Journal of
Advances in Agronomy and Crop Science

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Research Open Access

Study on Nitrogen Management through Nano Urea and Conventional Urea in Wheat (Triticum Aestivum L)

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Received Date: August 27, 2025 **Accepted Date:** September 06, 2025 **Published Date:** October 10, 2025

Citation: Vishuddha Nand, J. Gangadhar Reddy (2025) Study on Nitrogen Management through Nano Urea and Conventional Urea in Wheat (Triticum Aestivum L). J Adv Agron Crop Sci 4: 1-5

Abstract

The experiment was conducted during the Rabi season in 2021-22 at student instructional farm of Agronomy under Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) to Study on Nitrogen management through nano urea and conventional urea in wheat (Triticum aestivum L.)". The experiment was laid out in Randomized Block Design with four replications. Total six treatments had been made i.e. T1: Control, T2: 100% RDN through conventional Urea (40% at Basal+ 30% at 30DAS+30% at 50DAS), T3: 75% RDN through conventional Urea as Basal + 25% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T4: 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T5: 25% RDN through conventional Urea as Basal +75% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T6: 100% RDN through Nano Urea as topdressing (50% at 30 DAS+50% at 50 DAS). The experimental results revealed that among the treatments, 50% RDN through conventional urea as basal + 50% RDN through nano urea as topdressing (at 30 and 50 DAS) recorded maximum plant height, number of tillers (m-2), leaf area index, dry matter accumulation, same trends were found in case yield attributes and yield of wheat crop. The highest net returns (Rs. 51286 ha') and B: C ratio (1.42) were also noted with the application of 50% RDN through conventional urea as basal + 50% RDN through nano urea as topdressing (at 30 and 50 DAS).

Keywords: Nanourea, Conventional Urea, Growth, LAI, Yield and Wheat.

Introduction

Wheat (Triticum aestivum L) is one of the most important cereals crop in the world and it is a significant source of nutrient and energy, its grain is used in variety of food products including bread, pasta and baked goods and also used in animal feed as well as manufacturing of various products. In India wheat production is estimated to have reached a record high of 115.43 million metric tons in 2024-25. Uttar Pradesh, Punjab, and Haryana are the most producer states of wheat in India. Wheat contents 13% Protein, 71% carbohydrate,1.5 % fat. Gluten protein in wheat is found an adequate amount. The use of conventional N fertilizers in particular amount has resulted in significant N losses to the environment, causing eutrophication of rivers, soil acidity, and biodiversity loss. However, nitrogen is lost to surface and ground water through nitrate leaching, de- nitrification and ammonia volatilization, resulting in economic losses and environmental contamination [1]. Many agricultural management strategies have been proposed to increase NUE in annual crops such as wheat and mix crop-livestock systems ([2] similar finding was preposed by Mehta and Bharat, 2019) including split nitrogen application, nitrogen localization, precision farming, liquid formulations, foliar sprays, and liming treatments.Nano fertilizers have distinct advantages due to their small size and bigger surface area, which increases absorption, the rate of photosynthesis, and the creation of active compounds in the plant [3]. Nano fertilizers are so efficient that they minimize fertilizer application rates of annual demand when traditional negative environmental impact fertilizers must be addressed by laws [4]. There are some indications of the economic potential of nano fertilizers proposed by nanotechnology professionals dedicated to fertilizer improvement.

Materials and Methods

The experiment was conducted at Agronomy Research Farm, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during Rabi Season 2021-22, on study on nitrogen management through conventional urea and nano urea in wheat (Triticum aestivum L). In experiment Randomized Block Design was used along with six treatments replicated four timesi.e. T1: Control, T2: 100% RDN through conventional Urea (40% at Basal+ 30% at 30DAS+30% at 50DAS), T3: 75% RDN through conventional Urea as Basal + 25% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T4: 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T5: 25% RDN through conventional Urea as Basal +75% RDN through Nano Urea as topdressing (at 30 and 50 DAS), T6: 100% RDN through Nano Urea as topdressing (50% at 30 DAS+50% at 50 DAS). The maximum and minimum temperature was recorded as 35.9 0C and 8.5 0C during the crop growth period during the crop growth period. Maximum temperature ranged from 18.5 0C to 35.9 0C during maturity phase of the crop. Relative humidity varied from 46.5% to 95.7% during crop growth period. The area receives mean annual rainfall of 845mm. The crop variety HD-2967 was sown on 08 December 2021 and harvested on10 April 2022. The seed rate was applied @100 kg ha-1 with the help of seed drill in distance of 20 cm apart. The recommended dose of nitrogen (120 kg ha-1) as per the treatment, The whole quantity of phosphorous (60 kg ha-1) and potassium (40 kg ha-1) were applied as basal dose through DAP and murate of Potash at 8-10 cm depth. The seeds were treated with Azotobacter @200g per 10 kg seed, which was applied as per treatments before the sowing. Weeding operations were performed manually after first and second irrigation at proper soil moisture condition of the soil. the soil of experiment field may texturally classify as silty loam according to triangular method. The initial phisico-chemical properties viz, pH (8.4)high, EC (0.35dSm-1) medium, OC (0.35 %), Availbale N (185.0 kg ha-1),Availbale P (14.50kg ha-1) and Availbale K (280kg ha-1) were measured in soil before the experiment.

Result and Discussions

Plant height(cm), number of tillers (m-2), leaf area index and dry matter accumulation (gm-2) were signifaintly affected by the application of converntional urea and nano urea, which have been shown in Table-2. The results indicates that, the maximum growth parameters likes, taller plant (99.79cm) at harvest stage, dry matter accumulation (gm-2), no of tillers (m-2) at harvest stage and leaf area index at 90 DAS were recorded with the application of 50% RDN through conventional urea + 50% RDN throught nano urea, when topdressed at 30 DAS and 50 DAS. Which

was significantly higher over the rest of the treatments, while the number of tillers and dry matter accumulation was at par with the application of 25% RDN through conventional Urea as Basal + 75% RDN through Nano Urea astopdressing (at 30 and 50 DAS).The foliar application of nano fertilizers significantly improved growth parameters, this could be due to the fact that nano fertilizers have higher surface area, which improves reactivity and thus improves nutrient uptake in plants, resulting in a cumulative increase in plant height, leaf area, and number of tillers and dry matter accumulations [5].

Yield attributes such as effective tillers/m2, spike length (cm), number of grains per spike (g), and test weight (g)were sighnificantly affected through the application of conventional urea and nano urea. Which has been shown in Table 3.The effective tillers, spike length (cm), number of grains per spike (g), and test weight (g) were achieved more with the application of 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing at 30 and 50 DAS),which was found to be significantly higher over other treatments.The number of reproductive tillers was considerably reduced when conventional fertilizer was used alone or in combined with Nano-fertilizer, the yield attributes increase might be due increase the rate of follier application of nitrogen which cause enhanced leaf area assists in greater solar radiation consumption and accessible nutrients, both of which are critical for higher photosynthetic surface area, resulting in more accumulation and transfer of photosynthates, which ultimately increased biomass output [6] the similar finding was achived by [7].

The data pertaining to grain &straw yield and biological yield as influenced significantly by the application of conventiona urea and nano urea except harvest index which have been presented in Table 3. The maximum grain & straw yield and biological yield were obtained with the application of 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing at 30 and 50 DAS) which was found to be at par with the application of 25% RDN through conventional Urea as Basal + 75% RDN through Nano urea at topdressing (at 30 and 50 DAS) and significantly higher over rest of the treatments. The maximum yield were obtained might be due to higher potosynthetes results in increase more yield attributes which is ultimatedly increase the grain & straw and biological yield of wheat [8].

The data pertaining to Table 4 indicates that, The maximum Gross return, Net return and B: C ratio were noted with the application of 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing at 30 and 50 DAS) this might be due to maximum yield obtained under this teatement which is ultimately increase the sale price, similar finding was obtained by [9].

Conclusion

Based on the above cited results of the one year experiment, it could be concluded that two spray of nano urea in combination with the application of conventional urea fertilizers i.e. 50% RDN through conventional Urea as Basal + 50% RDN through Nano Urea as topdressing at 30 and 50 days after sowing significantly increase the growth and yield attributes and yield of wheat crop.

Acknowledgement

We thanks to our gratitude of hurt to my advisor Dr. Vishuddha Nand for their support and nice coopration with me and they provide all facilities during the conduct the experiment and guide me for analysis the data and writing entire thesis.

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