The Pharma Innovation Journal 2023; 12(1): 3030-3033

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(1): 3030-3033

www.thepharmajournal.com
Received: 26-11-2022
Accepted: 28-12-2022

Prabhat Ranjan
Ph.D. Scholar, Department of Agronomy, Bihar Agricultural University, Sabour, Bihar, India

Birendra Kumar
Assistant Professor, Department of Agronomy, Bihar Agricultural University, Sabour, Bihar, India

Anupriti Mala
Ph.D. Scholar, Department of Agronomy, Bihar Agricultural University, Sabour, Bihar, India

Shubham Priyadarshi
PG Student, Department of Horticulture Vegetable and Floriculture, Bihar Agricultural University, Sabour, Bihar, India

Aditya Shri
Ph.D. Scholar, Department of Agronomy, Bihar Agricultural University, Sabour, Bihar, India

Lal Babu
PG Student, Department of Horticulture Vegetable and Floriculture, Bihar Agricultural University, Sabour, Bihar, India

Aditya Narayan
PG Student, Department of Entomology, Bihar Agricultural University, Sabour, Bihar, India

Balbir Kumar
PG Student, Department of Horticulture, Institute of Agricultural Sciences, BHU Varanasi, Uttar Pradesh, India

Corresponding Author:
Birendra Kumar
Assistant Professor, Department of Agronomy, Bihar Agricultural University, Sabour, Bihar, India

Effect of foliar spray of Nano urea on yield and economics of rice

Prabhat Ranjan, Birendra Kumar, Anupriti Mala, Shubham Priyadarshi, Aditya Shri, Lal Babu, Aditya Narayan and Balbir Kumar

DOI: https://doi.org/10.22271/tpi.2023.v12.i1ai.19419

Abstract
A field experiment was conducted on "Effect of foliar spray of Nano urea on yield and economics of rice (*Oryza sativa* L.) at Bihar Agricultural College Farm, Sabour during *kharif* season of 2022 in randomized block design (RBD) with six treatments and four replications. The results showed that highest number of tillers meter^{-2}, number of panicles meter^{-2}, number of filled grains panicle^{-1}, 1000-grain weight (g), grain yield (4899 kg ha^{-1}) and straw yield 6094 kg ha^{-1}) was significantly highest under treatment T_2- 100% RDN through urea along with 2 foliar sprays of Nano-urea (4ml/L) at AT and PI which was at par with treatment T_1- 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)]. The lowest grain and straw yield (3287 and 4051 kg ha^{-1}) was recorded under control. Economics of different treatments indicated that by higher grain yield, treatment T_2- 100% RDN through urea along with 2 foliar sprays of Nano-urea (4ml/L) at AT and PI exhibited maximum B:C ratio.

Keywords: Nano urea, rice, grain and straw yield

Introduction
Rice is one of the important crops which contribute to the food basket of India. India is the 2nd largest producer of rice in the world after China at the global level. Total area under rice cultivation in 2021-22 is 45.77 million hectares which has resulted in production of 124.37 million tonnes (Anonymous 2023). Among states, West Bengal is the highest producer state followed by Uttar Pradesh and Punjab. Bihar is also one of the important states which have significant contribution in rice production. In Bihar rice is cultivated in the area of 3.2 million hectare with 7.7 million tonnes of production. Introduction of improved high yielding varieties of rice has made us self-sufficient and also strengthen the food security of India. But the increment of population at exponential rate compels us to produce more and more, so that our future generation shall not deprive of the basic need i.e., food.

Fertilizer has a crucial role in the crop growth and development. In rice, nitrogen plays an important role at every stage of rice from tillering to maturity. Also, high yielding varieties are highly fertilizer responsive. This has led to excessive use of traditional nitrogen fertilizers like urea by the farmers. Researchers have been working to improve rice production by use of different sources of fertilizers like urea application, FYM and Vermicompost application, foliar spray of Vermiwash, Panchgavya etc. Along with these use of nanomaterials like nano urea is also one of viable options to cut down the use of traditional fertilizers. The nanotechnology has wider areas of application in agriculture (Kumar *et al.*, 2022) [6]. The main reasons for excessive use of fertilizers are the low nutrient use of efficiency. The amount of nutrient taken by the crop is less than that are remains in the soil. Nanomaterials able to improve the nutrient uptake by providing nutrients for plants through more efficient nutrient delivery system. Nanomaterials are distinct object with minimum dimension of 1 and maximum dimension of 100 nm (Liu and Lal 2015) [1]. These Nanomaterials include different Nano fertilizers like Nano-urea, Nano-zinc etc. which are more environmentally friendly (Baboo *et al.* 2021) [8]. The nano fertilizers used are foliar fertilizers come from natural minerals and without chemical additives. Nano urea in rice boost yield, minimise fertiliser consumption and increase farmer revenue along with improvements in nitrogen use efficiency and reduction in leaching losses (Midde *et al.*, 2022) [7].

The purpose of this research is to study the effect of foliar spray of Nano urea along with traditional fertilizers in increase in productivity of rice.

Materials and Method

The experiment was conducted in Agricultural farm, Bihar Agricultural University, Sabour, Bhagalpur. The experimental setup was designed in Randomized Block Design (RBD) with six treatments and four replications. The variety of rice taken was Sabour Shri under *kharif* Season in 2022. The initial soil samples are collected and analysed for available nutrient content. Soil is nearly neutral in nature (Ph – 7.47) with EC – 2.81 dS/m, has organic carbon content (4.31%), available nitrogen 218.2 (kg/ha), available phosphorus (34.8 kg/ha) and available potassium (179.4 kg/ha).

The treatment details include the application of full dose of P and K as basal dose in all treatments. The treatments were consist of T_1 – 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panical initiation (PI)]; T_2 – T_1 + 2 foliar spray of Nano-urea (4ml/L) at AT and PI; T_3 – 50% RDN through urea as basal + Two foliar spray Nano-urea (4ml/L) at AT and PI; T_4 – 100% RDN through urea (75% basal + 12.5% AT + 12.5% PI); T_5 – T_4 + 2 foliar spray of Nano-urea (4ml/L) at AT and PI; T_6 – Control (no application of nitrogen). The recommended dose of fertilizers for the rice crop was 120:60:40 kg NPK/ha. Rice was transplanted on 19th July, 2022 in the experimental plot with size 24 m^2 each. The total of 24 plots were taken.

The observations were taken at various phases of crop, ranging from 30 DAS, 60 DAS and 90 DAS. Tillers $meter^{-2}$, number of panicles $meter^{-2}$, filled grains $panicle^{-1}$, grain yield, straw yield and test weight were the observations recorded at the harvesting stage of the crop. Soil analysis was carried out before planting and after harvest of the crop including available nitrogen, available phosphorus and available potassium.

Results and Discussion

Effect of different treatments on yield attributes characters and yield

Number of tillers $meter^{-2}$

Statistical analysis of the data (Table 1) indicated that urea with nano urea level in combination had significant effect on number of tillers of $meter^{-1}$. Significantly highest number of tillers $meter^{-1}$ with application of (T_1) 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of Nano-urea (4ml/L) at AT and PI, which was at par with T_1- 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)]. This might be due higher division, cell elongation and meristematic activity in plants, resulting in a higher number of tillers m^{-2}.

Number of Panicles $meter^{-2}$

Significantly highest number of panicles $meter^{-2}$ (288.9) (table 2) was found in T_2 with application of 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of nano-urea (4ml/L) at AT and PI, which was at par with T_1 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)]. The maximum number of panicles $metre^{-2}$ may be the result of a constant supply of nitrogen being provided by nano urea during a key period, which would have stimulated cell elongation and meristematic activity in plants, resulting in a higher number of panicles m^{-2}. Similar result supported by Jassim *et al.* (2019) [4].

Number of filled grains $panicle^{-1}$

Mean data (table 1) indicated that urea with two foliar sprays of nano-urea (4ml/L) at AT and PI had significant effect on the number of filled grains $panicle^{-1}$. Significantly highest number of filled grains $panicle^{-1}$ with application of 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of nano-urea (4ml/L) at AT and PI, which was at par with T_1- 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)], T_3- 50% RDN through urea as basal + Two foliar spray Nano-urea (4ml/L) at AT and PI; T_4- 100% RDN through urea (75% basal + 12.5% AT + 12.5% PI), (T 5) T 4 + 2 foliar spray of Nano-urea (4ml/L) at AT and PI. It might be attributed to an increase in enzyme activity, which could result in the creation and transportation of photosynthates, which could then cause the number of grains per panicle to increase. Similar results were found by Gewaily *et al.* (2019) [3].

1000 grain weight (g)

The highest 1000-grain weight (24.3 g) (table 2) was found in 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of Nano-urea (4ml/L) at AT and PI (T_2), which remained statistically at par to the treatment (T_1) -100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)].

Grain yield (kg ha^{-1})

In the present study (table 2), mean data showed that application of urea as a source of nitrogen at different growth stages and urea with nano urea showed the variation in grain yield from 3287 to 5203 kg ha^{-1}. The increase in grain yield 1916 kg ha^{-1} due to application of nano urea over control. Application of recommended dose of nitrogen [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with two sprays of nano urea at AT and PI stages showed the maximum yield followed by T_1- 100% RDN through urea application at different growth stages. The increase in grain yield was significantly higher under all the nano urea treated plot over control. The higher yield from the combined application of RDN with nano urea might be attributed, to enhanced nutrient uptake due to readily available for plant because it may be caused due to combined application of conventional fertilizer as basal dose and split dosage application of nano urea has been sprayed on plant surface leads to storage of remaining nitrogen in plant cells that may release slowly that can prevent the plant biotic and abiotic stress produces the high grain yield. These result findings were in close agreement with the findings of Kumar *et al.* (2020) [5].

Straw yield (kg ha^{-1})

Data (table-2) revealed that straw yield (6533.3 kg ha^{-1}) is significantly more in T_2- 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of nano-urea (4ml/L) at AT and PI over rest o the treatment. This might be the result of increased vegetative growth, increased plant height, increased leaf production, or increased accumulation of dry matter. Maximum straw production was achieved using both conventional and nano fertilisers. It is presumably because it controls the release of nutrients and releases nutrients only

when needed, which controls plant development and improves target activity, which results in biological crop output. Similar findings reported by Rosa *et al.* (2010) [2] and Nair *et al.* (2010) [9].

Effect of different treatments on economics

The economics of rice were evident due to nano urea, various fertiliser application techniques, labour requirements, and, most importantly, the weather during the production period. The economics of rice production were computed by itemising cultivation costs and subtracting them from the prices of various treatment costs to obtain the net return. Table 2 shows how the BC ratio increased significantly when different level of urea and nano urea application. Highest B:C ratio (2.16) of rice was obtained in treatment T2- 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of nano-urea (4ml/L) at AT and PI. It was due to cumulative resulted the higher grain, stover and stone yield, lead to more gross return, net return and B:C ratio. While, lowest B:C ratio (1.34) was recorded under treatment T8- no application of nitrogen.

Table 1: Effect of Nano urea application on yield attributing characters of rice crop

Treatment	Number of tillers meter^{-2}	Number of panicles meter^{-2}	Number of filled grains panicle^{-1}	1000 grain weight (g)
T_1-100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panical initiation (PI)	288.5	284.9	175.8	23.5
T_2 – T_1 + 2 foliar sprays of Nano-urea (4ml/L) at AT and PI;	294.3	288.9	178.2	24.3
T_3 – 50% RDN through urea as basal + Two foliar spray Nano-urea (4ml/L) at AT and PI;	226.0	221.0	165.1	22.0
T_4 – 100% RDN through urea (75% basal + 12.5% AT + 12.5% PI)	241.8	236.7	172.9	22.0
T_5 – T_4 + 2 foliar sprays of Nano-urea (4ml/L) at AT and PI	249.3	242.0	174.0	22.5
T_6 – Control (no application of nitrogen	198.3	191.8	157.6	21.3
S.Em	7.15	6.85	6.11	0.44
CD (5%)	21.58	20.66	15.72	1.32

Note: AT- active tillering, PI- panicle initiation stages

Table 2: Effect of Nano urea application on grain, straw yield and economics of rice crop

Treatment	Grain yield (Kg ha^{-1})	Straw yield (Kg ha^{-1})	B:C ratio
T_1 – 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panical initiation (PI)	4899	6094.2	1.98
T_2 – T_1 + 2 foliar spray of Nano-urea (4ml/L) at AT and PI;	5203	6533.3	2.16
T_3 – 50% RDN through urea as basal + Two foliar spray Nano-urea (4ml/L) at AT and PI;	4089	5055.7	1.67
T_4 – 100% RDN through urea (75% basal + 12.5% AT + 12.5% PI)	4532	5536.1	1.86
T_5 – T_4 + 2 foliar sprays of Nano-urea (4ml/L) at AT and PI	4884	6016.6	2.04
T_6 – Control (no application of nitrogen	3287	4051.2	1.34
S.Em	92.11	100.58	0.049
CD (5%)	277.66	303.18	0.149

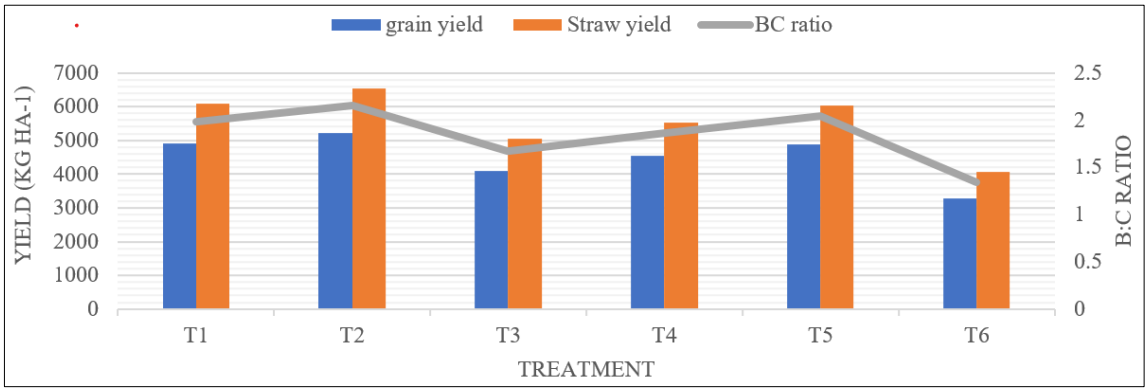

Fig 1: Effect of various treatments on grain yield, straw yield and BC ratio of rice

Conclusion

The highest number of tillers meter^{-2}, number of panicles m^{-2}, Number of filled grains panicle$^{-1,}$ 1000 grain weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and B:C ratio was recorded under treatment T2-100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)] along with 2 foliar sprays of nano-urea (4ml/L) at AT and PI which was at par with treatment T1 100% RDN through urea [50% basal + 25% active tillering (AT) + 25% panicle initiation (PI)].The lowest number of highest number of tillers meter^{-2}, number of panicles m^{-2}, Number of filled grains panicle$^{-1,}$ 1000 grain weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and B:C ratio was recorded under control.

References

1. Liu R, Lal R. Potentials of engineered nanoparticles as fertilizers for increasing agronomic productions. A review. Science of the Total Environment. 2015;514:131-139. http://dx.doi.org/10.1016/j.scitotenv.2015.01.104).
2. De Rosa MC, Monreal C, Schitzer M, Walsh R, Sultan Y. Nano technology in fertilizers. Nature Nano technology.

2010;5:91.
3. Gewaily EE, Ghoneim AM, Khattab EA. Nano silicon and nitrogen foliar spray affects the growth, yield and nutrients content of rice. World Journal of Agricultural Sciences. 2019;15(6):367-375.
4. Jassim RAH, Kadhem HN, Nooni GB. Impact of levels and time of foliar application of nano fertilizer (super micro plus) on some components of growth and yield of rice (*Oryza sativa* L.). 2019;19(1):1279-1283.
5. Kumar Y, Tiwari KN, Singh T, Sain NK, Laxmi S, Verma R, *et al*. Nano fertilizers for enhancing nutrient use efficiency, crop productivity and economic returns in winter season crops of Rajasthan. Annals of Plant and Soil Research. 2020;22(4):324-335.
6. Kumar M, Perumal M, Murugan G, Sudhagar R, Sai Vikram, Reddy Bada. Evaluation of Nano Urea on Growth and Yield Attributes of Rice (*Oryza Sativa* L.). 2022, 211-214.
7. Midde SK, Perumal MS, Murugan G, Sudhagar R, Mattepally VS, Bada MR. Evaluation of Nano Urea on Growth and Yield Attributes of Rice (*Oryza Sativa* L.). Chemical Science Review and Letters. 2021;11(42):211-214.
8. Prem Baboo. Nano Urea the Philosophy of Future, 2021. https://www.researchgate.net/publication/ 353260539.
9. Remya Nair, Saino Hanna Varghese, Baiju G, Nair T, Maekawa T, Yoshida Y, *et al*. Nano particulate Material delivery to plants. Plant Science. 2010;179(3):154-163.