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# Effect of Fertilizers on the Yield and Yield Components of Lentil (*Lens culinaris* L.)

**Mohammad Tojammel Haq & Md. Shamim Ahmed**

## Abstract

From November 18 to March 6, 2019, researchers at BAPARD Agricultural Farm in Kotalipara, Gopalganj, investigated the impact of fertilizers on lentil (Lens culinaris L.) production and yield components. This research will aid in determining the correct fertilizer dosage for lentil growing. As a consequence, fertilizer waste may be avoided, lentil yields can be raised, and farmers can profit financially. $T_1$, $T_2$, and $T_3$ treatments were used, as well as BARI masur-6, BARI masur-7, and masur-9 variations. 45kg Urea, 90kg TSP, 45kg MoP, 55kg Gypsum, 03 kg Zinc Sulphate, and 5 tons of cow dung per acre were the suggested fertilizer dosages. The number of branches per plant, pods per plant, seed per pod, 100 seed weight (gm), and seed production (kg/ha) all rose. BARI masur-6, BARI masur-7, and BARI masur-9, respectively, measured 41.50 cm, 38.10 cm, 43.66 cm, and 27.80, 14.00, 12.80 cm in height and number of branches per plant. The greatest number of pods per plant, seed output (kg/ha.), and 100 seed weight (gm) were 74.20, 67.00, 41.00; 2.78, 2.51, 2.76; 2442.30, 2206.39, and 1665.72, respectively. However, the current study revealed that with the combined application of fertilizers, several growth indices and seed yield of lentil (*Lens culinaris* L.) increased progressively.

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## INTRODUCTION

Bangladesh is an agro-based country with a diverse range of crops. Pulses are one of the primary sources of protein for individuals, particularly the impoverished in Bangladesh. After grains, pulses are the most significant crops. Pulses are also one of the greatest protein sources for domestic animals. They also help in the fight against malnutrition, a serious health problem in Bangladesh that has put the entire country in jeopardy. One of Bangladesh's most important pulse crops is lentil (Lens culinaris L.). It is grown in rainfed conditions during the rabi season. It is commonly referred to as masur in Bangladesh. In Bangladesh, total lentil output was 175384 tons from 351930 hectares in 2018-2019, with an average yield of 0.4984 t/ha (BBS, 2020). Despite the many benefits of lentils, their coverage and production are on the decline. Pulses are being pushed to the margins, where nutritional deficiencies are severe, since they can't compete in terms of productivity and economic return with high yielding variety (HYV) cereals. Lentil may be cultivated well in Bangladesh because to its suitable climate and soil. However, as compared to other lentil-growing nations such as Mayanmer, India, and Australia, the country's average lentil production is low. Low lentil yields in Bangladesh can be linked to a variety of factors, including a lack of high-quality seed, the use of indigenous varieties, seeding at the right time, fertilizer treatment that isn't optimal, and a loss in organic matter in the soil. In Bangladesh, lentils are an excellent source of easily digestible protein. Lentils include around 11% water, 25% protein, and 60% carbohydrates (Singh,2001). It also contains a lot of calcium, iron, and niacin. Pulses are the most concentrated source of nutritious protein in underdeveloped nations like Bangladesh. It is regarded as a poor man's meat and the most affordable form of protein for those who cannot afford animal protein (Gowda and kaul, 1982). There is a demand for 25 lakh matric tones of pulses in Bangladesh, but only 9 lakh matric tones are produced annually. Bangladesh imports roughly 16 lakh metric tons of pulses each year (Bangla News, 29 july, 2021).

Bhushi is a high protein concentrated feed for cattle, horses, pigs, and sheep made from the plant's stalks and husk (Tomar et. al., 2000). Lentil may fix atmospheric nitrogen via *Rhizobium* bacteria in root nodules, reducing the need for nitrogen fertilizer input to the crop. It is clear that using a pulse-based cropping strategy increased the amount of organic matter in the soil (Islam, 1988). Any crop's first and most important prerequisite for starting and accelerating its production program is an enhanced variety. In order to produce a high output of lentils, variety is crucial. The Bangladesh Agricultural Research Institute has developed some lentil varieties (BARI). The released lentil varieties BARI masur-6, BARI masur-7, and BARI masur-9 are renowned for their growth performance, yield, and quality. BARI Masur-6 is a high-yielding cultivar that is resistant to pests and diseases (rust and stemphylum blight). The F-3 population BARI masur-7 was examined in Bangladeshi soil and environment. BARI masur-9 is a short-season crop with disease resistance (leaf blight) (Azad et. al.,2020). Nitrogen (N) is present in little amounts, while phosphorus and potassium are essential minerals for increased lentil output. Furthermore, various lentil cultivars have varying potential and respond differently to different fertilizer amounts. Although seeded in soil with extremely little available N or in cold, damp soil, lentils can generally fix enough N for their own needs. To guarantee enough early development to promote nodulation and N fixation, a little quantity of beginning N dosage is required (Mahmod et.al., 2010). Phosphorous (p) is an essential nutrient for plants. It boosts the crop's toughness. Crop yield and growth have also increased. Phosphorus fertilizer has a substantial impact on crop productivity because it encourages nodulation, which allows pulse crops to fix more nitrogen from the air through their nodules (Datta et. al., 2013). Potassium (K) as a plant nutrient is becoming more essential in Bangladesh, with strong crop responses shown in a number of locations. Potassium treatment increased the yields of pulse crops. Increased potassium availability in pulse grains also increases biological nitrogen fixing and protein content (Srinivasarao et.al.,2003). Farm yard manure, either alone or in conjunction with NPK, significantly improved soil fertility above the initial soil state (Singh et.al., 2001). Leguminous crops require phosphorus and potassium, especially during the blooming and pod setting periods (Zahran et.al.,1998). The usage of sulphur-free fertilizers has resulted in widespread sulphur shortage in soils. Sulphur increases protein production in beans because it is a component of several amino acids. The use of S has had a significant influence on crop yield, nutrient uptake, and quality (Tripathi et. al.,1997). A deficiency of Zn in field crops results in poor growth, interveinal chlorosis, and lower leaf necrosis. Plants that sprout from low-Zn seeds might be more vulnerable to biotic and abiotic stressors (Obata et.al., 1999). Zinc-rich seeds have a higher likelihood of germination, seedling health, crop growth, and yield advantage (Cakmaket.al., 1996). As a result, getting decent lentil yields requires adequate fertilizer application. The goal of this study was to see how fertilizers affected lentil production and yield components.

**MATERIALS AND METHODS**:
From November 18 to March 6, 2019, the study was done at the BAPARD (Bangabandhu Academy for Poverty Alleviation and Rural Development) Agricultural Farm field in Kotalipara, Gopalgonj. The farm is situated between the latitudes of $21^0$51' and $23^0$10' north and the longitudes of $89^0$56' and $90^0$10' east. The agricultural field's terrain was moderately high land, with sandy loam soil that was well drained. The location's average yearly temperature ranges from 12.1 $^0$C to 36.1 $^0$C. The location's climate was defined by severe rains that began in June and lasted into September. BARI masur-6, BARI masur-7, and BARI masur-9 are three improved lentil (Lens culinaris L.) cultivars supplied by the Bangladesh Agricultural Research Institute, Gopalganj, for this study. On November 18, 2018, the seeds were planted in the field. BARI masur-6, BARI masur-7, and BARI masur-9 seed rates were 30 kg/ha, 30 kg/ha, and 70 kg/ha, respectively, and were planted in rows at a depth of 1-2 cm beneath the soil surface. Rows and seeds were separated by 25 cm and 5 cm, respectively. The crop was cultivated in a humid environment. The study used a three-replication and randomized complete block design (RCBD). On the field, there were 27 plots. The size of the experiment plot was 4.0m length and 2.5m width. The three treatments employed in the experiment field were $T_1$ (urea, TSP, and MOP), $T_2$ (urea, TSP, MOP, and Gypsum), and $T_3$ (Urea, TSP, MoP, Gypsum and Zinc sulphate). The chemical fertilizer doses were 45 kg Urea, 90 kg TSP, 45 kg MoP, 55 kg Gypsum, and 03 kg Zinc sulphate per hectare, whereas the organic fertilizer doses were 5 tons of cowdung per hectare. The entire amount of cowdung and other chemical fertilizers was applied during the final field preparation. Throughout lentil (Lens culinaris L.) cultivation, irrigation, weeding for plant protection, and other intercultural activities were conducted as needed. On 06 March 2019, 28 February 2019, and 13 February 2019, the BARI masur-6, BARI masur-7, and BARI masur-9 varieties were harvested at full maturity. The wheat was harvested and taken to the threshing door for three days of drying. The seed and straw were then separated and thoroughly cleaned. Crop characteristics were documented at harvest. Five randomly selected plants in each plot were used to obtain the mean values of the yield contributing parameters. On a plot-by-plot basis, the yield was computed by harvesting the 10m2 area of each plot and then converting it to hectares. Branches/plants, pods/plants, seed/pods, 100 seed weight (grams), and seed production (kg/ha) were all taken into account. The collected data were statistically explored utilizing the analysis of variance technique using the computer application MSTAT, and the mean difference was estimated using Duncan's Multiple Ranged Test (DMRT) (Gomez and Gomez, 1984).

**RESULTS AND DISCUSSION**:

**Plant height (cm):**

BARI masur-6, BARI masur-7, and BARI masur-9 plants ranged in height from 38.50 cm to 41.50 cm (Table-1), 36.20 cm to 38.10 cm (Table-2), and 33.78 cm to 43.66 cm (Table-3) (Table-3). BARI masur-6 $T_3$ (41.50cm), BARI masur-7 $T_3$ (38.10cm), BARI masur-9 $T_3$ (43.66cm), and BARI masur-6 $T_1$ (38.50cm), BARI masur-7 $T_1$ (36.20cm), and BARI masur-9 $T_1$ (33.78cm) were the maximum and minimum plant heights, respectively. Treatment $T_3$ (Urea, TSP, MoP, Gypsum, and Zinc) on the BARI masur-6 variety produced the maximum plant height (41.50cm), which was statistically superior to treatments $T_1$ (Urea, TSP, and MoP) and $T_2$ (Urea, TSP, MoP, and Gypsum) (Table-1). Treatment with BARI masur-7 Treatment $T_3$ (Urea, TSP, MoP, Gypsum, and Zinc) produced the maximum plant height (38.10 cm), which was comparable to treatments $T_1$ (Urea, TSP, and MoP) and $T_2$ (Urea, TSP, MoP, and Gypsum) (Table-2). Treatment $T_3$ (urea, TSP, MoP, Gypsum, and Zinc) of the variety BARI masur-9 yielded the maximum plant height (43.66 cm), which was substantially higher than treatments $T_1$ (urea, TSP, and MoP) and $T_2$ (urea, TSP, MoP, and Gypsum) (Table-3). As a result, the use of fertilizers (urea, TSP, mop, gypsum, and Zinc) in combination enhanced the plant height of all lentil varieties (*Lens culinaris* L.). The results obtained are somewhat in accord with those of Tariq et al (2001). As a result, $T_3$ may be recognized as the most effective therapy for increasing yield. Plant height for several lentil cultivars was observed to range from 0.3m to 0.44m (Hanlan et. al., 2006).

**Table: 1. Effect of Fertilizers on the Yield and Yield components of BARI Masur-6**

| Treatment | Plant height at harvest (cm) | Number of branch/plant | Number of pod/plant | Number of seed/pod | 100 seed (weight(gm) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 38.50 | 14.20c | 63.20b | 1.20b | 2.44b | 1475.71b |
| $T_2$ | 39.70 | 20.00b | 72.80a | 1.44a | 2.73a | 2289.50a |
| $T_3$ | **41.50** | **27.80a** | **74.20a** | **1.48a** | **2.78a** | **2442.30a** |
| F-test | NS | * | * | * | * | * |
| CV (%) | 5.94 | 4.97 | 3.68 | 4.25 | 0.8972 | 7.79 |

At the 5% level of significance, figures with the same letter in the same column do not differ significantly*; NS= Non-significant.

Source: Field study at BAPARD and output of the software STAR (Statistical Tool for Agricultural Research)

**Number of branches per plant:**

BARI masur-6, BARI masur-7, and BARI masur-9 had different numbers of branches per plant, ranging from 14.20 to 27.80 (Table-1), 9.20 to 14.00 (Table-2), and 7.60 to 12.80 (Table-3). With BARI masur-6 $T_3$ (27.80), BARI masur-7 $T_3$ (14.00), BARI masur-9 $T_3$ (12.80), and BARI masur-6 $T_1$ (14.20), BARI masur-7 $T_1$ (9.20), BARI masur-9 $T_1$ (9.20), the maximum and lowest number of branches per plant were recorded (7.60). $T_3$ (Urea, TSP, MOP, Gypsum, and Zinc) was applied to the soil and resulted in a considerable increase in the number of branches per plant. Hamdiet *et. al.* (2003) found that various genotypes of plants have varying numbers of branches per plant.

**Table: 2. Effect of Fertilizers on the Yield and Yield components of BARI Masur-7**

| Treatment | Plant height at harvest (cm) | Number of branch/plant | Number of pod/plant | Number of seed/pod | 100 seed (weight(gm) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 36.20 | 9.20b | 53.40c | 1.56 | 2.42b | 1612.68c |
| $T_2$ | 37.30 | 13.40a | 60.20b | 1.60 | 2.46b | 1895.57b |
| $T_3$ | 38.10 | 14.00a | 67.00a | 1.64 | 2.51a | 2206.39a |
| F-test | NS | * | * | NS | * | * |
| CV (%) | 5.71 | 2.99 | 3.39 | 2.06 | 0.7412 | 3.74 |

At the 5% level of significance, figures in the same column with the same letter do not differ significantly*; NS= Non-significant.

Source: Field study at BAPARD and output of the software STAR (Statistical Tool for Agricultural Research)

**Number of pods per plant:**

BARI masur-6, BARI masur-7, and BARI masur-9 pods per plant ranged from 63.20 to 74.20 (Table-1), 53.40 to 67.00 (Table-2), and 29.80 to 41.00 (Table-3) (Table-3). BARI masur-6 $T_3$ (74.20), BARI masur-7 $T_3$ (67.00), BARI masur-9 $T_3$ (41.00) had the highest number of pods per plant, whereas BARI masur-6 $T_1$ (63.20), BARI masur-7 $T_1$ (53.40), BARI masur-9 $T_1$ (29.80) had the lowest. In this investigation, treatment $T_3$ (urea, TSP, MOP, Gypsum, and Zinc) was shown to be the most effective in increasing the quantity of pods per plant. Treatments $T_2$ and $T_3$ outperformed treatment $T_1$ by a wide margin. It appears to be owing to fertilizer's favorable influence on soil chemical characteristics, particularly near the rhizosphere. As a result, all of these variables may produce an increase in nutrient absorption from the soil, resulting in an increase in the total number of pods per plant, either directly or indirectly.

**Table: 3. Effect of Fertilizers on the Yield and Yield components of BARI Masur-9**

| Treatment | Plant height at harvest (cm) | Number of branch/plant | Number of pod/plant | Number of seed/pod | 100 seed weight (gm) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| T1 | 33.78c | 7.60c | 29.80b | 1.72 | 2.45c | 1004..62c |
| T2 | 39.50b | 9.00b | 35.20ab | 1.84 | 2.57b | 1331.46b |
| T3 | 43.66a | 12.80a | 41.00a | 1.84 | 2.76a | 1665.72a |
| F-test | * | * | * | NS | * | * |
| CV (%) | 3.02 | 6.64 | 7.94 | 2.78 | 0.9445 | 9.17 |

At the 5% level of significance, figures in the same column with the same letter do not differ significantly*; NS= Non significant

Source: Field study at BAPARD and output of the software STAR (Statistical Tool for Agricultural Research)

**Number of seed per pod:**

BARI masur-6, BARI masur-7, and BARI masur-9 seeds per pod ranged from 1.20 to 1.48 (Table-1), 1.56 to 1.64 (Table-2), and 1.72 to 1.84 (Table-3). $T_3$ (1.48, 1.64, 1.84) had the most seed per pod of the three kinds, whereas $T_1$ had the least (1.20, 1.56, 1.72). The quantity of seeds per pod of the lentil cultivars investigated was unaffected by fertilizer mixture. The amount of seeds per pod appears to be a genetically fixed feature that is unaffected by fertilizer treatments. These results agree with Malik et al. (1991), however they differ with Zedian (2007), who observed a significant increase in the number of seeds per pod as P was raised from 25 to 75 kg per hectare.

**100 seed weight (gm):**

The weight of 100 BARI masur-6, BARI masur-7, and BARI masur-9 seeds were ranged from 2.44gm to 2.78gm (Table-1), 2.42gm to 2.51gm (Table-2) and 2.45gm to 2.76gm (Table-3) respectively. The treatment $T_3$ (2.78gm, 2.51gm, and 2.76gm) yielded the highest 100 seed weight, whereas the treatment $T_1$ (2.44gm, 2.42gm, and 2.45gm) yielded the lowest. Treatments $T_2$ and $T_3$ outperformed treatment $T_1$ by a wide margin. The weight of seeds was discovered to vary depending on their size and shape. As a result of the combined application of Urea, TSP, MoP, Gypsum, and Zinc fertilizers, the 100 seed weight steadily increased.

**Seed yield (kg/ha):**

BARI masur-6, BARI masur-7, and BARI masur-9 seed yields ranged from 1475.71 to 2442.30kg/ha (Table-1), 1612.68 to 2206.39kg/ha (Table-2) and 1004.62 to 1665.72kg/ha (Table-3) respectively. BARI masur-6 $T_3$ (2442.30kg/ha), BARI masur-7 $T_3$ (2206.39kg/ha), and BARI masur-9 $T_3$ (1665.72kg/ha) had the greatest seed yields, whereas BARI masur-6 $T_1$ (1475.71kg/ha), BARI masur-7 $T_1$ (1612.68kg/ha), and BARI masur-9 $T_1$ (1004.62kg/ha) had the lowest. Different fertilizers were used to gradually boost the seed output of these three experimental cultivars. $T_3$ was shown to be statistically superior to other therapies in this aspect. Chakraborty (2009) discovered that combining B with Mo or Zn resulted in a better seed production than applying them separately.

**CONCLUSION:**

The results of this study demonstrated that fertilizers including urea, TSP, potassium, gypsum, and zinc are important in increasing BARI masur-6, BARI masur-7, and BARI masur-9 yield and yield contributing characters. It was discovered that supplementing these varieties with Gypsum and Zinc boosted the amount of pods per plant and the amount of seeds per pod. Applying Urea, TSP, Potassium, Gypsum, and Zinc, on the other hand, enhances 100 seed weight and seed yield of BARI masur-6, BARI masur-7, and BARI masur-9 considerably more than applying Urea, TSP, and Potassium. The findings of this study showed that using a combination of Urea, TSP, Potassium, Gypsum, and Zinc to increase lentil seed production in sandy loam soil might be beneficial. Finally, these findings will assist our farmer in applying a balanced fertilizer application that is coordinated with crop need and reduces production costs. It may be implemented in all Bangladeshi districts to boost overall production of lentil (*Lens culinaris* L.)

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