



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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i213939

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/107605>

Original Research Article

Received: 03/08/2023
Accepted: 07/10/2023
Published: 12/10/2023

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 T₁-(Recommended dose of nitrogen through inorganic source (120 Kg) urea) recommended dose of N through inorganic source and significantly superior over T₂ recommended dose of N through organic source. The availability of N was not significantly influenced by various treatments.

Keywords: Organic source; nitrogen content; recommended dose; total uptake of nitrogen; wheat production.

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1. 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 [1]. "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)" [1]. "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" [2,3]. "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" [4,5]. Keeping in view the sustainability and quality of wheat production through the integrated use of chemical fertilizers supplemented.

2. 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°C± 2°C 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.

2.1 Available Nitrogen (Kg ha⁻¹)

The maximum nitrogen content in grain (1.44%) was found with the treatment T₁ and was significantly higher with the rest of treatments. Minimum nitrogen content in grain was recorded with T₂. The highest phosphorus content in grain was observed under the treatment T₁ and was significantly higher than rest of the treatments. The minimum phosphorus content was observed in T₂. The maximum potassium content in grain with T₁ and was significantly higher than rest of the treatments except with T₃ in straw which was on par. Minimum potassium content was observed with T₂ 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 [6].

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)

2.2 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 °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 [7].

2.3 Nitrogen Uptake by Crop ($Kg\ ha^{-1}$)

Grains and straw of wheat samples from each plot were analyzed by modified micro Kjeldahl's method [8]. Nitrogen content in grain and straw obtained was multiplied by the respective dry 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 ($kg\ ha^{-1}$).

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

$$N\ uptake\ by\ straw\ (kg\ ha^{-1}) = \frac{N\ content\ in\ straw\ (\%) \times Straw\ yield\ (kg\ ha^{-1})}{100}$$

3. RESULTS AND DISCUSSION

3.1 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 .

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 was observed for nitrogen content in the straw was observed among other 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 uses. The results are in corroboration with the findings of Chaudhary et al. [9] and Parmar and Sharma [10].

3.2 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 .

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 [11], Singh et al. [12].

3.3 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

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

4. CONCLUSION

Nitrogen content in grain and total uptake of nitrogen were significantly affected by various treatments and highest with T₁- (Recommended dose of nitrogen through inorganic source) recommended dose of N through inorganic source and significantly superior over T₂- (Recommended dose of nitrogen through organic source) recommended dose of N through organic source.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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