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Short Communication

Effect of nano urea on growth and yield of Indian mustard (*Brassica juncea* L)

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Abstract

A field experiment was carried out to investigate the effect of nano urea on growth and yield of Indian mustard during the *Rabi* 2022–23. The results revealed that a substantially higher number of siliquae per plant, seed yield and stover yield were recorded with the application of 100% recommended dose of nitrogen (RDN) through *neem* coated urea (NCU, 50% as basal + 50% top dressed at 35 DAS) and it was on par with 100% basal RDN through NCU + two spray of nano urea (4 ml/litre) at 30 and 45 days after sowing. The other growth and yield parameters did not influence due to different treatments.

Keywords: *Growth, Indian mustard, nano urea, yield*

Introduction

India is one of the world's top producers of oilseeds and this industry contributes significantly to the agricultural economy by producing an estimated 36.10 million tonnes of nine cultivated oilseeds per year (Anonymous, 2021). Oilseeds are a plentiful source of nourishment and energy. By providing the people with adequate calorie intake, edible oils and oil meals play a significant part in reducing malnutrition. After soybean, rapeseed-mustard is India's second-largest edible oilseed crop in India. In India, one of the main sources of oil is mustard. Particularly for marginal and small farmers in rainfed areas, rapeseed-mustard is the main source of revenue. Nitrogen is one of the most critical elements for plant growth and development. Without such nutrients, the population would need to import significant amounts of food. Protein and chlorophyll synthesis in plants depend on nitrogen. Throughout the entire growth cycle, nitrogen is absorbed and used, but sadly, nitrogen is also lost through leaching, de-nitrification, volatilization and runoff to surface and ground water, leading to financial losses and environmental damage. Agriculture has undergone a true revolution thanks to nanotechnology. Nano is a Greek word that means "dwarf," with a diameter of 10^{-9} m. Nano-sized particles have a high surface-to-volume ratio and are minuscule in size. In the past ten years, the use of nano fertilisers has enhanced productivity, decreased production costs and also had higher solubility, which has increased production stability because of a reduction in biotic and abiotic pressures. Furthermore, nano fertiliser can increase crop output, enhance nutrient use efficiency and decrease the burden of chemical fertilisers in the soil. Boosting nutrient uptake and use efficiency, lowering gaseous emissions and leaching losses, and lowering the risk of nutrient toxicity are all benefits of nano fertilisers, which are also known as "smart fertilisers" for ensuring food security through more productive and profitable farming methods. Nano urea can potentially enhance mustard crop performance by providing a controlled and sustained release of nitrogen. This helps in meeting the nutritional needs of the mustard crop at different growth stages, promoting healthier plants and better yields. Accordingly, in the present study a field experiment was conducted to assess the effect of nano urea on growth and yield of Indian mustard.

Materials and Methods

The experiment was conducted at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha, Gujarat. The soil at the experimental site was loamy sand in texture with low organic carbon (0.27%) and neutral pH (7.30). The overall weather was fairly cool and dry and more or less quite favorable for satisfactory growth and development of mustard crop during *Rabi* season of 2022-23. The experiment was laid out in randomized complete block design consisting of eight treatments *viz*., 100% recommended dose of nitrogen (RDN) through *neem* coated urea (NCU, 50% as basal + 50%

top dressed at 35 DAS), 75% RDN through NCU (50% as basal + 50% at 35 DAS), 100% basal RDN through NCU + two spray of nano urea (2 ml/litre) at 30 and 45 DAS, 100% basal RDN through NCU + 3 ml/litre two spray of nano urea at 30 and 45 DAS, 100% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS, 75% basal RDN through NCU + 2 ml/litre two spray of nano urea at 30 and 45 DAS, 75% basal RDN through NCU + 3 ml/litre two spray of nano urea at 30 and 45 DAS and 75% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS with three replications. The recommended doses of fertilizer were 50:50:00:40 kg/ha of N:P_2O_5:K_2O:S, respectively. The half dose of nitrogen and full dose of phosphorus and sulphur applied as basal dose and remaining half dose of nitrogen applied after 30 DAS. The observations on plant population, growth, yield and yield attributes of mustard were recorded as per standard procedure. The data were statistically analyzed for various characters with 5% probability as described by Panse and Sukhane (1967).

Results and Discussion

The data presented in Table 1 showed that plant population per metre row length, plant height and number of branches per plant were not influenced significantly under the different treatments. The data presented in Table 2 indicated that among the different treatments, application of 100% RDN through NCU (50% as basal + 50% at 35 DAS) gave significantly higher siliquae per plant which were at par with application of 100% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS, 100% basal RDN through NCU + 3 ml/litre two spray of nano urea at 30 and 45 DAS, 75% RDN through NCU (50% basal dose + 50% at 35 DAS) and 75% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS. It might be due to application of 100% RDN through NCU (50% as basal + 50% at 35 DAS) increased nutrient availability for longer period coinciding with physiological need of crop and have accelerated crop growth there by enhanced photosynthetic activity which ultimately enhanced number of flower and their fertilization resulted in higher number of siliquae per plant. The result is in close conformity with those reported by Mohamed *et al*. (2022) and Kumar *et al.* (2022). Different treatments did not exhibit significant influence on number of seeds per siliqua, length of siliqua, test weight and harvest index of the mustard.

Table 1: Effect of different treatments on plant population and growth parameters of Indian mustard

Treatment	Plant population (m-row length))		Plant height (cm)				Branches/ plant
	20 DAS	At harvest	30 DAS	45 DAS	60 DAS	At harvest	
100% RDN through NCU (50% as basal + 50% at 35 DAS)	8.1	8.0	53	75	142	173	5.8
75% RDN through NCU (50% as basal + 50% at 35 DAS)	8.7	8.4	51	68	131	155	4.8
100% basal RDN through NCU + 2 ml/litre two sprays of nano urea at 30 and 45 DAS	8.6	8.5	52	70	141	164	5.5
100% basal RDN through NCU + 3 ml/litre two sprays of nano urea at 30 and 45 DAS	8.1	7.9	54	74	139	177	5.8
100% basal RDN through NCU + 4 ml/litre two sprays of nano urea at 30 and 45 DAS	8.4	8.1	54	75	140	175	5.9
75% basal RDN through NCU + 2 ml/litre two sprays of nano urea at 30 and 45 DAS	8.0	7.8	52	70	140	167	5.6
75% basal RDN through NCU + 3 ml/litre two sprays of nano urea at 30 and 45 DAS	8.1	7.9	52	70	136	170	5.5
75% basal RDN through NCU + 4 ml/litre two sprays of nano urea at 30 and 45 DAS	8.4	8.1	54	71	139	171	5.7
SEm±	0.4	0.4	2.9	2.5	4.1	6.4	0.2
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS

Yield is an output of sequential metamorphosis from source to sink. Significantly higher seed yield (1991 kg/ha) and stover yield (4315 kg/ha) were obtained under application of 100% RDN through NCU (50% as basal + 50% at 35 DAS). These yields were maintained at par with applications of 100% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS, 100% basal RDN through NCU + 3 ml/litre two spray of nano urea at 30 and 45 DAS, 75% RDN through NCU (50% basal dose + 50% at 35 DAS), 75% basal RDN through NCU + 4 ml/litre two spray of nano urea at 30 and 45 DAS. It might be as a result of the fact that foliar nano urea treatment encourages plant development and metabolic processes like photosynthesis lead to enhanced photosynthates accumulation and transport to the plant's functional parts. Furthermore, it had a direct impact on energy conversion, the activation of an enzyme involved in carbohydrate metabolism and the increased translocation of photosynthates to vegetative and reproductive parts, all of which improved growth and yield characteristics that affected seed yield. The findings support those from Samui *et al.* (2022), Mahmood and Omer (2021) and Kumar *et al.* (2020a).

Table 2: Effect of different treatments on yield attributes and yield of Indian mustard

Treatment	Siliquae /plant	Seeds/ siliqua	Siliqua length (cm)	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
100% RDN through NCU (50% as basal + 50% at 35 DAS)	291	12.8	5.8	5.1	1991	4315	31.6
75% RDN through NCU (50% as basal + 50% at 35 DAS)	267	11.8	4.7	4.9	1796	3891	31.8
100% basal RDN through NCU + 2 ml/litre two sprays of nano urea at 30 and 45 DAS	247	11.0	5.0	5.0	1571	3669	29.6
100% basal RDN through NCU + 3 ml/litre two sprays of nano urea at 30 and 45 DAS	280	12.9	5.7	4.9	1886	4046	31.8
100% basal RDN through NCU + 4 ml/litre two sprays of nano urea at 30 and 45 DAS	289	12.7	5.8	4.8	1966	4217	31.9
75% basal RDN through NCU + 2 ml/litre two sprays of nano urea at 30 and 45 DAS	235	12.7	5.3	4.8	1481	3518	29.6
75% basal RDN through NCU + 3 ml/litre two sprays of nano urea at 30 and 45 DAS	251	11.7	5.1	4.9	1667	3682	31.2
75% basal RDN through NCU + 4 ml/litre two sprays of nano urea at 30 and 45 DAS	258	12.7	5.5	4.8	1694	3861	30.5
SEm±11.290.70.30.298.77163.971.6							
CD (P=0.05)	34.24	NS	NS	NS	300	497	NS

Conclusion

It can be concluded that for obtaining higher yield of mustard, the crop should be fertilized with 100% RDN (50 kg N/ha) through neem coated urea (25 kg N as basal + 25 kg N at 35 DAS) or 100% basal RDN (25 kg/ha) through neem coated urea along with two foliar spray of nano urea @ 4 ml/litre at 30 and 45 DAS, in addition to recommended dose of other nutrients.

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