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## Effect of nano urea on growth and yield attributes of Indian mustard [*Brassica juncea* L.]

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### Abstract

Field experiment entitled “Effect of nano urea on growth, yield and quality of Indian mustard [*Brassica juncea* (L.)]” was conducted at School of Agricultural Sciences, JRNRVU Dabok, Udaipur during *rabi* seasons at 2023-24 to study the effect of nano urea on growth, yield and quality of Indian mustard. The experiment consisting ten treatments- T<sub>1</sub> (control), T<sub>2</sub> (100% RDN), T<sub>3</sub> (75% RDN), T<sub>4</sub> (50% RDN), T<sub>5</sub> (50% RDN + Nano urea 2ml l<sup>-1</sup>), T<sub>6</sub> (50% RDN + Nano urea 4ml l<sup>-1</sup>), T<sub>7</sub> (50% RDN + Nano urea 6ml l<sup>-1</sup>), T<sub>8</sub> (75% RDN + Nano urea 2ml l<sup>-1</sup>), T<sub>9</sub> (75% RDN + Nano urea 4ml l<sup>-1</sup>) and T<sub>10</sub> (75% RDN + Nano urea 6ml l<sup>-1</sup>). These treatments were evaluated under randomized block design with three replication. Treatment T<sub>10</sub> (75% RDN + Nano urea 6ml l<sup>-1</sup>) significantly increase plant height at 30 DAS and 60 DAS, dry matter accumulation at 30 DAS, 60 DAS, 90 DAS and at harvest, number of branches plant<sup>-1</sup>, number of siliqua plant<sup>-1</sup>, number of seed siliqua<sup>-1</sup>, length of siliqua, 1000-seed weight, respectively. The application of 75% RDN with nano urea 6ml l<sup>-1</sup> resulted in significant increase in seed yield (1995 kg ha<sup>-1</sup>) by 33.0% and 17.2% over T<sub>1</sub> (control) and T<sub>3</sub> (75% RDN) but was at par with T<sub>2</sub> (100% RDN). Similar trends were observed with stover yield and biological yield. However, it did not cause any significant increase in secondary branches plant<sup>-1</sup> and harvest index (%).

**Keywords:** RDN, mustard, yield, foliar spray, Nano urea

### Introduction

Conventional fertilizers offer nutrients in chemical forms that are not often fully accessible to plants. Additionally, inversion of these chemical fertilizers to sparingly soluble forms in soil is the reason for the very low utilization of most of the added micronutrients. These problems make it imperative to go in for the repeated use of fertilizers. It is fairly well known that the yield of many crops has begun to drop as a result of imbalanced fertilization and decrease in soil organic matter. Nano urea is a source of nitrogen, a major essential nutrient required for better growth and development of crops. IFFCO Nano Urea liquid, based on nano technology, effectively fulfills crop nitrogen requirement when sprayed at critical crop growth stages. It is used in place of conventional urea and other nitrogenous fertilizers for better environment, soil health and farmers profitability. Nano urea contains 4% nitrogen by weight in its nano form (Kantwa and Yadav, 2022) [3]. Nano urea is a potential component of 4 R nutrient stewardship as it promotes precision and sustainable agriculture. It promotes clean and green technology as its industrial production is neither energy intensive or resource consuming. Nano urea reduces the requirement of conventional urea by 50% or more (Baboo, 2021) [2]. Keeping in the above facts, present study was conducted entitled “Effect of nano urea on growth, yield and quality of Indian mustard [*Brassica juncea* (L.)]” to study the effect of nano urea on growth and productivity of Indian mustard.

### Materials and Methods

The experiment was carried out at the Instructional Farm, School of Agricultural Sciences, Dabok, Udaipur (Raj).

The soil of experimental field was clay loam in texture that was low in organic carbon and medium in available nitrogen and phosphorus and high in potassium status with slightly alkaline in reaction.

The experiment consisting ten treatments- T<sub>1</sub> (control), T<sub>2</sub> (100% RDN), T<sub>3</sub> (75% RDN), T<sub>4</sub> (50% RDN), T<sub>5</sub> (50% RDN + Nano urea 2ml l<sup>-1</sup>), T<sub>6</sub> (50% RDN + Nano urea 4ml l<sup>-1</sup>), T<sub>7</sub> (50% RDN + Nano urea 6ml l<sup>-1</sup>), T<sub>8</sub> (75% RDN + Nano urea 2ml l<sup>-1</sup>), T<sub>9</sub> (75% RDN + Nano urea 4ml l<sup>-1</sup>), T<sub>10</sub> (75% RDN + Nano urea 6ml l<sup>-1</sup>). These treatments were evaluated under randomized

block design with three replication. Mustard variety NRL pride of India (4G) was used as test crop which was sown on 14<sup>th</sup> October 2023 in 30 cm row spacing @5 kg ha<sup>-1</sup>. Recommended dose of fertilizer (60:40:00 kg ha<sup>-1</sup> N,P and K) were applied. ½ dose of N and full dose of P<sub>2</sub>O<sub>5</sub> were given at the time of sowing and remaining ½ dose of N were given at the time of first irrigation. With respect to application of nano urea, different concentrations of nano urea were prepared by dissolving in 600 liters of water and sprayed manually at 35 DAS.

**Table 1:** Effect of nano urea on plant height and dry matter accumulation in mustard

S. No	Treatment details	Plant Height (Cm)		Dry Matter Accumulation Plant <sup>-1</sup> (G)			
		At 30 DAS	At 60 DAS	At 30 DAS	At 60 DAS	At 90 DAS	At harvest
T <sub>1</sub>	Control	41.0	146.4	9.2	25.0	34.2	136.4
T <sub>2</sub>	100% RDN	42.2	160	12.5	29.6	43.9	147.3
T <sub>3</sub>	75% RDN	41.6	157.2	11.8	28.0	40.8	142.6
T <sub>4</sub>	50% RDN	41.3	154.9	10.6	27.3	39.8	140.9
T <sub>5</sub>	50% RDN + Nano urea 2 ml l <sup>-1</sup>	43.7	155.5	10.8	28.7	40.5	149.9
T <sub>6</sub>	50% RDN + Nano urea 4 ml l <sup>-1</sup>	44.4	158.1	10.9	30.7	43.6	152.1
T <sub>7</sub>	50% RDN + Nano urea 6 ml l <sup>-1</sup>	45.4	159.9	11.3	31.9	44.0	157.4
T <sub>8</sub>	75% RDN + Nano urea 2 ml l <sup>-1</sup>	46.8	161.6	11.9	32.3	43.7	160.4
T <sub>9</sub>	75% RDN + Nano urea 4 ml l <sup>-1</sup>	47.1	161.8	12.1	32.4	48.0	162.1
T <sub>10</sub>	75% RDN + Nano urea 6 ml l <sup>-1</sup>	47.7	162.1	12.6	33.9	49.4	165.4
	SEM±	0.81	1.05	0.38	2.64	1.87	2.20
	CD (P= 0.05)	2.37	3.0	1.12	7.73	5.48	6.46

**Table 2:** Effect of nano urea on growth and yield attributes of mustard

S. No	Treatment details	Primary branches plant <sup>-1</sup>	Secondary Branches plant <sup>-1</sup>	Number of siliqua plant <sup>-1</sup>	Number of seed siliqua <sup>-1</sup>	Length of siliqua (cm)	1000-seed weight (g)
T <sub>1</sub>	Control	4.4	4.9	221	6.0	3.1	3.4
T <sub>2</sub>	100% RDN	5.1	5.7	268	8.7	4.0	4.3
T <sub>3</sub>	75% RDN	5.0	5.4	263	8.4	3.8	4.2
T <sub>4</sub>	50% RDN	4.8	5.2	244	8.0	3.5	4.1
T <sub>5</sub>	50% RDN + Nano urea 2 ml l <sup>-1</sup>	4.9	5.3	262	8.7	3.7	4.7
T <sub>6</sub>	50% RDN + Nano urea 4 ml l <sup>-1</sup>	5.3	5.5	266	8.8	3.8	4.8
T <sub>7</sub>	50% RDN + Nano urea 6 ml l <sup>-1</sup>	5.4	5.8	269	8.9	3.9	4.9
T <sub>8</sub>	75% RDN + Nano urea 2 ml l <sup>-1</sup>	5.3	5.5	270	8.8	4.0	5.0
T <sub>9</sub>	75% RDN + Nano urea 4 ml l <sup>-1</sup>	5.4	6.3	277	8.9	4.1	5.2
T <sub>10</sub>	75% RDN + Nanourea 6 ml l <sup>-1</sup>	5.9	6.5	282	9.1	4.2	5.3
	SEM±	0.23	0.31	5.59	0.27	0.19	0.22
	CD (P= 0.05)	0.67	N.S	16.41	0.80	0.55	0.64

**Table 3:** Effect of nano urea on yield of mustard

S. No	Treatment details	Seed yield (kg ha <sup>-1</sup> )	Stover yield (kg ha <sup>-1</sup> )	Biological yield (kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub>	Control	1500	4178	5678	26.4
T <sub>2</sub>	100% RDN	1933	4424	6357	30.5
T <sub>3</sub>	75% RDN	1702	4365	6067	28.0
T <sub>4</sub>	50% RDN	1655	4306	5961	28.6
T <sub>5</sub>	50% RDN + Nano urea 2 ml l <sup>-1</sup>	1833	4364	6198	29.5
T <sub>6</sub>	50% RDN + Nano urea 4 ml l <sup>-1</sup>	1856	4421	6277	29.7
T <sub>7</sub>	50% RDN + Nano urea 6 ml l <sup>-1</sup>	1871	4485	6357	29.4
T <sub>8</sub>	75% RDN + Nano urea 2 ml l <sup>-1</sup>	1913	4475	6389	29.4
T <sub>9</sub>	75% RDN + Nano urea 4 ml l <sup>-1</sup>	1954	4540	6494	29.6
T <sub>10</sub>	75% RDN + Nanourea 6 ml l <sup>-1</sup>	1995	4679	6674	29.6
	SEM±	96.7	75.0	123.9	0.95
	CD (P= 0.05)	219.8	220.1	363.6	N.S.

## Results and Discussion

**Growth attributes:** The results showed (Table 1 and 2) that foliar application of nano urea significantly influenced the growth attributes viz plant height at 30 and 60 DAS, dry matter accumulation at 30, 60, 90 DAS and at harvest and number of branches plant<sup>-1</sup>. The highest plant height 47.7 and 162.1 cm was observed at 30 and 60 DAS, respectively with T<sub>10</sub> (75% RDN +

Nano urea 6ml l<sup>-1</sup>) which was significantly higher over T<sub>2</sub> (100% RDN) and T<sub>1</sub> (control). Treatment T<sub>10</sub> (75% RDN + Nano urea 6ml l<sup>-1</sup>) accumulated maximum dry matter plant<sup>-1</sup> (12.6, 33.9, 49.4 and 165.4 g) at 30, 60, 90 DAS and at harvest, respectively. The number of primary branches plant<sup>-1</sup> (5.9) were significantly higher with treatment T<sub>10</sub> (75% RDN + Nano urea 6ml l<sup>-1</sup>) over T<sub>1</sub> (control), T<sub>2</sub> (100% RDN) and T<sub>3</sub> (75% RDN) but was at par

with T<sub>6</sub> (50% RDN + Nano urea 4ml l<sup>-1</sup>), T<sub>7</sub> (50% RDN + Nano urea 6ml l<sup>-1</sup>), T<sub>8</sub> (75% RDN + Nano urea 2ml l<sup>-1</sup>) and T<sub>9</sub> (75% RDN + Nano urea 4ml l<sup>-1</sup>). However, foliar spray of nano urea did not influence number of secondary branches plant<sup>-1</sup> significantly. The probable reason of increasing height is may be due to the large dose of nano urea fertilizer boosts the synthesis of auxins, which promotes cell division and elongation across the entire vegetative plant. This directly affects the plant's height and other growth attributing traits. Foliar spray of nano urea influenced the growth rate due to the rapid cell division cause maximum plant height, more number of branches plant<sup>-1</sup> which ultimately enhanced dry matter weight of plants. Nano urea helps in building larger cells, as well as an increase in the number of cells and then an increase in the general growth of the plant, which is an indication of increased vegetative growth. The results of this investigation are in consonance with the findings of Singh and Kumar (2017) [9], Rathnayaka *et al.* (2018) [7], Pandav *et al.*, (2022) [6] and Verma *et al.* (2023) [11].

**Yield attributes and yield:** It is evident from the data in Table 2 and 3 that the higher yield attributes viz number of siliqua plant<sup>-1</sup> (282), number of seed siliqua<sup>-1</sup> (9.1), length of siliqua (4.2cm), 1000-seed weight (5.3g) were recorded under T<sub>10</sub>(75% RDN + Nano urea 6ml l<sup>-1</sup>) which was significantly superior over T<sub>1</sub>(control), T<sub>2</sub>(100% RDN), T<sub>3</sub>(75% RDN) and T<sub>4</sub>(50% RDN). The application of 75% RDN with nano urea 6ml l<sup>-1</sup> resulted in significant increase in seed yield (1995 kg ha<sup>-1</sup>) by 33.0% and 17.2% over T<sub>1</sub> (control) and T<sub>3</sub> (75% RDN) but was at par with T<sub>2</sub> (100% RDN). Similar trends were observed with stover yield and biological yield. However, foliar spray of nano urea did not influence harvest index significantly. The increase in yield attribute is maybe due to continuous nitrogen supply likely maintained heightened meristematic activity and stimulated cell elongation in plants, ultimately resulting in a higher number of siliqua per plant, number of seed per siliqua, seed yield, stover yield, biological yield. The increase in yield might be directly associated with concomitant increase in growth and yield attributes of mustard plant, because of improved nutritional environment in the plant metabolic system leading to higher plant metabolism and photosynthetic activity due to nano urea. This excess assimilates stored in the leaves and translocated into the seed at the time of senescence, ultimately resulted into higher yield. Similar finding was close vicinity of those reported by Pandav *et al.*, (2022) [6], Waladi *et al.* (2023) [12], Sharma *et al.*, (2023) [1], Babasaheb and Sharma (2023) [1], Vadlamudi *et al.*, (2023) [10].

## Conclusion

On the basis of one year's experiment entitled "Effect of nano urea on growth, yield and quality of Indian mustard [*Brassica juncea* (L.)]" conducted during Rabi 2023-24, it is concluded that the significant increase in growth, yield parameters as well as seed yield of mustard was recorded with application of 75% RDN along with foliar application of nano urea 6ml l<sup>-1</sup>. The maximum seed yield of 1995 kg ha<sup>-1</sup> was obtained with the application of 75% RDN with foliar spray of nano urea 6ml l<sup>-1</sup> which was at par with 100% RDN. Thus, 25% nitrogen can be save by spraying nano urea 6ml l<sup>-1</sup> in reducing environmental pollution.

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