# *Original Research Article*

**Response of BARI Bush Bean-2 in different levels of nitrogen fertilization**


## ABSTRACT

A field experiment was carried out at Sher-e-Bangla Agricultural University Farm during the *Rabi* season of 2008 to investigate the response of BARI Bush Bean-2 against different levels of nitrogen fertilization in respect of various yield components. The red brown tarrece soil of Tejgaon was silty clay loam in texture having pH 5.6. The experiment was laid out in a RCBD with three replications. The experiment comprises 4 levels of nitrogen from urea (0 kg, 40 kg, 80 kg and 120 kg nitrogen/ha). The results obtained revealed that different levels of nitrogen showed significant variations on the parameters studied. The treatment $N_{80}$ (80 kg nitrogen) gave the highest pod length (11.15 cm), pod diameter (2.93 cm), average single pod weight (5.42 g), total pod weight per plant (25.63 g), pod yield per plot (1789.58 g) and pod yield per hectare (4.37 ton). Thus the findings of the experiment suggested that combined use of 80 kg nitrogen produced maximum growth and yield of BARI Bush Bean-2 in red brown terrace soil of the Tejgaon series.



*Keywords: Yield; Bush Bean; Nitrogen*


## 1. Introduction

Being a major grain legume cop of the world Bush bean (*Phaseolus vulgaris* L.) is consumed in all parts of the globe for its edible seeds and pods [1]. It belongs to the family Leguminosae, and sub-family Papilionaceae [2]. In Bangladesh, this crop is known as “Farashi Sheem” [3]. It is also known as french bean, kidney bean, common bean, basic bean, snap bean, raj bean, navy bean, haricot bean, string bean, pole bean, wax bean and bonchi [4]. Bush bean originated in Central and South America [5]. Now it is cultivated in many parts of the tropics, sub-tropics and throughout the temperate region [6]. It is an annual herbaceous vegetable crop-producing strait or slightly curved pod. Bush beans are green, tender, rounded shaped pods, 4 to 6 inches (10 to 15 cm) long. The pods are eaten whole, including the immature seeds, when they are still young, juicy and tender. Its green pods are rich in protein, carbohydrate, fat, thiamin, riboflavin, Ca, Fe and niacin as well as fiber [7,8]. It also contains various immune system-boosting antioxidants e.g. flavonoids and carotenoids [9]. Due to their high levels of flavonoids, this power-packed legume has been shown to help manage and regulate diabetes symptoms in many patients and reduce the risk of heart diseases [10]. Bush bean has a delicate texture and sweet flavor. Fresh green beans are sweeter than canned. This crop is also valuable in Bangladesh mostly for exporting tender beans to the European market [11]. In recent years, the Hortex Foundation, Vegetable Export Center of BRAC and some other organizations facilitated the export of this vegetable of Bangladesh. Although, to play an important role in the economy of Bangladesh and increasing popularity in vegetable consumption, the yield of Bush bean in Bangladesh is lower than the world average. In this context, the yield of Bush bean has become an important component of vegetable production and cash income. Many factors influenced the production of BARI Bush Bean-2. Among them, fertilizer especially nitrogen is the most effective and critical input for increasing crop yield [12]. In agro-ecological zones the requirement of fertilizer for any crop varies with the cultivars and soil types [13]. Nitrogen is one of the most limiting nutrients to plant growth [14]. [15] Found a maximum pod yield of Bush bean from 120 kg N $ha^{-1}$. By using 120 kg N $ha^{-1}$, [16] found the maximum plant height, the number of branches plant and green pod $yield^{-1}$ of Bush bean $ha^{-1}$. [2] stated that the maximum plant height (39.03 cm), number of branches $plant^{-1}$(18.25), pod length (14.10 cm), pod weight (5.37 g) and pod yield (8.26 t/ha) were recorded in the treatment receiving 120 kg N. The short growth cycle of this crop is one of the reasons that Nitrogen fixation is not as efficient as other legumes because carbohydrate production by the Bush

bean plant occurs at the same time as the plants and the rhizobium needs a maximum carbohydrate supply and there is a heavy competition for Carbohydrate between the bacteria and Bush bean [17]. Nitrogen is one of the most essential elements for crop production. It encourages vegetative growth and increases the leaf area of plants, which helps in photosynthetic activity. It stimulates the root growth and development of the plant. Furthermore, it helps in the uptake of other nutrients from the soil. The vegetative growth and yield of BARI Bush Bean-2 were increased with a successive increase in the dose of nitrogen and potassium [18]. BARI Bush Bean-2 can fix atmospheric nitrogen in its root zone, an optimum amount of nitrogen for the whole growth period is necessary to produce the maximum yield of good quality zhar sheem but in a small amount relative to other leguminous crops [19]. For that reason, nitrogen fertilizer should be applied in an optimum doze to maximize its utilization for crop production. Therefore the present experiment carried out to investigate the response of BARI Bush Bean-2 against different levels of nitrogen fertilization in respect of various yield components.

## 2. Methods and materials

The research work was conducted in Rabi season at Sher-e-Bangla Agricultural University Farm, Sher-e-Bangla Nagar, and Dhaka during the Rabi season of November 2008 to March 2009. It is located at 90.3350E longitude and 23.7740 latitudes. The treatment of the experiment was different dozes of Nitrogen viz. 0, 40, 80, 120 kg/ha. The experiment was laid out in Randomized Complete Block Design (RCBD) with 3 replications. The unit plot size was 2.4 m x 1.5 m (3.6 $m^2$). The distance between the two plots was 50 cm and between blocks was 50 cm. The plots selected for the experiment was plowed on the 30th of November' 2008 and cross-plowed several times to obtain a good tilth. The manures and fertilizers like Cow dung, TSP, MOP, Gypsum, and Boric acid were applied at the rate of 5000, 2000, 60 and 5 kg/ha, respectively [20]. The entire quantity of Cow dung, Gypsum, and Boric acid was applied during the final land preparation while full doses of TSP and half of MoP were at seed sowing time and rest half MoP at 30 days after seed sowing. Seeds of BARI Bush Bean-2 were sown on 03 December 2008. The seeds were sown per hill at a depth of 5 cm and the seeds were covered with pulverized soil just after sowing and gently pressed with hands. Intercultural operations were done whenever required for getting better growth and development of the plants. Data were collected on pod length, pod diameter, average single pod weight, total pod weight per plant, pod yield per plot and pod yield per hectare. The data obtained from the experiment were analyzed statistically using the MSTAT computer package program to find out the significance of the difference among the treatments. The mean values of all the treatment were calculated and analysis of variances for all the characters was performed by the 'F' (variance ratio) test. The significance of the differences among the pairs of treatment means was estimated by the Duncan Multiple Range Test (DMRT) at 1% and 5% level of probability [21] for the interpretation of results.

## 3. Results and Discussion

### 3.1 Pod Length

Nitrogen influenced significantly in respect of pod length. Pod length increased gradually due to increasing dose of nitrogen fertilizer. The length of pod increased significantly with the increasing levels of nitrogen up to 80 kg N $ha^{-1}$. The highest length of the green pod was found (11.15 cm) in treatment N80 which is statistically identical with $N_{40}$, $N_{120}$ treatments and the lowest (10.30 cm) was found in the plot treated with $N_0$ treatment (Table 1). This result is in full agreement with [22, 23]. They reported that pod length was significantly influenced by higher dose of nitrogen.

### 3.2 Pod diameter

At different levels of nitrogen application there were found significant variations in pod diameter. By the increasing levels of nitrogen the diameter of pod increased significantly up to 80 kg N $ha^{-1}$. The topmost diameter of the pod was found (2.93 cm) in treatment $N_{80}$ which is statistically alike with $N_{120}$ treatment and the lower most (2.73 cm) was found in the plot treated with $N_0$ treatment (Table 1). The increment in the yield component may be due to the proper use of nitrogenous fertilizer which resulted in boosting in

biosynthesis of the photosynthates and finally the yield. These results are in alike with the findings of [15, 24].

### 3.3 Average single pod weight

A significant influence was observed in respect of average single pod weight at different rates of nitrogen. The highest average single pod weight was found (5.42 g) in treatment $N_{80}$ which is statistically similar with $N_{40}$, $N_{120}$ treatments while the lowest (4.78 g) was found in the control plot (Table 1). It was clearly observed that there was a positive effect of nitrogen on the pod weight plant. [25] also reported similar results.

### 3.4 Total pod weight per plant

Statistically, significant variation was recorded for different levels of nitrogen in terms of total pod weight per plant. The highest total pod weight per plant was observed (25.63 g) in treatment $N_{80}$ which is statistically identical with $N_40$, $N_{120}$ treatments and the lowest (22.85) was found in the zero treated plot (Table 1). This result is similar to that of [26].

### 3.5 Pod yield per plot

The effect of nitrogen on pod yield per plot showed a statistically significant difference among the treatments at the harvesting stage of BARI Bush Bean-2. Pod yield per plot increased significantly by the increasing rates of nitrogen up to 80 kg N $ha^{-1}$. The maximum pod yield per plot was found (1789.58 g) in treatment $N_{80}$ which is statistically alike with $N_{40}$ treatment followed by $N_{120}$. The lowest on pod yield per plot (1454.17 g) was found in control treatment (Table 1). Similar result was found by [22, 27]. On the other hand [21] found significantly influenced by higher dose of nitrogen on green pod yield.

### 3.6 Pod yield per hectare

Pod yield per hectare was recorded at the harvest stage of BARI Bush Bean-2 and it was observed that there were significant variations in relation to nitrogen application. Pod yield per hectare increased significantly by the increasing levels of nitrogen up to a certain dose. The highest pod yield per hectare was found (4.37 ton) in treatment $N_{80}$ which is statistically identical with $N_{40}$ treatment followed by $N_{120}$. The lowest (3.55 tons) was found in the control treated plot (Table 1). [22] Found the similar result and stated that pod yield of bush bean increase with the increment of nitrogenous fertilizer.

### Conclusion

This experiment was conducted to investigate the response of BARI Bush Bean-2 against different levels of nitrogen fertilization in respect of various yield components. Though the different treatments of the experiment ($N_{80}$ and $N_{120}$ kg/ha) performed similar but the nitrogen level 80 kg performed best in all the studied treatments. And this doze of nitrogen fertilizer can be recommended for commercial cultivation of BARI Bush Bean-2.



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**Table 1. Effect of nitrogen on the growth and yield of BARI Bush Bean-2**

| Treatment | Pod length (cm) | Pod diameter (cm) | Average single pod weight (g) | Total pod weight per plant (g) | Pod yield per plot (g) | Pod yield per hectare (ton) |
|---|---|---|---|---|---|---|
| $N_0$ | 10.30 b | 2.73 c | 4.78 b | 22.85 c | 1454.17 c | 3.55 c |
| $N_{40}$ | 10.55 ab | 2.74 b | 5.17 ab | 24.42 ab | 1600.00 ab | 3.90 ab |
| $N_{80}$ | 11.15 a | 2.93 a | 5.42 a | 25.63 a | 1789.58 a | 4.37 a |
| $N_{120}$ | 10.90 ab | 2.90 ab | 5.00 ab | 24.99 ab | 1537.50 b | 3.750 b |
| CV (%) | 7.28 | 7.47 | 10.48 | 7.01 | 15.43 | 15.41 |
| Level of significance | * | * | * | * | * | * |