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Efficiency of BJRI Kenaf-4 Yield Under Different Fertilizer Levels

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Abstract: The present study was conducted to clarify the fertilizer requirement on the growth and yield of the variety Bangladesh Jute Research Institute Kenaf-4. Consequently the experiment was conducted in Jute Agriculture Experimental Station, Manikganj and Jute Research Regional Station, Kishoreganj of Bangladesh Jute Research Institute. The results indicated significant effect of different NPKS levels on Bangladesh Jute Research Institute (BJRI) Kenaf-4 yield and yield contributing characters over control. The highest fibre (3.14t/ha) and stick (7.65t/ha) yield were obtained by the combination dose of N_{100} Kg/ha with PKS 10-60-20 kg/ha at Kishoreganj. The plant height (3.14m), base diameter (19.47mm) also found highest with the same fertilizer treatment combination. By the same treatment produced higher fibre yield and yield contributing characters at Manikganj though that yield was slightly lower than Kishoreganj. Economic analysis suggested the best combination is $N_{100}P_{10}K_{60}S_{20}$ kg/ha. The findings of the present experiment clearly indicated a great prospect of nutrient combination of $N_{100}P_{10}K_{60}S_{20}$ kg/ha on the growth and yield of fibre production on the variety BJRI kenaf-4.

Keywords: BJRI Kenaf-4, Fertilizer Requirements, Fiber Yield

1. Introduction

Bangladesh Jute Research Institute is the major organization of Jute and allied fibre crops research and Kenaf (*Hibiscus cannabinus L.*) is a promising fibre crop in Bangladesh [1, 2]. It can be grown as an alternative crop of cotton that may be economically feasible to produce in Bangladesh [3]. Kenaf fiber used to make quality fine paper, as well as lower grade papers and cordage, also used to produce rope, canvas, sacking, carpet backing, fishing nets, interior automobile parts, such as door panels, headliners, animal bedding, and composite lumber substitutes [1]. Fertilizer application is necessary for high yielding Kenaf. There are many reports published on fertilizer requirement for kenaf production [4-19]. In Bangladesh farmers are not well known of better kenaf production technology that hinders the expected production of Kenaf and fibre and seeds are grown conventionally [20]. Poor fertilizer management practices also a cause for low yield of Kenaf. Therefore, the production of quality kenaf fibre in the country is very much essential to meet the increasing demand and expand this valuable crop. Taking into account all these essentials, upgrading of fiber yield and quality of Kenaf is the prime need of Bangladesh. In this aspect, research regarding development of new high yielding variety of Kenaf and determination of its fertilizer requirement is very important. Therefore, the present study has been undertaken to observe the effects of N, P, K and S fertilizers on the growth and yield of the pre-released Kenaf variety, BJRI Kenaf-4 and to find out the finest requirement of nutrients combination to obtain highest fibre production.

2. Materials and Methods

The experiment was set up at the Jute Agricultue Experimental Station (JAES) of BJRI, Jagir, under Sadar Upazila of Manikganj district and Regional Station, Kishoreganj of BJRI.

The experiment was laid out in randomized complete block design (RCBD) with three replications. A total 10 treatment combinations along with a control were distributed

randomly in each plot as one replication (Table 1). The dimension of unit plots was 3 m × 3 m having 1 m space between the plots, blocks and around the field. There was 20 cm deep drain around each block and plot. Each replication was divided into 10 unit plots. At the beginning of the experiment, the land was well prepared and fertilizers were applied as per treatment.

Table 1. *Treatment combinations of N, P, K and S.*

Treatment combinations	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)	Sulfur (kg/ha)
T_1: $N_0P_0K_0S_0$	00	00	00	00
T_2: $N_{50}P_{05}K_{30}S_{10}$	50	05	30	10
T_3: $N_{50}P_{10}K_{60}S_{20}$	50	10	60	20
T_4: $N_{50}P_{15}K_{90}S_{30}$	50	15	90	30
T_5: $N_{100}P_5K_{30}S_{10}$	100	05	30	10
T_6: $N_{100}P_{10}K_{60}S_{20}$	100	10	60	20
T_7: $N_{100}P_{15}K_{90}S_{30}$	100	15	90	30
T_8: $N_{150}P_{05}K_{30}S_{10}$	150	05	30	10
T_9: $N_{150}P_{10}K_{60}S_{20}$	150	10	60	20
T_{10}: $N_{150}P_{15}K_{90}S_{30}$	150	15	90	30

Required amounts of N, P, K, S fertilizers were applied in the form of urea, TSP, MoP and gypsum. Urea was applied in two splits: half amount was applied at sowing and the rest half was top dressed at 45 DAS (days after sowing) while all other fertilizers were applied at the time of sowing. Kenaf seeds were broadcasted at the rate of 12 kg/ha. All cultural operations were done as and when necessary. The crop was harvested when 80% of the plants showed the sign of maturity. After shedding of leaves, the bundles were steeped plot-wise in pond water for 15-20 days for retting and fiber was extracted. At harvesting time, six plants were selected at random from each plot and tagged in the field to note plant height (PH), base diameter (BD), fiber yield (FY) and stick yield (SY).

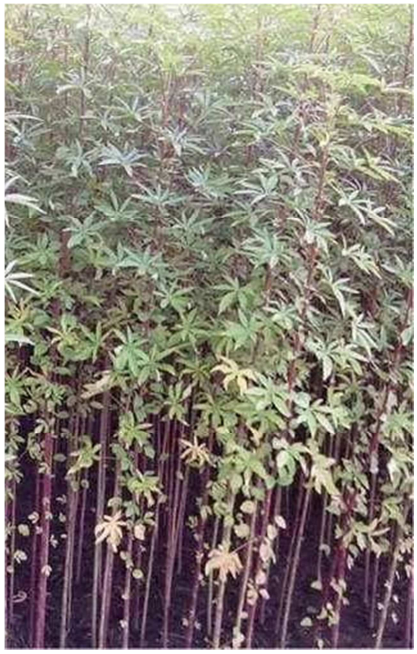

Figure 1. *BJRI Kenaf-4 plant.*

3. Results and Discussion

Results revealed that combined fertilizer doses focused the significant positive effect on the yield contributing parameters like plant height, base diameter, (Table 2 & 3). The yield and yield components i.e. plant height, base diameter, yield of fibre and stick were significantly increased over control by different rates of nitrogen. The highest dose of N150 kg/ha reduced the fibre yield (3.06t/ha) in compare to N100 kg/ha (3.13t/ha) at Kishoreganj. Results showed that 100 kg N/ha is enough to produce the variety BJRI Kenaf-4. Incremental N doses enhanced the plant height and base diameter than control.

Phosphorus levels (5, 10 and 15 kg/ha) were used in the experiment. The dose of P 10 kg/ha contributed significantly highest yield of fibre (3.13t/ha) and stick (7.65t/ha) (Table 3). In Kishoreganj, the longest plant (3.14m) found with P 10Kg/ha that was statistically identical with plant height found by P 15Kg/ha. Significantly highest base diameter (19.47mm) found also with P 10Kg/ha (Table 3).

The rate of potassium 0 kg/ha, 30 kg/ha, 60 kg/ha and 90 kg/ha were used to conduct this experiment. In Manikganj the rate 60 kg K/ha gave the highest plant height (3.1m), base diameter (19.16mm),) fibre (3.03t/ha) and stick (6.98t/ha) in compare to 90 Kg/ha. Study noticed that the variety BJRI Kenaf-4, needs K 60 Kg/ha to produce maximum yield.

All the treated plots with Sulphur increased the different growth parameters and yield of the variety BJRI Kenaf-4 over control. The highest rate of S 30 kg/ha reduced the plant height. Maximum plant height (3.14m) observed with 20 kg S /ha. Base diameter found the highest (19.47mm) with a medium dose of S 20 kg S/ha. The yield of fibre (3.13t/ha) and stick (7.65t/ha) achieved the highest with 20 kg S/ha (Table 3). The study showed that combined dose of NPK and S 100-10-60-20 Kg/ha was a suitable dose for the cultivation of the variety BJRI Kenaf-4.

Table 2. *Results of nutrient combinations on growth and yield of thevariety BJRIKenaf-4 at JAES, Manikganj.*

Treatment (N-P-K-S kg/ha)	Plant height (m)	Base diameter (mm)	Yield of fibre (t/ha)	Yield of stick (t/ha)
T_1: $N_0P_0K_0S_0$	1.30f	10.55d	1.10f	3.17e
T_2: $N_{50}P_{05}K_{30}S_{10}$	2.18e	15.26c	1.96e	4.58de
T_3: $N_{50}P_{10}K_{60}S_{20}$	2.19de	15.66bc	2.03de	5.03cd
T_4: $N_{50}P_{15}K_{90}S_{30}$	2.43c	16.36abc	2.38cd	5.26bcd
T_5: $N_{100}P_5K_{30}S_{10}$	3.06ab	17.16abc	2.65b	6.58abc
T_6: $N_{100}P_{10}K_{60}S_{20}$	3.1a	19.16a	3.03a	6.98a
T_7: $N_{100}P_{15}K_{90}S_{30}$	3.01ab	19.11a	2.93ab	6.93ab
T_8: $N_{150}P_{05}K_{30}S_{10}$	2.98ab	19.06a	2.9ab	6.86ab
T_9: $N_{150}P_{10}K_{60}S_{20}$	3.08ab	19.04a	2.93ab	6.83ab
T_{10}: $N_{150}P_{15}K_{90}S_{30}$	3.1a	19.06a	2.94ab	6.78ab
CV (%)	4.95	5.08	4.75	6.42

Table 3. *Results of nutrient combinations on growth and yield of the variety BJRIKenaf-4 at Regional Station Kishoreganj.*

Treatment (N-P-K-S kg/ha)	Plant height (m)	Base diameter (mm)	Yield of fibre (t/ha)	Yield of stick (t/ha)
T_1: $N_0P_0K_0S_0$	1.38e	11.81f	1.07f	3.54f
T_2: $N_{50}P_{05}K_{30}S_{10}$	2.04d	14.32e	1.88e	5.1e
T_3: $N_{50}P_{10}K_{60}S_{20}$	2.49cd	15.77de	2.13de	5.35de
T_4: $N_{50}P_{15}K_{90}S_{30}$	2.61bc	16.47cde	2.38cde	5.6cde
T_5: $N_{100}P_5K_{30}S_{10}$	3.11ab	17.18bcd	2.68bc	6.55bc
T_6: $N_{100}P_{10}K_{60}S_{20}$	3.14a	19.47a	3.13a	7.65a
T_7: $N_{100}P_{15}K_{90}S_{30}$	3.09ab	19.12ab	3.08ab	7.29ab
T_8: $N_{150}P_{05}K_{30}S_{10}$	3.06ab	18.92ab	3.06ab	7.45ab
T_9: $N_{150}P_{10}K_{60}S_{20}$	3.11ab	18.72ab	3.08ab	7.55ab
T_{10}: $N_{150}P_{15}K_{90}S_{30}$	3.1ab	19.07ab	3.1ab	7.6ab
CV (%)	5.33	4.86	5.15	5.61

Study exposed that high dose of K (60 kg/ha) caused highest plant height and base diameter (Table 3). Some studies revealed that yield; Plant height and Base diameter increased with increasing rate of K dose [21-28].

Fibre yield and stick yield found significantly positive in trends of different treatments combinations for BJRI Kenaf - 4 (Table 3). Highest fibre yield (3.13 t/ha) and stick yield (7.65 t/ha) were recorded with T_6 ($N_{100}P_{10}K_{60}S_{20}$ kg/ha) treatment, which was 192.52 and 116.10% higher than control (Calculated from Table 3). Based on Fibre yield among the treatments the treatment T_6 can be ranked first and T_1 for last position. The nutrient ratio is one of the key factors for kenaf production that is partially supported by previous report [1, 29].

Economic performance of a variety is a prime need for its cultivation and jute and allied fibre crops is not out of that. There are 1.2 million farmers are still directly connected with jute and allied fibre crops cultivation. Jute sector provides about 10% of total employment (production, transportation, processing and marketing) in the economy [30]. Therefore, economic analysis was made considering the variable cost of fertilizers, seeds, labor and price of fiber and stick (Table 4 & 5). Result reveals that T_6 ($N_{100}P_{10}K_{60}S_{20}$ kg/ha) treatment was the most cost effective treatment as it gives the highest gross return with benefit cost ratio (BCR) which is highly profitable.

Table 4. *Economics for var. BJRI Kenaf-4 at Manikganj.*

Treatment	Gross return (Taka/hectare)	Variable Cost (Taka/hectare)	BCR
T_1: $N_0P_0K_0S_0$	51925	60750	0.854
T_2: $N_{50}P_{05}K_{30}S_{10}$	89850	85930	1.045
T_3: $N_{50}P_{10}K_{60}S_{20}$	93775	88760	1.056
T_4: $N_{50}P_{15}K_{90}S_{30}$	108350	91590	1.182
T_5: $N_{100}P_5K_{30}S_{10}$	122450	88030	1.391
T_6: $N_{100}P_{10}K_{60}S_{20}$	138650	90860	1.526
T_7: $N_{100}P_{15}K_{90}S_{30}$	134525	93690	1.435
T_8: $N_{150}P_{05}K_{30}S_{10}$	133150	90130	1.477
T_9: $N_{150}P_{10}K_{60}S_{20}$	134275	92960	1.444
T_{10}: $N_{150}P_{15}K_{90}S_{30}$	134550	95790	1.405

Table 5. *Economics for var. BJRI Kenaf-4 at Kishoreganj.*

Treatment	Gross return (Taka/hectare)	Variable Cost (Taka/hectare)	BCR
T_1: $N_0P_0K_0S_0$	51650	60750	0.850
T_2: $N_{50}P_{05}K_{30}S_{10}$	87950	85930	1.023
T_3: $N_{50}P_{10}K_{60}S_{20}$	98575	88760	1.110
T_4: $N_{50}P_{15}K_{90}S_{30}$	109200	91590	1.192
T_5: $N_{100}P_5K_{30}S_{10}$	123575	88030	1.403
T_6: $N_{100}P_{10}K_{60}S_{20}$	144325	90860	1.588
T_7: $N_{100}P_{15}K_{90}S_{30}$	141425	93690	1.509
T_8: $N_{150}P_{05}K_{30}S_{10}$	141025	90130	1.564
T_9: $N_{150}P_{10}K_{60}S_{20}$	142075	92960	1.528
T_{10}: $N_{150}P_{15}K_{90}S_{30}$	143000	95790	1.492

4. Conclusions

Each and every one of the treatments influenced on growth and yield. Among the treatment combination $N_{100}P_{10}K_{60}S_{20}$ kg/ha (T_6) treatment performed best for the most valuable yield parameters fiber and stick yield. We found highest benefit cost ratio from economic analysis and it was originated by the nutrient combination of $N_{100}P_{10}K_{60}S_{20}$ kg/ha. Bearing in mind all these aspects, especially yield and economics, T_6 ($N_{100}P_{10}K_{60}S_{20}$ kg/ha) treatment seems to be the best combination for fibre production of this variety (BJRI Kenaf-4).

Conflict of Interest

The authors declared no conflict of interest exist.

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