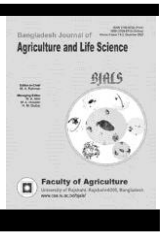
Original Article

Bangladesh Journal of Agriculture and Life Science
Faculty of Agriculture, University of Rajshahi
Rajshahi-6205, Bangladesh
Vol. 05 (1&2): 09-13, 2024
http://csa.ru.ac.bd/bjals/



Response of Different Chickpea Cultivars to Foliar Application of Nitrogen

Ferdous Akter, Aporna Roy, Md. Arifur Rahman, Md. Mejbah Uddin*, Chandni Khatun, Afroza Sultana and Nusrat Jahan Lima

Department of Agronomy and Agricultural Extension, University of Rajshahi, Bangladesh

ARTICLE INFO

Article History

Received: July 7, 2025
Accepted: September 12, 2025
Online: December 10, 2025

Keywords
Nitrogen
Foliar application
Chickpea
Variety
Yield

ABSTRACT

Chickpea is one of the most importance sources of protein all over the world, yet its productivity is often constrained by poor soil fertility, water scarcity and inefficient nutrients management, particularly in nitrogen management. A field experiment was carried out from November 2021 to December 2022 to find out the response of different chickpea cultivars to foliar application of nitrogen. This research work was organised in RCBD considering three varieties of gram viz. Bengal gram, BARI Chola-5, BARI Chola-9 and four nitrogen treatments were tested: N_0 (control, no nitrogen), N_1 (full recommended basal dose), N_2 (half basal + 1% foliar spray at flower initiation), and N_3 (half basal + 2% foliar spray at flower initiation). Only N_2 and N_3 involved foliar application, allowing evaluation of its effect on chickpea growth and yield. This experiment revealed that BARI Chola-9 (V_3) produced the highest number of pod (44.33), number of seeds per pod (2.11), 1000 seed weight (196.03g) and seed yield (2.42 t ha^{-1}). On the other hand, foliar application of nitrogen significantly influenced the characters. In case of 2% foliar nitrogen application treatment ($^1/_2$ basal dose +$^1/_2$foliar spray at pre flowering stage) showed the highest no. of pod (42.26), no. of seed (2.04), 1000 seed wt. (136.41g) and seed yield (1.95 t ha^{-1}). Observing the interaction effect, it was found that maximum pod (45.66), no. of seed (2.33), 1000 seed wt. (197.13g) and seed yield (2.55 t ha^{-1}) were recorded from V_3N_3. Overall, BARI Chola-9 gave maximum yield when 2% nitrogen foliar spray was applied with basal dose at flowering stage of chickpea.

Introduction

Chickpea is a well-known pulse which is self-pollinated and also an ancient crop under the family of fabaceae. It is an important protein rich grain legume cultivated in Bangladesh, occupying 10712.66 acres of land and produced 4846.62 Metric tons (BBS, 2022).

Chickpeas are low in fat, primarily composed of polyunsaturated fats. Furthermore, they contain high concentrations of minerals, including calcium (57 mg/100 g), magnesium (79 mg/100 g), iron (4.31 mg/100 g), zinc (15 mg/100 g), and carbohydrates (62.95 g/100 g). (Wallace *et al*., 2016). It accounts for about 3.87 percent of all pulses produced in Bangladesh, and also has the same caloric content as rice, but almost four times the protein and eight times the riboflavin is provided. Compared to other nations such as India (833 kg ha-1), China (6,000 kg ha-1), Mexico (1,600 kg ha-1), Myanmar (1,106 kg ha-1), Bangladesh's chickpea yield (761 kg ha-1) is pitifullylow (FAO 2012). Chickpeas have a high potential yield and many advantages, but their yield per unit area is low, meaning there is room for improvement in terms of productivity potential with the right management practices. One of the most crucial elements in determining a crop's yield is variety. The distinct genotypic characteristics of

***Address of correspondence**
Department of Agronomy and Agricultural Extension
University of Rajshahi, Bangladesh
E-mail: mejbah155@gmail.com (Md. Mejbah Uddin)

different chickpea varieties, such as their ability to adapt to stressful conditions, high nutrient utilization efficiency, and low input requirements. High-yielding cultivars have longer plants, deeper roots, more pod^{-1} plants, and more grains per pod^{-1} when compared to traditional varieties.

A number of sophisticated cultivars, including Hyprochola, BSMRU-1, BARI Chola-5, BARI Chola-9, Nishchola-4, Nishchola-5, Nishchola-6, Nishchola-7, Nishchola-8, and Binachola-1, have been developed to guarantee the sustainable use of natural resources. Growing chickpea on leftover soil moisture after the harvest of rainfed (aman) rice has a tremendous potential to improve the livelihood of Bangladesh's poor farmers through ensuring the high yield.

Nitrogen has an impact on plant physiology. Additionally, field crop quality and productivity depend heavily on this nutrient. Because chickpeas are excellent at fixing nitrogen from the atmosphere through nodules, they require less nitrogen during the growth season. Therefore, foliar nitrogen application may be useful for raising protein content and yields in chickpeas as well as various quality parameters. Furthermore, the amount of nutrient applied to crop foliage by means of foliar spray is less than that applied through soil application, and the crop responds rapidly. Foliar nitrogen management prolongs the greenness of the leaves, resulting in greater chlorophyll content and a higher photosynthetic efficiency, increase the system ability of root to food consumption from the surface solution and reduce the nutrient losses through leaching. According to Alexander and Schroeder (1987), foliar fertilization shows a high potential for preventing ground water and soil pollution. Urea is one of the most suggested sources of nitrogen fertilizer because of its rapid penetration of leaves and ability to reach the cytosol (Witte *et al*., 2002). Consequently, urea spraying during the reproductive growth stages (flowering to pod formation) of chickpeas may improve crop quality and yield.

Therefore, the goal of the current experiment is to investigate the effects of applying nitrogen topically to three distinct types of chickpeas: the Bengal Gram, BARI Chola-5 and BARI Chola-9.

Materials and methods

The experiment was conducted at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, University of Rajshahi during the period from November 2021 to April 2022 to study the response of chickpea to foliar application of nitrogen. Geographically the experimental field is belonging to calcareous dark grey floodplain soil and calcareous brown floodplain soils. The experimental field is situated in calcareous floodplain soils, with silty loam top soil and slightly alkaline pH (7.56), and experiences subtropical climate with heavy rainfall and low temperature.

The experiment was laid out in a Randomized Completely Block Design (RCBD) with three replications. The experiment comprised with three varieties viz. V_1 = Bengal Gram, V_2 = BARI Chola-5, V_3 = BARI Chola-9 and four nitrogen levels viz. N_0 = Control (N_0), N_1 = Recommended dose as basal dose (36kg N/ha), N_2 = ½ Basal dose + ½ foliar spray (1% solution) , N_3 = ½ Basal dose + ½ foliar spray (2% solution). The seeds were sown on 28th November 2021 in 3-4 cm depth on each plot. The seeds were sown in lineand seed rate was used as 50 g m^{-2}. After sowing the seed were covered with soiland slightly presses by hand. The final land preparation involved applying half of the urea (36 kg ha^{-1}), TSP 90 kg ha^{-1}, and MoP 40 kg ha^{-1}. The remaining urea was used for foliar application. Harvesting was done on 24th April 2022 by hand picking. Five plants wererandomly selected prior to maturity from each plot for data recording. Recorded data for different perimeters were compiled and tabulated in proper form for statistical analysis. Analysis of Variance (ANOVA) was done by using STAT-VIEW program. The mean difference was adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984) at 5% level of significance.

Results

It was observed that the plant height significantly varied in terms of varieties, the maximal height (63.25cm) was found in V_3 (BARI Chola-9) and the lowest plant height (50.71 cm) measured in Bengal Gram (Table 1). Branches plant^{-1} (number) showed significant difference during data sampling dates. The maximum number of branches plant^{-1} was noted in BARI Chola-9 and the lowest number was in Bengal Gram (Tabla-1). The number of flowers were varied significant at 100 DAS in where maximum number was estimated in BARI Chola-9 and minimal number was in Bengal Gram (Table 1). Number of pods was recorded statistically significant for the variety of BARI Chola-9, BARI Chola-5 and Bengal Gram. V_3 (BARI Chola-9) produced the highest pod (44.33) and V_1 (Bengal Gram) produced the lowest one (37.45). The data of effective pod was showed statistically significant at 120DAS. The maximal number of effective pod (36.21) was collected from the variety of BARI Chola-9 and the lowest (29.21) was obtained from the Bengal Gram (Figure1).Indicative variation of number of seeds per pod was recorded due to variety. It was found out that BARI Chola-9 (V_3) produced the maximal amount of seed (Figure 1) than BARI Chola-5 (V_2) and Bengal Gram (V_1).

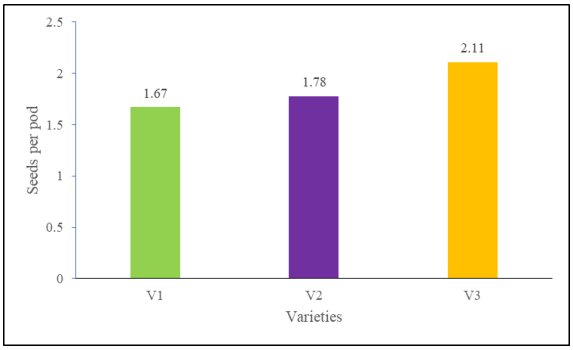


Fig. 1. Effect of variety on seed pod^{-1}
V_1= Bengal Gram, V_2= BARI Chola-5, V_3= BARI Chola-9

Thousand seed weight was recorded statistically significant (p= 0.01) for BARI Chola-9, BARI Chola-5 and Bengal Gram. The highest weight (196.03g) was enumerated from the variety BARI Chola-9 and the lowest wt. (95.94g) from the Bengal Gram. Seed yield was significantly influenced (p= 0.01) by cultivars. The highest yield (2.42 t ha-1) was recorded from BARI Chola-9 (Figure 2) and the lowest (1.16 t ha-1) was gained from the Bengal Gram. Significant variation was noticed on stover yield of chickpea due to cultivar difference. The highest stover yield (3 t ha-1) was found from BARI Chola-9 and the lowest stover yield (2.47 t ha-1) was found from Bengal Gram (Table 1).

Table 1. Effect of variety on plant characters and yield and yield contributing characters

Variety	Plant height (cm)	No. of branches plant^{-1}	No of flower plant^{-1} (100 DAS)	Number of pods plant^{-1}	No. of effective pod plant^{-1}	Pod Length (cm)	No. of seed pod^{-1}	1000 seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
V_1	50.71b	23.88b	15.55b	37.45b	29.21b	1.61b	1.67b	95.94c	1.16c	2.47b	3.63c	31.98c
V_2	58.6a	24.95ab	16.14b	40.11ab	32.33ab	1.68b	1.78b	114.28b	1.99b	3.02a	5.02b	39.7b
V_3	63.25a	25.83a	19.03a	44.33a	36.30a	1.88a	2.11a	196.03a	2.42a	3.00a	5.42a	44.63a
LS	0.01	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV (%)	7.08	7.12	14.16	10.58	12.98	7.11	12.31	5.47	5.65	5.24	5.31	1.57

It was recorded the higher biological yield from BARI Chola-9 (V_3) than the BARI Chola-5 (V_2) and Bengal Gram (V_1). According to this experimental result, the highest harvest index (44.63%) was gained in V_3(BARI Chola-9) and the lowest harvest index (31.98%) was recorded in V_1 (Bengal Gram).

The application of nitrogen had important impact on plant height at 20 and 40DAS and not significant at 60, 80,100 and 120DAS. According to Table 2, the longest height was observed in N_3 (58.97) whereas shortest plant height (56.03) was observed from N_0. The maximal number of branches (26.11) were recorded in BARI Chola-9 (N_3) and the lowest (23.88) is in Bengal Gram (N_0). The number of flowers showed significant response at all the sampling dates. Each of the varieties were influenced by different foliar application in where maximum number of flowers were counted in N_3 (Table 2).

Table 2. Effect of treatment on plant characters and yield and yield contributing characters

Treatment	Plant height (cm)	No. of branches plant^{-1}	No of flower plant^{-1} (100 DAS)	Number of pods plant^{-1}	Number of effective pods plant^{-1}	Pod Length (cm)	Number of seeds pod^{-1}	1000 seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
N_0	56.03	23.88b	15.70b	39.74	31.4	1.65b	1.59b	134.17	1.78b	2.75b	4.53b	38.63b
N_1	57.25	24.56ab	16.37ab	40.18	32.25	1.68ab	1.85ab	135.17	1.80b	2.81ab	4.61b	38.40ab
N_2	57.85	25.00ab	17.11ab	41.01	33.11	1.76ab	1.92a	135.92	1.89ab	2.85ab	4.74ab	38.88ab
N_3	58.97	26.11a	18.44a	42.26	33.7	1.80a	2.04a	136.41	1.95a	2.92a	4.87a	39.17a
LS	NS	0.05	0.05	NS	NS	0.05	0.01	NS	0.01	0.05	0.05	0.05
CV (%)	7.08	7.12	15.70b	10.58	12.98	7.11	12.31	5.47	5.65	5.24	5.31	1.57

The way of this application level showed unnoticeable difference in terms of number of pods. The most amount of pod was obtained from N_3 and the lower amount was recorded from N_0. Data did not show statistically significant at 120DAS by of foliar application in terms of number of effective pods. The

highest number of effective pods was found from N_3 and the lowest was found from the N_0 (Table 2). The outcome of foliar spray influenced the pod length significantly at 120DAS. The longest pod length was obtained from N_3 which means ½ Basal dose + ½ foliar spray (2% solution) and at control treatment the lowest pod length was recorded (Table 2). Maximal seed per pod was enumerated from N_3 (Figure 3) and the lowest was found from N_0. Foliar spraying had non-significant effect on 1000 test weight.

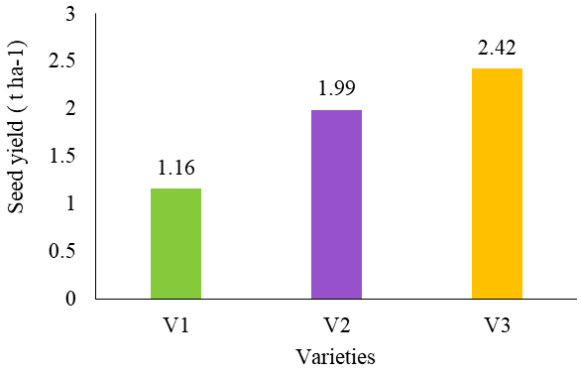


Fig. 2. Effect of variety on seed yield (t ha^{-1})
V_1= Bengal Gram, V_2= BARI Chola-5, V_3= BARI Chola-9

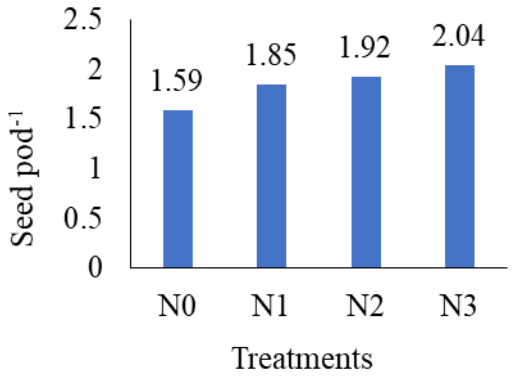


Fig. 3. Effect of foliar nitrogen application
N_0= Control, N_1= Recommended dose as basal dose, N_2=$^1/_2$ basal dose+$^1/_2$ foliar spray (1% solution), N_3=$^1/_2$ basal dose+$^1/_2$ foliar spray (2% solution)

Although spraying different levels of nitrogen solution showed no significant differences, the N_3 treatment produced a higher weight compared to N_0. Seed yield was influenced significantly (p=0.01) due to different liquid nitrogen level. Significantly maximal yield (1.95 t ha^{-1}) was noted from N_3 and the lowest (1.78 t ha^{-1}) was produced at N_0 i.e. no foliar application (Figure 4).

Various level of foliar applications showed significant effect (5% level) on stover yield of chickpea. It was estimated that 2% foliar nitrogen treatment produced higher stover yield (2.92 t ha^{-1}) than the control (2.75 t ha^{-1}) treatment (Table 2). Biological yield of chickpea showed significant (5% level) effect on different foliar application solution. Numerically the higher yield (4.87 t ha^{-1}) was recorded N_3 and the lower biological yield (4.53 t ha^{-1}) was found at N_0 that means no foliar treatment of nitrogen (Table 2). The maximal harvest index (39.17%) was noted at N_3 and the minimal HI (38.63%) was found at N_0.

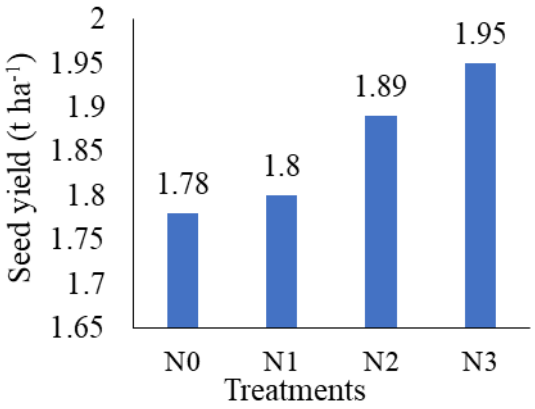


Fig. 4. Effect of foliar nitrogen application
N_0= Control, N_1= Recommended dose as basal dose, N_2=$^1/_2$ basal dose+$^1/_2$ foliar spray (1% solution), N_3=$^1/_2$ basal dose+$^1/_2$ foliar spray (2% solution)

Discussion

Having different genotypical characteristics of each variety, its play a tremendous role to confine the yield of chickpea. High yielding varieties are more convenient structure with developed root system and high resources utilization capacity while the traditional varieties are vice versa. The effects of foliar nitrogen application vary depending on the variety. According to Roy *et al*. (2016), BARI Chola-9 yields more pods and seeds over BARI Chola-8 and native varieties, respectively. Both Atram (2007) and Sritharan *et al*. (2015) observed that foliar treatment increased biological yield and harvest index relative to the control.

As being of legume crop, chickpea demand less amount of nitrogen. Application of nitrogen in liquid form might be an effective way of increasing yield and to ensure the mitigation of nitrogen loss, to lessen the environmental pollution. Nitrogen fertilizer applied on foliage contributes to improving the growing environment for the longest-growing chickpea plant. Increased branches per plant are reported by Sritharan *et al*. (2015), while maximal pods were found at 2% nitrogen treatment, higher than the control, according

to Venkatesh *et al*. (2012). The yield of chickpea (Das and Jana, 2015) and the weight of 1000 seeds (Tanwar *et al*., 2014) varied significantly depending on the intensity of foliar sprays.

Conclusion

Based on the data, it was determined that BARI Chola-9 produced the highest yield (1.95 t ha^{-1}) when applied on foliage in liquid form to the field during the flowering stage (2% solution).

Authors' Contribution

Conceptualization, MGH; Formal analysis TC; Methodology, TC and MGH; Investigation, TC, MAHNAK and MGH; Writing- original draft preparation, MGH and ANMAR; Writing-reviewing and editing, MGH and ANMAR; Supervision, MGH. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflicts of interests.

References

Alexander A and Schroeder M (1987). Modern trends in foliar fertilization. Journal of Plant Nutrition 10(9-16): 1391-1399.

Atram SS (2007). Effect of seed priming and foliar spray of urea on productivity of chickpea (*Cicer arietinum* L.) under rainfed condition. M.S. Theis. Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India.

BBS (Bangladesh Bureau of Statistics). (2022). Statistical Yearbook of Bangladesh. Statistics Division, Ministry of Planning, Government of the People Republic of Bangladesh, p. 100.

Das SK and Jana K (2015). Effect of foliar spray of water soluble fertilizer at pre flowering stage on yield of pulses. Agricultural Science Digest 35(4): 275-279.

FAO (Food and Agricultural Organization). (2013). Yearly yield of chickpea 2013. FAO Statistics Citation. Available at: http://www.fao.org.

FAO (Food and Agriculture Organization) (2012). Yearly yield of chickpea 2011.FAO Statistics Citation. Available at: http://www.fao.org.

Roy I, Biswas PK, Ali MH, Haque MN and Achakzai AKK (2016). Effect of supplemental application of nitrogen, irrigation and hormone on the yield and yield components of chickpea. World Journal of Agricultural Sciences 12(1): 70-77.

Gomez KA and Gomez AA (1984). Statistical Procedures for Agricultural Research. (2 den) John Wiley and Sons. New York. Chuckester, Brisbane, Toronto. Singapore. p.680.

Sritharan N, Rajavel M and Senthilkumar R (2015). Physiological approaches: Yield improvement in black gram. Legume Research 38(1): 91-95.

Tanwar SPS, Rokadia P and Singh AK (2014). Seed priming and foliar urea application for enhancing productivity of chickpea (*Cicer arietinum* L.) under rainfed conditions. National Academy Science Letter 37(5): 407-411.

Venkatesh MS and Basu PS (2012). Effect of foliar application of urea on growth, yield and quality of chickpea under rainfed condition. Journal of Food Legumes Research 24(2): 110- 112.

Wallace TC, Murray R, Kathleen M and Zelman K (2016). The nutritional value and health benefits of chickpeas and humus. Nutrients. 8(12): 766-766.

Witte CP, Tiller SA, Taylor MA and Davies HV (2002). Leaf urea metabolism in potato. Urease activity profile and patterns of recovery and distribution of 15N after foliar urea application in wild-type and urease-antisense transgenics. Plant Physiology 128(3):1129-1136.