Journal of Agroforestry and Environment

Volume 16, Issue 2, 2023

Journal DOI: https://doi.org/10.55706/jae

Journal homepage: www.jagroforenviron.com

Foliar Application of Nano Urea on Growth and Yield of Binamash-3 (*Vigna mungo* L.)

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Received: 09/10/2023

Accepted: 22/12/2023

Available online: 30/12/2023

Abstract: One effective way to increase the yield of black gram is by applying foliar nano urea, which is a balanced dose of nitrogen. Accordingly, from September to December 2022, the Bangladesh Institute of Nuclear Agriculture (BINA) substation experimental field in Rajshahi was the site of this study, which assessed the growth of black gram (*Vigna mungo* L.) under two different forms of nitrogen. Using a randomized block design, three treatments were applied to the black gram variety Binamash-3: control (no fertilizer) (T1), farmers practice (recommended fertilizer application as basal dose and top dressing during active growth) (T2), and nano urea (5 ml of nano urea (5 % N) in one litre of water and sprayed on crop leaves at its active growth stages) (T3). The effects of various forms of nitrogen (urea) on yield and characteristics that contribute to yield are significant. The highest grain yield, 1625.32 kg/ha, was produced by T3, while the lowest yield, 995.47 kg/ha, was produced by T1. It was evident that sparingly misting Binamash-3 with nano urea as a foliar spray during its rapid growth stages could greatly increase seed yield and potentially aid other legume ctops in increasing their yield as well.

Keywords: Nano urea; Binamash-3; Foliar application; Growth; Yield.

INTRODUCTION

In Bangladesh, one of the most significant edible legumes is the black gram (*Vigna mungo* L.). It is a popular short-duration grain legume crop that is predominantly grown on Bangladesh's marginal lands in the country's northwest and north. In the fields of the farmers, the mean yields are low, ranging from 1200 to 1600 kg per hectare. Pulses have an unpredictable growth habit and will continue to develop new flashes, therefore 40–45 days after seeding, the top dressing will be applied. In 60–65 days, the crop completes its first flesh of mature pods, and in 20–25 days, it completes its second flesh. Additionally, the primary physiological barriers to raising yields were found to be the slow rate of dry matter buildup during the pre-flowering phase and the low assimilate partitioning efficiency to grain (Pawar and Bhatia, 1980). While root nitrogen is important for all crops, it varies by species. For instance, chickpeas have the same amount of nitrogen in their roots as they do in their shoots, but *faba beans* and mungbeans have about half the amount of nitrogen in their roots as in their shoots (Unkovich *et al.*, 2010). According to Sinclair and de Wit, (1975), only 20 mg N of photosynthate as opposed to the necessary 26 mg N would be accessible from the soil to the developing seed. It was evident that black gram cannot fix or absorb enough N from the soil to meet the needs of its seeds. Senthil Kumar and colleagues, (2008) discovered that applying 1% urea topically to black gram plants at the onset of flowering and 15 days post-flowering resulted in increased growth, yield metrics, and yield. Similarly, Verma *et al.* (2011) discovered that foliar spraying a 2% urea solution 40 days after sowing increased grain production in various black gram types by 27.4 to 31.0%. Increased seed yield would result from the foreign supply of nitrogen in the form of urea or nano urea, which would delay leaf senescence during pod development. Because it requires less energy and yields more, nano urea is becoming more popular and foliar fertilization is becoming more important in raising crop yields. This has led us to conduct the experiment in order to ascertain whether foliar application of nano urea in Binamash-3 is appropriate for its better yield as well as for other legumes also.

MATERIALS AND METHODS

The field experiment was conducted during Kharif-2, 2022 at Rajshahi (24.45° N, 88.34° E) (Figure 1) and the soil was clay loam in texture.

Fig. 1: Study area map of the experiment

Design of the experiment

The experiment was laid out in a simple randomized block design with three replications. Binamash-3 variety was sown at a depth of 2-3 cm by line sowing. Unit plot size was 20 m^2 (4 m × 3 m). Plant to plant distance was from 5 to 6 cm in a row while line to line distance was 40 cm.

Experimental treatment

There were 3 treatments viz. Control (no fertilizer) (T_1), Farmers practice (recommended fertilizer application as basal dose and top dressing during active growth) (T_2) and Nano urea (5 ml of Nano urea (5 % N) in one litre of water and sprayed on crop leaves at its active growth stages) (T_3). A fertilizer dose of 25, 45 and 25 kg ha^{-1} of N, P_2O_5 and K_2O, respectively was applied at the time of sowing as basal dose.

Intercultural operations and Data collection

To ensure that plants grew and developed properly, intercultural activities such as weeding, thinning, applying pesticides, etc., were carried out. Fertilizer was applied as a top dressing and a basal treatment by farmers. During the active growth stages, a single spray application of 5 ml/litre of nano urea were made for each row. After 85 days, the crop was harvested.

Analysis of data

In order to interpret the results, the treatment means were separated using Duncan's New Multiple Range Test (DMRT) at the 5% and 1% significance levels, and the mean differences were adjusted using the Least Significant Different (LSD) test.

RESULTS AND DISCUSSION

Plant height (cm)

Nano urea (T_3) was found to significantly increase plant height (43.21 and 40.63 cm), followed by Farmers practice (T_2). Comparing the control (T_1) to the other treatments, the plant height (33.62 cm) is noticeably lower.

Table 1: Effect of Nano urea spray on growth and yield of Binamash-3

Treatments	Plant height (cm)	Primary branches/plant (no.)	Pods/plant (no.)	Seeds/pod (no.)	100-seed weight (g)	Seed Yield (kg/ha)
T_1 (Control)	33.62c	1.42b	41.00c	3.75c	3.73c	995.47c
T_2 (Farmers practice)	40.63b	2.25ab	45.00b	4.85b	4.65b	1485.32b
T_3 (Nano urea)	43.21a	2.85a	49.53a	6.54a	5.72a	1625.32a
LSD	3.52	0.85	0.82	0.92	0.65	135.64
P-value	0.004	0.051	0.002	0.003	0.002	0.002

Figures in the column having the same letters (s) do not differ significantly; *= significant at 5% level of probability; **= significant at 1% level of probability; T_1= Control (no fertilizer); T_2= Farmers practice (recommended fertilizer application as basal dose and top dressing during active growth); T_3= Nano urea (5 ml of Nano urea (5 % N) in one litre of water and sprayed on crop leaves at its active growth stages)

Yield attributes

The nano urea spray had a substantial impact on the number of primary branches per plant, pods per plant, 100-seed weight, and seeds per pod during the active growth phases of black gram. Farmers practice (T_2) was determined to be the method that produced the largest number of pods per plant, 100-seed weight, and seeds per pod when using nano urea spray (T_3) (Table 1). In comparison to the other treatments, the control (T_1) group showed a noticeably lower number of pods per plant and seeds per pod.The reason for the superiority from high concentration of nano fertilizer is the increase in leaf area, especially at the high level, which makes the leaf surface more vulnerable to spraying the fertilizer and then absorbing the element more by the leaves. This is because it plays a major role in increasing the number of flower nodes and the fertilization process by speeding up the transport of sugars from their source to the locations where they are needed in the plant during the reproductive phase. The increase in pods per plant was indicative of this (Hassan *et al.*, 2019).

DOI: https://doi.org/10.55706/jae1639

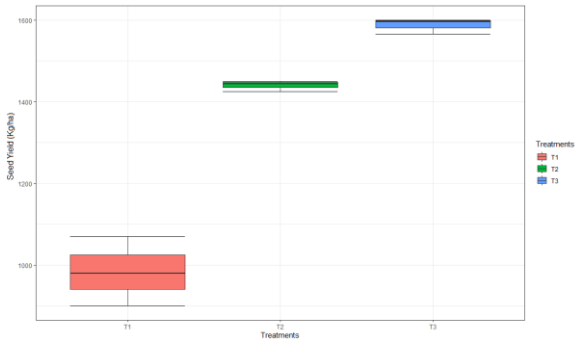

Figure 2. Boxplot showing effect of treatments on seed yield

Seed yield (kg/ha)

The application of nano urea spray (T_3) yielded the significantly greatest yield (1625.32 kg), with farmers practice (T_2) coming in second with 1485.23 kg (Figure 2). Increases in mature pods per plant, 100-seed weight, and

seeds per pod with nano urea spray during active growth stages were the causes of the increased seed yield. Seed yield (995.47 kg) was lowest for control (T_1) (Table 1). Urea sprayed foliarly increases photosynthetic capacity and slows down the loss of chlorophyll and leaf nitrogen, increasing seed yield (Mitra *et al.*, 1987). This outcome is consistent with recent research findings (Drostkar *et al.*, 2016) and (Gomma *et al.*, 2016) that shown the beneficial effects of nano nitrogen on seed yield and for several legume crops.

CONCLUSION

According to the study, yields of Binamash-3 have increased dramatically (1625.32 kg/ha) when nano urea is applied during vegetative growth stages, compared to farmers' practices or controls. Therefore, it can be suggested to apply nano urea foliar application to increase black gram production and it is possible to do additional research to get more practical results in future.

Conflict of Interest

There are no conflicts of interest declared by the authors.

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DOI: https://doi.org/10.55706/jae1639