



INFLUENCE OF INM PRACTICES AND NANO UREA ON YIELD ATTRIBUTES AND YIELD OF DRUM SEEDED RICE

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ABSTRACT

A study was carried out during *Late Navarai* season (February-May, 2023) at Experiment Farm, Department of Agronomy, Faculty of Agriculture, Annamalai Nagar, Tamil Nadu, India to investigate “Influence of INM practices and nano urea on yield attributes and yield of drum seeded rice”. The experiment was laid out in randomized block design with four replications making six treatment combinations. The results showed that the maximum number of productive tillers m^{-2} (361), number of filled grains panicle $^{-1}$ (105.50), test weight (15.58g), grain (6,234 kg ha^{-1}) and straw yield (9,261 kg ha^{-1}) was significantly highest under treatment T₅ - 100% RDF + 25% RDN as goat manure + 0.2% Nano urea spray which was followed by treatment T₄ - 100% RDF + 0.2% Nano urea spray. The lowest grain (4,106 kg ha^{-1}) and straw yield (6,631 kg ha^{-1}) was recorded under treatment, T₁ – 100% RDF.

Keywords: Rice, Nano urea, Goat manure, Productive tillers, filled grains, Grain and Straw yield.

INTRODUCTION

India is the second largest producer and consumer of rice in the world. India is also the fourth largest exporter of rice in the world. Rice is cultivated worldwide in an area of 177.25 million ha with the production of 518.14 million tonnes, having a productivity of 2.92 t ha^{-1} (USDA, 2022-23). In India, rice is cultivated in an area of 46.38 million hectares having annual production of 130.29 million tonnes with a productivity of 2.8 t ha^{-1} (MAFW, 2022). In Tamil Nadu, rice is cultivating in the area of 2.2 million hectares with a production of 8.65 million tonnes and average productivity of about 3.93 t ha^{-1} (ICAR, 2023). Rice is one of the most important food crops and a primary food source for more than one third of the world's population (Prasad *et al.*, 2010). Rice plants require a lot of mineral nutrients, especially nitrogen, to grow, develop, and produce grains. Nitrogen is one of the important elements in plant owing to its major part in chlorophyll production, which is essential for the photosynthesis process. Nitrogen is part of different enzymatic proteins that catalyze and regulate plant

development processes (Sinfield *et al.*, 2010). Nano urea is liquid formulations manufactured by Nano Biotechnology Research Center in association with Indian Farmers Fertilizers Cooperative Limited. The 500 ml of nano urea is equivalent to a 45 kg urea fertilizer. It contains nano scale nitrogen particles (55,000 nano particles) with high surface area (10,000 times over 1mm Urea prilled). On foliar application, these small particles are delivered directly to the plant cell, thereby releasing nitrogen inside the cells as per the requirement in a phased manner which ensure low and target efficient release for providing the nutrients to the crop and thus increase nutrient use efficiency. Nano urea when sprayed on crop leaves triggers pathway for uptake and assimilation of nitrogen inside the plants. Thus, foliar application of nano urea enhances availability of nitrogen through stomata of leaves via gaseous uptake and activate many enzymes involved in biochemical pathways for maintenance of biological membranes. Integrated nutrient management has been shown to considerably improve rice yields by minimizing nutrient losses to the environment and managing the nutrient supply, and thereby results in high nutrient use efficiency (Parkinson *et al.*, 2013). Integration of organic manure along with inorganic fertilizers could be the best option for sustaining rice yield and restoring soil fertility and facilitating the continuous supply of nutrients throughout the crop season. Therefore, the present investigation was undertaken to study the effect of INM practices and nano urea on the growth and yield component for enhancing the production of rice.

MATERIAL AND METHODS

The experiment was conducted in Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil Nadu, India during *Late Navarai* season (February-May, 2023). The experiment was laid out in Randomized Block Design (RBD) with six treatments and four replications to study the “Influence of INM practices and nano urea on yield attributes and yield of drum seeded rice”. The plot size was 5 x 4 m and the treatments were: T₁ - 100% RDF, T₂ - 100% RDF + 25% RDN as goat manure, T₃ - 100% RDF + 25% RDN as green leaf manure, T₄ - 100% RDF + 0.2% Nano urea spray, T₅ - 100% RDF + 25% RDN as goat manure + 0.2% Nano urea spray, T₆ - 100% RDF + 25% RDN as green leaf manure + 0.2% Nano urea spray. The soil of the experiment field was clay in texture. The variety under study was ADT-43 at a seed rate of 60 kg ha⁻¹ with row-to-row spacing of 20 cm. The recommended dose of fertilizer for the rice crop was 120:40:40 NPK kg ha⁻¹. Fifty per cent N, full dose of P₂O₅ and fifty per cent K₂O were applied as basal. The remaining fifty per cent each of N were top dressed in two equal splits at active tillering and panicle initiation stages. The balance fifty per cent of potassium was top dressed at panicle initiation stages. The fertilizer materials used were urea, single super phosphate and muriate of potash to supply nitrogen, phosphorus and potassium respectively. The experimental data recorded for various parameters under study were analyzed statistically (Gomez and Gomez, 1984) to draw a valid conclusion.

RESULTS AND DISCUSSION

Yield attributes

Among the treatments, the highest number of productive tillers m⁻² (361), number of filled grains panicle⁻¹ (105.50) and test weight (15.58g) were recorded under treatment T₅- 100% RDF + 25% RDN as Goat manure

+ 0.2 % Nano urea spray which was followed by treatment T₄- 100% RDF + 0.2 % as Nano urea spray (Table 1).

The highest number of productive tillers (m^{-2}) might be due to the foliar spray of nano urea, led to the meristematic activity and stimulation of cell elongation in plants. These result findings were in close agreement with the findings of Jassim *et al.* (2019). Increase in number of filled grains panicle⁻¹ by application of goat manure might be due to high amount of phosphorus and potash content in goat manure and also due to better translocation of carbohydrates from source to sink is continuous supply during the flowering and grain filling stage of rice. Similar findings reported by Shalini and Brijbhooshan (2017) and also foliar application of nano urea fertilizer which might be due to the higher translocation of starch both from the active site of leaves and also straw to grain (sink) and also higher nitrogen supplied by nano urea throughout the growth stages. The increased amount of interception of photosynthetically active radiations and greater photosynthesis. Similar results were found by Gewaily *et al.* (2019).

Grain and straw yield

Among the treatments, the highest grain (6,234 kg ha⁻¹) and straw yield (9,261 kg ha⁻¹) was observed under treatment T₅- 100% RDF + 25% RDN as Goat manure + 0.2 % Nano urea spray which was followed by treatment T₄- 100% RDF + 0.2 % as Nano urea spray (Table 1).

Grain yield increased with application of goat manure might be due to the improved parameters like plant growth and filled grains per panicle. The high organic matter and nutrients content in goat manure attribute to better plant growth due to improved soil microbial activity and readily release of macro and micro nutrients to enhance physiological and reproductive activity in rice and thus producing high yield. Similar finding is also documented by Surekha *et al.* (2010), Uwah and Eyo (2014) and Shalini and Brijbhooshan (2017) and also Nano fertilizers increase rice grain yield it is mainly because of increasing growth of plant parts and metabolic process such as photosynthesis leads to higher photosynthates accumulation and translocation to the economic parts of the plant. These result findings were in close agreement with the findings of Kumar *et al.* (2020). Straw yield increased with foliar spray of nano urea fertilizer might be due to nano fertilizer' quick absorption by the plant and easiness of translocation, which aided in better rates of photosynthesis and more dry matter accumulation, resulting in higher straw yield. Nearly similar results were found by Khalil *et al.* (2019).

Table 1. Effect of Effect of INM practices and nano urea on yield attributes and yield of rice

Treatment	No. of productive tillers (m^{-2})	No. of filled grains panicle ⁻¹	Test weight (g)	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)
T ₁ - 100% RDF	295	82.74	15.24	4106	6631

T ₂ - 100% RDF + 25% RDN as GM (Goat manure)	327	89.74	15.37	5367	8272
T ₃ - 100% RDF + 25% RDN as Green Leaf manure	308	86.01	15.32	4696	7357
T ₄ - 100% RDF + 0.2% Nano Urea spray	349	98.90	15.55	5887	8790
T ₅ - 100% RDF + 25% RDN as GM (Goat manure) + 0.2% Nano Urea spray	361	105.50	15.58	6234	9261
T ₆ - 100% RDF + 25% RDN as Green Leaf manure + 0.2% Nano Urea spray	339	94.91	15.49	5616	8544
SEm±	2.89	0.98	0.25	72.00	80.00
CD (P=0.05)	8.73	2.95	NS	217.45	241.61

CONCLUSION

The highest number of productive tillers m⁻², number of filled grains panicle⁻¹, test weight, grain yield and straw yield was recorded under treatment, T₅ - 100% recommended dose of fertilizer + 25% recommended dose of nitrogen as goat manure + 0.2% Nano urea spray and this was followed by application of 100% RDF + 0.2% Nano urea spray (T₄). The lowest number of productive tillers m⁻², number of filled grains panicle⁻¹, grain yield and straw yield was recorded under treatment, T₁ – 100% RDF.

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