Impact of method and levels of fertilizer application and weed management on nutrient economy and yield of wheat (*Triticum aestivum*). Indian Journal of Agronomy. 2006;51(3):193-198.
15. Patel GG, Sadhu AC, Patel HK, Shan SN, Lakum YC. Effect of organic and inorganic fertilizers in comparison with humic acid on growth and yield of wheat (*Triticum aestivum* L.). International Journal of Agriculture Sciences. 2018;10:6524-6527.
16. Patel TG, Patel C, Patel VN. Effect of integrated nutrient management on yield attributes and yield of wheat (*Triticum aestivum*). International Journal of Chemical Studies. 2017;5(4):1366-1369.
17. Prajapat K, Vyas AK, Shiva Dhar. Productivity, profitability and land-use efficiency of soybean-based cropping systems under different nutrient-management

practices. Indian Journal of Agronomy. 2014;59(2):229-34.
18. Richards LA. Diagnosis and improvement of saline and alkali soils. Method No. 4, United States Department of Agriculture (Hand Book No.60), 1954.
19. Sharma I, Sendhil R. Wheat Production in India—A Decadal Synopsi, 2016. Available from: http://www.FnBnews.com Accessed: 15 January 2019.
20. Singh MP, Kumar P, Kumar A, Kumar R, Diwedi A, Gangwar S, *et al*. Effect of NPK with biofertilizers on growth, yield and nutrient up take of wheat (*Triticum aestivum*) in western Uttar Pradesh Condition. Prog. Agric. 2016;16(1):83-87.
21. Singh D, Singh DR, Nepalia V, Kumari Amina. Argro-economic performance of dual purpose barley (*Hordeum vulgare* L.) varieties under varying seed rate and fertility levels. Annals of Agricultural Research. 2013;34(3):325-329.
22. Singh P, Singh P, Singh KN, Singh R, Raja Waseem. Evaluation of wheat (*Triticum aestivum* L.) genotypes for productivity and economics under graded levels of nitrogen in temperate Kashmir. Indian Journal of Agricultural Sciences. 2010;80(5):380-384.
23. Singh RK, Singh SK, Singh LB. Integrated nitrogen management in wheat (*Triticum aestivum*). Indian Journal of Agronomy. 2007;52(2):124-126.
24. Singh RN, Surendra Singh, Prasad SS, Singh VK, Pramod Kumar. Effect of integrated nutrient management on soil fertility, nutrient uptake and yield of rice-pea cropping system on an upland Acid soil of Jharkhand. Journal of the Indian Society of Soil Science. 2011;59:158-163
25. Tripathi SC, Subhash Chander, Meena RP. Effect of early sowing, N levels and seed rates on yield and yield attributes of different wheat (*Triticum aestivum*) varieties. Indian Journal of Agronomy. 2013;58(1):63-66.
26. Verma RK, Shivay YS, Kumar D, Ghasal PC. Productivity and profitability of wheat (*Triticum aestivum*) as influenced by different cropping systems and nutrient sources. Indian Journal of Agronomy. 2016;61(4):429-435.
27. Yadav DS, Kumar A. Long-term effect of nutrient management on soil health and productivity of rice (*Oryza sativa*)-wheat (*Triticum aestivum*) system. Indian Journal of Agronomy. 2009;54(1):15-23.