Effects of Nitrogen Sources on Soil Properties and Wheat (*Triticum aestivum* L.) Production

Abstract

An experiment was conducted at Agriculture Research Farm, Shri Durga Ji Post Graduate College, Chandeshwar, Azamgarh, Uttar Pradesh during winter session of 2019-20. Among nitrogen content in grain and total uptake of nitrogen were significantly affected by 05 treatments and highest with T_1-(Recommended dose of nitrogen through inorganic source (120 Kg) urea) recommended dose of N through inorganic source and significantly superior over T_2 recommended dose of N through organic source. The availability of N was not significantly influenced by various treatments.

Key words: Organic source, nitrogen content, recommended dose, total uptake of nitrogen, wheat production.

Introduction

Wheat (*Triticum aestivum* L.) belongs to the family Gramineae (Poaceae), is a staple food across the globe. The important and economic consideration for increasing wheat production lies effective use of nitrogen fertilizer. Nitrogen fertilizer uses is the most important factor to a wheat agronomist for achieve his high yield targets. About 91% of the total wheat production is contributed by northern states in India. India is one of the major wheat producing and consuming country of the world. In India, wheat it is cultivated 29.14 million hectare having production of 102.20 million tonnes and productivity level of 3140 kg ha^{-1}(Anonymous, 2018-19). "It contributes about 34% of total food grain production of the country. Uttar Pradesh ranks first in respect to area 9.734 million ha and production 32.74 million tonnes but the productivity is much lower (3113 kg ha^{-1}) than Punjab (5097 kg ha^{-1}) and Haryana (5182 kg ha^{-1})" (Anonymous, 2018-19). "Nitrogen is an essential nutrient among essential plant nutrients, play key role in plant growth, development and reproduction. Though nitrogen is one of the most abundant elements on earth, still nitrogen deficiency is probably the most common nutritional problem affecting plants worldwide. Number of tillers m^{-2} in wheat increased when N rate was increased" (Mossedaq and Smith 1994; Iqtidar *et al*., 2006). "To cope with this situation and to compensate for nitrogen loses due to usage of

synthetic N fertilizers, the inclusion of organic sources of nutrients become the considered best possible solution for N management for wheat production. Application of farmyard manure (FYM) to soil have been practiced for many centuries and its application to soil have increased crop yield, improved soil fertility, increased soil organic matter, increased microbiological activities and improved soil structure for sustainable agriculture" (Blair *et al*., 2006; Kundu *et al*., 2007). Keeping in view the sustainability and quality of wheat production through the integrated use of chemical fertilizers supplemented.

Materials and methods

The experiment was conducted at Agriculture Research Farm of Shri Durga Ji Post Graduate College, Chandeshwar, Azamgarh during winter season of 2019-20 using wheat (variety Kundan- DL-153-2) as test crop. The experiment comprised of five (5) treatments used under a randomized block design with four (4) replications using plot size 4.0 m x 5.0 m with wheat sowing at 20 cm within rows. Five plants were tagged randomly in each plot for data collection on plant height in cm at 30, 60, and 90 DAS. The height was measured from ground surface to the base of fully opened leaf before the ear emergence and up to the base of ear head after heading and averaged out. Total number of shoots per meter length was counted in each plot at 30, 60, and 90 days after sowing. The plants were sun dried separately and then oven dried at $70^0C \pm 2^0C$ till a constant weight was obtained. By summing the values of dry weight of plant, dry matter accumulation of plants per meter row length was computed.

Table 1: Treatment details

T_1	Recommended dose of nitrogen through inorganic source (120 Kg) urea.
T_2	Recommended dose of nitrogen through organic source (FYM)
T_3	75% of recommended dose of nitrogen through inorganic + 25% of recommended dose of nitrogen through organic source (FYM)
T_4	50% of recommended dose of nitrogen through inorganic + 50% of recommended dose of nitrogen through organic source (FYM)
T_5	25% of recommended dose of nitrogen through inorganic + 75% of recommended dose of nitrogen through organic source (FYM)

Available nitrogen (Kg ha^{-1})

The maximum nitrogen content in grain (1.44%) was found with the treatment T_1 and was significantly higher with the rest of treatments. Minimum nitrogen content in grain was

recorded with T_2. The highest phosphorus content in grain was observed under the treatment T_1 and was significantly higher than rest of the treatments. The minimum phosphorus content was observed in T_2. The maximum potassium content in grain with T_1 and was significantly higher than rest of the treatments except with T_3 in straw which was on par. Minimum potassium content was observed with T_2 both in grain and straw. Available N, P & K content in soil sample was estimated by the alkaline permanagante method as described by Subbiah and Asija (1956).

Plant analysis

Analysis of grain and straw samples at harvest was carried out for their nitrogen, phosphorus and potassium contents. Each sample was first dried in the sun and finally in an oven at 70 ±2 ^{O}C and ground in Wiley mill. Grinded grain and straw samples weighted 0.2 and 0.5 g, respectively were digested in diacid mixture of H_2SO_4+ $HClO_4$ (4:1). After digestion, a known volume was made with glass distilled water and stored in well washed plastic bottles after filtration through Whatman filter paper no.42. All the estimations in the aliquot were made according to the following procedures:

(a) Nitrogen content was determined by Nessler's reagent method (Linder, 1944).

Nitrogen uptake by crop (Kg ha^{-1})

Grains and straw of wheat samples from each plot were analyzed by modified micro Kjeldahl's method (Jackson, 1973). Nitrogen content in grain and straw obtained was multiplied bythe respective dty matter yield. The values of both were expressed as total nitrogen uptake by the crop in Kg ha^{-1}.

Total nitrogen uptake (kg ha^{-1}) = N uptake by grain (kg ha^{-1}) + N uptake by straw (kg ha^{-1}).

$$\text{N uptake by grain (kg ha}^{-1}\text{)} = \frac{\text{N content in grain (\%) x Grain yield (kg ha}^{-1}\text{)}}{100}$$

$$\text{N uptake by straw (kg ha}^{-1}\text{)} = \frac{\text{N contnetin straw (\%) x Straw yield (kg ha}^{-1}\text{)}}{100}$$

Results and discussion

Table 2: Nitrogen content, uptake in grain and straw of wheat as influenced by different sources of Nitrogen

Treatments	N content (%)		N uptake (kg ha^{-1})		Total uptake (kg ha^{-1})
	grain	straw	grain	straw	
T_1-Recommended dose of nitrogen through inorganic source	1.44	0.38	69.70	24.56	94.26
T_2-Recommended dose of nitrogen through organic source	1.34	0.36	35.64	13.02	48.66
T_3-75% of recommended dose of nitrogen through inorganic source + 25% of recommended dose of nitrogen through organic source	1.56	0.43	61.09	21.30	82.39
T_4-50% of recommended dose of nitrogen through inorganic source + 50% of recommended dose of nitrogen through organic source	1.50	0.42	50.89	18.02	68.92
T_5-25% of recommended dose of nitrogen through inorganic source + 75% of recommended dose of nitrogen through organic source	1.46	0.41	39.93	14.83	54.76
SEm±	**0.016**	**0.004**	**1.746**	**0.636**	**1.886**
CD at 5%	**0.048**	**0.013**	**5.381**	**1.960**	**5.812**

Wheat nitrogen content (%)

Data on plant nitrogen contents (Table 2) revealed that the nitrogen content was highest in the grains than in straws and the mean differences between the grains and straws were significantly different due to the various treatments. Maximum nitrogen content in grain (1.44%) was obtained with the treatment T_1 and was significantly higher over the rest of the treatments. The least nitrogen content in grain was obtained with T_2.

Nitrogen uptake (Kg ha^{-1})

The data (Table 2) revealed that nitrogen uptake was significantly affected by the various fertilizer treatments. T_1 resulted in highest uptake of N in the grain (69.70 kg ha^{-1}) which was significantly higher than the rest of the treatment. The least nitrogen uptake was obtained with T_2.

Total nitrogen uptake (Kg ha^{-1})

The total N uptake (Table 2) showed that the total uptake of nitrogen also followed the same trend as observed in grain and straw uptakes

The highest nitrogen content in grain (1.44%) was observed under treatment $T_{1,}$ which was the recommended dose of N through inorganic source and was significantly higher than the rest of the other treatments. However, same trend ar obtained for nitrogen content in the straw was observed among pther the treatments. Similarly the nitrogen uptake in grain and straw was significantly higher in T_1 than the rest of the treatments. Similar trend was observed in the total nitrogen uptake. This was perhaps due to improved availability of nitrogen in the soils resulting from the fertilizer uages. The results are in corroboration with the findings of Chaudhary *et al.* (1997) and Parmar and Sharma (1996).

The maximum available nitrogen (172.50 kg ha^{-1}) in the soil was observed with T_3 75% of recommended dose of nitrogen through inorganic source + 25% of recommended dose of nitrogen through organic source was higher than T_2 recommended dose of nitrogen through organic source and T_1 recommended dose of nitrogen through inorganic source but not significantly affected by any of the treatment. The results showed that integrated nutrient application through organic and inorganic fertilizer used in a suitable combination improved the soil fertility than use of inorganic fertilizers alone. Similar results were reported by Bhiday (1994), Singh *et al*. (1999).

Conclusion

Nitrogen content in grain and total uptake of nitrogen were significantly affected by various treatments and highest with T_1- (Recommended dose of nitrogen through inorganic source) recommended dose of N through inorganic source and significantly superior over T_2- (Recommended dose of nitrogen through organic source) recommended dose of N through organic source.

References

1. Anonymous. 2018-19. The Hindu Survey of Indian Agriculture. Printed & Published at the National Press, Chennai.
2. Bhiday MR. 1994. Earthworms in Agriculture. *Indian Farming*, 43 (2): 31-33.
3. Blair NR, Faulkner D, Till AR and Poult PR. 2006. Longterm management impacts on soil C. N. and physical fertility. *Soil and Tillage Res*., 91 : 30-38.
4. Chaudhary GA, Sadiq M, Habib G and Khan MA. 1994. Response of two wheat cultivars to nitrogen and phosphorus application under rainfed conditions. *J. Agric. Res*., 27 (1): 13-17.
5. Iqtidar H, Ayyaz KM and Ahmad KE. 2006. Bread wheat varieties as influenced by different nitrogen levels. *J Zhejiang Univ. Sci*., 7: 70-78.
6. Jackson ML. 1973. Soil chemical analysis. Prentice Hall of Indian Pvt. Ltd., New Delhi, pp. 493.
7. Kundu S, Bhattacharyya R, Parkash V, Ghosh BN and Gupta HS. 2007. Carbon sequestration and relationship between carbon addition and storage under rainfed soybean-wheat rotation in a sandy loam soil of the India Himalayas. *Soil and Tillage Res*., 92: 87-95.
8. Lindner RC. 1944. Rapid analytical method for some of more common inorganic constituents of plant tissues. *Plant Physical*, 19: 76-78.
9. Mossedaq F and Smith DH. 1994. Timing nitrogen application to enhance spring wheat yields in Mediterranean climates. *Agron. J*., 86: 221-226
10. Sharma PK and Parmar DK. 1998. Effect of phosphorus and mulching on the uptake of secondary nutrient and productivity of wheat at different growth stages on an altisol from western Himalayas. *J. Indian Soc. Soil Sci*., 46 (1): 67-70.

11. Singh KP, Singh H, Ranwa RS, Kathuria MK and Singh SM. 1999. Relative efficiency of vermicompost and some other organic manure integrated with chemical fertilizers in cereal based cropping system. *Haryana J. Agron*., 14 (1): 34-40.
12. Subbiah BV and Asija GL. 1956. A rapid procedure for determination of available nitrogen in soils. *Curr. Sci.*, 25 : 259-260.