

RESEARCH ARTICLE

POPULATION DENSITY AFFECTS ON VEGETATIVE GROWTH AND YIELD OF BJRI DESHI PAT SHAK-3

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ABSTRACT

Plant density is very important growth and yield contributing character of different crops. An experiment was conducted at Jute Agriculture Experimental Station, Bangladesh Jute Research Institute, Jagir, Manikganj to select suitable seed rate for leaf and seed yield of jute as vegetable. Six different seed rate i.e., T₁=4.17, T₂=8.33, T₃=12.5, T₄=16.67, T₅=20.83 and T₆=25.00 kg/ha were used as experimental treatment. Results revealed that the highest leaf number (14.13), leaf fresh weight (10.9g) and leaf dry weight (2.03g) was recorded in T₃ treatment whereas the highest capsule number (375), number of seed per capsule (32) and seed yield per plant (15.16g) was found in T₂ treatment. Days to seed maturity was minimum (85 days) in T₂ treatment. It might be concluded that considering as a vegetable crop 12.5 kg/ha rate is the best seed rate for vegetative yield.

KEYWORDS

BJRI deshi pat shak-3; plant density; growth and yield

1. INTRODUCTION

Jute is an important cash crop of Bangladesh. Once, it was well-known as a golden fiber for its contribution to the economy of Bangladesh. Jute leaf is consumed in various parts of the world for different vitamins and minerals. Chemical analysis of jute leaf reveals that it contains as many as 17 nutrient elements, including carbohydrate, protein, fat, dietary fibre, ash, calcium, potassium, iron, beta-carotene, Vitamin B complex, alpha-tocopherol and antioxidants (Calleja, 2010). The presence of lycopene in the jute leaf is very effective against oxidative inflammation. Besides, the recent discovery of anti-cancerous substances in jute leaf, such as phytol (3,7,11,15-tetramethyl-2-hexadecen-1-ol) and monogalactosyldiacylglycerol (1,2-di-O-alpha-linolenoyl-3-O-beta-D-galactopyranosyl-sn-glycerol) rises the worth of jute leaf as a vegetable (Furumoro et al., 2002). In addition, Compared to other leafy vegetables such as spinach, jute leaf contains more nutrients (Islam, 2013).

Production of tea from jute leaf is another fledge of commercial exploitation of jute vegetables. Not only is that, because of the relentless endeavors of some enthusiastic entrepreneurs, jute tea now exporting abroad. As a result of having such commercial value the demand of jute vegetable is increasing day by day. Proper plant spacing and optimum plant population are crucial for fiber production. Similarly, vegetative growth and development of jute is also influenced by plant population. For this reason, keeping the optimum plant population for vegetable jute cultivation is indispensable in getting maximum output from per unit area. In the case of fiber production of Deshi Jute, it is recommended to use 4.0 – 4.5 kg/ha and 5.0-5.5 kg/ha seeds for the line sowing and broadcasting method, respectively. However, in-depth research on plant spacing and population for vegetable production of BJRI Pat Shak- 3 to obtain a maximum economic return from per unit area is not yet done. The experiment was designed to justify the effect of plant population on vegetable and seed yield of BJRI Pat Shak- 3.

2. MATERIALS AND METHODS

The experiment was conducted at the Jute Agriculture Experimental Station, Bangladesh Jute Research Institute, Manikganj, Bangladesh, from March to June 2022. The newly released Bangladesh Jute Research Institute (BJRI) jute vegetable variety BJRI deshi pat shak-3 (Merha green) was used as experimental materials. The altitude of the experimental field was 4 m in the Old Brahmaputra-Jamuna flood plain (AEZ-8) with a silt loam soil, pH 6.8. The soil contained 1.6% organic matter, 0.08% total nitrogen, 2.8 microgram·g⁻¹ available P, 0.07 meq.100⁻¹ g K, and 10.00 mg·kg⁻¹ available S. The soil was ploughed in two directions and smoothed. The soil received urea, triple superphosphate, muriate of potash, gypsum and zinc sulfate @ 155, 28, 32, 46, and 12 kg·ha⁻¹, respectively. During final land preparation, half of the urea, and all other materials, were applied. Seed treated with Vitavax 200® (0.04%), were broadcast sown on 16 March 2022 into 3 m × 2 m plots.

All cultural operations were according to a standard procedure (Cox et al., 1986). After emergence of seedling manual weeding was done at 14 and soil moisture maintained at field capacity by surface irrigation once weekly. Growth parameters were calculated 10 days interval initiated from 30 days after sowing (DAS) to 60DAS. Plants were harvested on 16 April 2022 for calculating vegetative yield attributes and on 16 June for calculating seed yield. Randomized complete block design (RCBD) was used for this experiment with three replications. Leaf area meter (LI-3100C, Li-Cor, Lincoln, NE) was used to determine leaf area meter. Population density were counted· m⁻². Data were subjected to ANOVA using statistical software R. Treatment means were detached with LSD (Least significant difference).

3. RESULTS AND DISCUSSION

3.1 Effect of Plant Growth on Morphological Attributes

The different morphological attributes varied significantly among various

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growth rates of jute vegetable. Data on different morphological characters like plant height, number of leaf, leaf fresh weight, plant fresh weight, leaf area, and number of branches of jute genotype were collected, analyzed and summarized in figure 1. The highest plant height was found 60.362cm in 60 days after sowing (DAS) whereas the lowest plant height was found

12.76cm in 30 DAS. The highest leaf number, plant fresh weight, leaf area and number of branches were found in 60 DAS and the lowest were found in 30 DAS (Figure 1). Result revealed that morphological parameter values increases with increasing plant age. Similar results were reported by many other researchers (Hasan, 2021; Moniruzzaman et al., 2009).

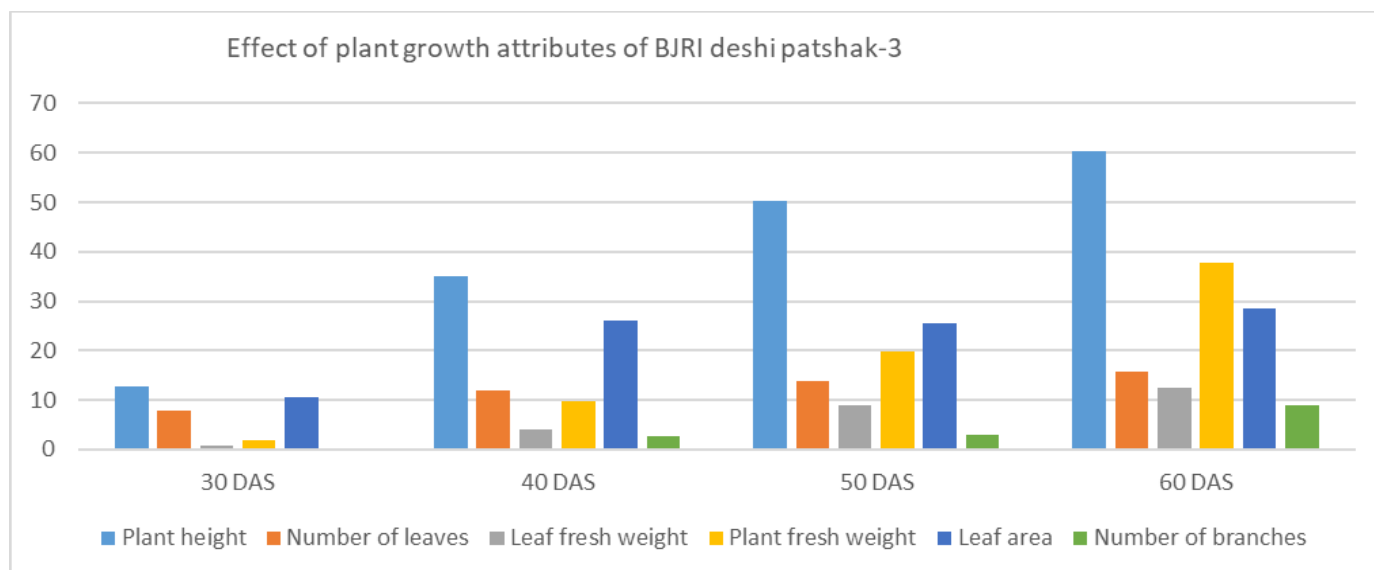


Figure 1: Effect of plant growth on morphological attributes of BJRI deshi pat shak-3

Table 1: Effect of Plant Density on Vegetative Yield Attributes of BJRI Deshi Pat Shak-3

Treatments	Plant Population/m ²	Plant Height (cm)	Number of Leaf/Plant	Fresh Leaf Weight (g)	Dry Leaf Weight (g)
T ₁	44e	46.33ab	12.8a	8.2b	1.62b
T ₂	77.33de	44.27b	13.87a	8.7b	1.77ab
T ₃	128.33cd	51.7ab	14.13a	10.9a	2.03a
T ₄	197.33bc	53.87a	14a	8.2b	1.63b
T ₅	245ab	53.49ab	14.58a	8.26b	1.6b
T ₆	289a	51.85ab	14.12a	8.35b	1.56b
CV (%)	8.87	10.42	8.87	12.69	10.74
LSD (0.05)	73.98	9.52	2.24	2.02	0.33

3.2 Effect of Plant Density on Vegetative Yield Attributes

The variation in different morphological characteristics occurred due to the variation in genetic inheritance of germplasm as well as agro-climatic condition of the research area influence the phenotypic appearance (Mudher et al., 2020; Zhao et al., 2020). Data on different vegetative yield attributes like number of plant population, plant height, number of leaf per plant, fresh leaf weight, and dry leaf weight of jute genotype were collected, analyzed and summarized in table 1. Analysis found significance difference among studied treatments (Table 1). The highest plant population was recorded in T₆ treatment and the lowest was recorded in T₁ treatment. Other treatments remain in the middle position. The highest plant height was found T₄ treatment and the lowest was found in T₂ treatment.

Number of leaf per plant, fresh leaf weight and dry leaf weight are the important vegetative yield contributing characters of plant. But here number of leaf per plant did not varied significantly among studied treatments. In addition, leaf number indicates the biomass production capacity of a plant which has a significant positive role in plant height (Tareq et al., 2019; Choudhary et al., 2013). The highest leaf fresh and dry weight was recorded in T₃ treatment and the lowest was recorded respectively in T₁ treatment. Other treatments were remained in the middle position reported increase in plant height in densely planted crops (Pawar et al., 2007; Ferdush et al., 2023).

3.3 Effect of Plant Density on Phenological Attributes

Jute is a photosensitive crop having critical photoperiod for completing its life cycle however, it has no significant effect on days to 1st flowering and days to average flowering. Days to seed maturity varied significantly among studied treatments. The highest days to seed maturity was recorded in T₆ treatment and the lowest days to seed maturity was recorded in T₁ treatment which was statistically identical with T₂ and T₃

(Table 2).

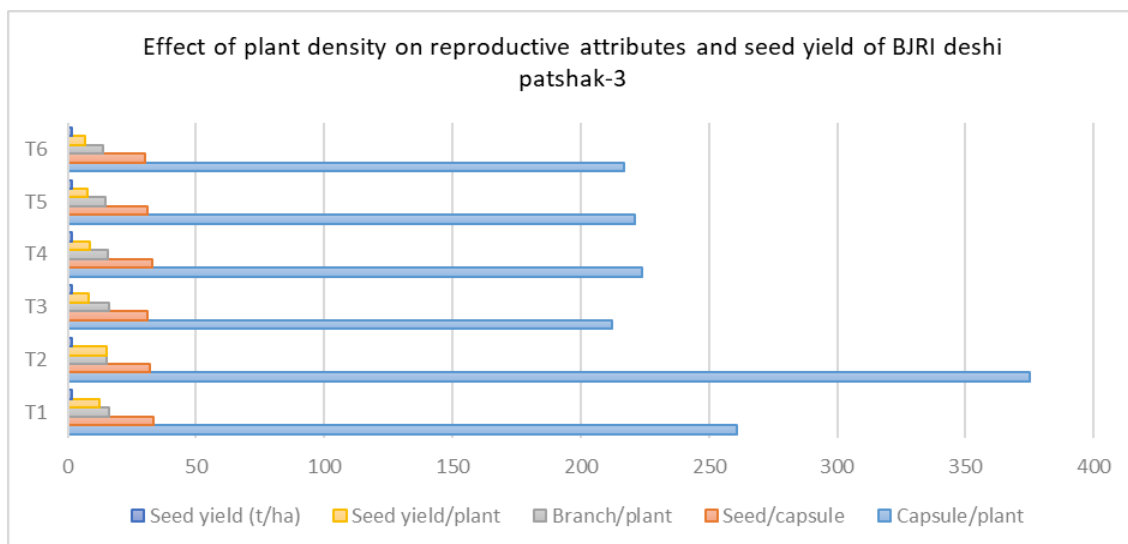
3.4 Effect of Plant Density on Reproductive Attributes and Seed Yield

Yield is an important and complex character and it is depending on many factors which are simply and relatively depends on the inheritance (Rao et al., 1990). Number of capsule per plant, number of seed per capsule, number of branch per plant are important yield contributing characters of jute. Among studied treatments number of seed per capsule, number of branch per plant were not significantly different whereas number of capsule per plant and seed yield per plant were significantly different (Figure 2). The highest number of capsule per plant and seed yield were recorded in T₂ treatment whereas the lowest were recorded in T₆ treatment and other treatments remain in the middle position. It may be due to comparatively less number of plant present in T₂ treatment so that plant got enough space for proper growth of capsule and seed whereas T₆ treatment contained more plant population so that they did not get enough space for growth and development of seed.

Plant spacing affects the yield contributing characters and yield which can be manipulated to maximize yield. With higher spacing vegetative growth enhances because of less competition of nutrients, light, moisture and space but yield potential decreases. The role of adequate plant spacing regarded as major factor in determining the production of jute seed. The plants grown in the wider spacing exhibit more continuous vegetative growth due to less population pressure but they also give less yield. However, plants grown under normal spacing will have an optimum population density which provides optimum conditions for luxuriant crop growth and better plant canopy due to maximum light interception, photosynthetic activity, assimilation and accumulation of more photosynthesis into the plant system and hence plants can produce more fresh capsules with quality seeds (Kazemi et al., 2012). Optimization of plant density for high yielding genotypes by following suitable inter as well as intra row spacing is essential. Similar results was reported (Rakesh et al., 2021; Ferdush et al., 2023).

Table 2: Effect of Plant Density on Phenological Attributes of BJRI Deshi Pat Shak-3

Treatments	Days to 1 st Flowering	Days to Average Flowering	Days to Seed Maturity
T ₁	33.67a	37a	85c
T ₂	33.33a	36.67a	85c
T ₃	34a	36.33a	85c
T ₄	33.67a	37.33a	86bc
T ₅	33.67a	36.67a	87ab
T ₆	33.33a	37.67a	88a
CV (%)	2.08	2.14	1.01
LSD (0.05)	1.27	1.44	1.58

**Figure 2:** Effect of plant density on reproductive attributes and seed yield of BJRI deshi pat shak-3

4. CONCLUSION

Results revealed that plant growth increase with increasing plant age. The highest leaf yield was found in T₃ and the highest seed yield was found in T₂ treatment.

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