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A Nutrient Combination That Can Affect Yield of Olitorius Jute

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Abstract: Mineral fertilizer use is expanding in Jute growing countries to satisfy fiber demands. Fertilizer consumers are being asked to improve fertilizer use efficiency through better management in their fields to provide a healthy economy. Following the thought a field experiment was established to determine the influence of mineral fertilizer (NPKS) on growth and yield of the advanced *C. olitorious* breeding line of O-043-7-9. We selected three different locations under Bangladesh Jute Research Institute to examine jute crop response to optimum fertilizer combination and the yield variability by 10 different nutrient combinations. Because of the essentiality of N, P, K, and S fertilizer combination on Jute fibre production and their effects on its growth were studied. The lower levels of N, P, K and S were zero applications in specific treatments. N, P, K and S were positively correlated with yield level. Over time, the simple effect of N exhibited an increased positive trend only when applied limited to 100kg/ha, while simple effects of P and K increased sharply at the rate 10 and 30 kg/ha respectively. The zero fertilizer treatment yielded decline for each mineral in specific treatment in the trial. Fertilizer N, P, K and S were utilized more efficiently in fully balanced combination. After the findings from three different locations for growth, yield and agronomic characteristics, we can draw the conclusion that the combination dose of N_{100} P_{10} K_{30} S_{15} Kg/ha may need to be applied for breeding line O-043-7-9 cultivation in Bangladesh.

Keywords: Yield, Jute, Nitrogen, Potassium, Phosphorus, Sulfur

1. Introduction

Among the total jute fibre production in the world, ninety two percent produced in Bangladesh and India. Raw jute signifies fibre produced from, *Corchorus capsularis, Corchorus olitorius, Hibiscus sabdariffa* and *Hibiscus cannabinus*. Renowned jute growing areas in Bangladesh are Faridpur, Jessore, Manikganj, Kishoregan, Mymensingh and Rangpur regions. *Corchorus olitorius* is one of the most popular fibre crops in every districts of Bangladesh. *Corchorus olitorius* is mainly known for its fibre product, jute and for its leafy vegetables [1]. Several species of Corchorus are used as vegetable, of which *Corchorus olitorius* is most frequently cultivated. *C. olitorius* is consumed as a healthy vegetable in Japan, because it contains abundant carotenoids, vitamin B1, B2, C and E, and minerals. On the other hand, accidental death of cattle has occurred when the cattle were feed with vegetation containing the seeds, because the seeds contain cardiac glycoside [2]. The dark-green leaves of *C. olitirius* have varying proportion of Ca, Fe, -carotene, vitamin C, fibreand protein required for health [1, 3]. Nutrition is an important aspectof Jute production system and this includes adequate supply of essential nutrients like nitrogen, phosphorus, potassium, sulfur etc to the plant.

The availability of these nutrients to plant contributes a lot to its growth and yield. Therefore adequate amount of nutrients need to be supplied to plant at the right quantity and also at the right time to favour both growth and yield. NPKS have influence on the growth and yield of fibre crops [4-40]. Fertilizer studies showed positive responses of *Corchorus*

olitorius to nitrogen [41]. Phosphorus is important in root development and helps hasten maturity of the fruit. Soils require extraneous inputs of phosphorus for optimum *Corchorus olitorius* growth [42]. The role of nitrogen and phosphorus in crop fertilization, leading to increased absorption of elements can be attributed to increase top growth particularly as a result of nitrogen absorption [43]. Similarly, application of any essential element should have a marked effect on yield if the soils were deficient in the element. Therefore, it is necessary to determine the growth and yield performance of the advance olitorius lineO-043-7-9 by nutrient combination.

2. Methods

The experiment was conducted at three locations of Bangladesh Jute Research Institute to determine the nutritional requirement for optimum growth and yield of the advanced *C. olitorious* breeding line of O-043-7-9. The experiment was laid outin randomized complete block design with three replications. A total of 10treatment combinations along with a control were distributed randomly in each equal plot as one replication. Each replication was divided into 10unit plots. At the time of final land preparation, the land was well prepared and fertilizers were applied as per treatment (Table 1). NPKS fertilizers were applied in the form of urea, TSP, MAP and gypsum respectively. Half of urea was applied at sowing and the rest half was top dressed at45 days after sowing while all other fertilizers were applied at the time of sowing. At harvesting time, ten plants were selected at random from each plot and tagged in the field to make a note of yield and yield contributing parameters.

Table 1. *Treatment combinations (NPKS in Kg/ha).*

T1: N0P10K30S20	T6: N100P15K30S20
T2: N75P10K30S20	T7: N100P10K0S20
T3: N100P10K30S20	T8: N100P10K45S20
T4: N125P10K30S20	T9: N100P10K30S0
T5: N100P0K30S20	T10: N100P10K30S15

3. Results and Discussions

Our research findings showed that among the ten nutrient combinations of chemical fertilizer, nutrient combination for treatment T_{10} performed best for the advanced breeding line O-043-7-9 yield and yield influencing factors. The plant growth and yield were affected by N levels over the control. Nitrogen @ 100 kg/ha treatment (T_{10}) produced significant highest fibre yield. But highest dose of N 125 kg/ha showed significantly lower yield than the dose N 100 kg/ha. The growth indicator i.e. plant height and base diameter were found significantly highest by N 100 kg/ha (T_{10}) that was identical with the treatments T_3, T_4, T_6, T_7 and T_8. From the results, it was observed that 100 kg N/ha may be an adequate amount for fibre production for the advance breeding line O-043-7-9. The different results noticed that application of higher dose of fertilizer consequenced on growth and yield of fibre production of the advance olitorius line O-043-7-9 (Figures 1-4).

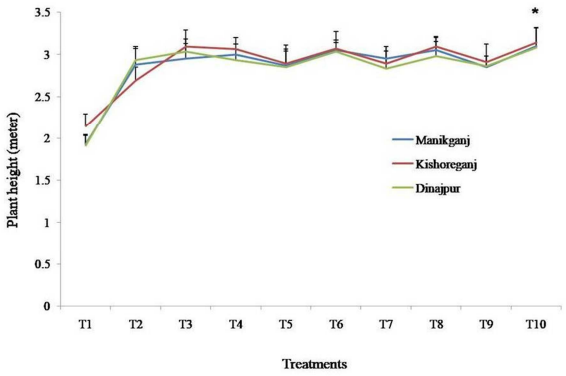

Figure 1. *Plant height of olitorius breeding line O-043-7-9 using different chemical fertilizer treatments. Each datum was calculated from three independent experiments. The results are expressed as the mean ± S.E.M. *p<0.05 significance by the Student's t-test.*

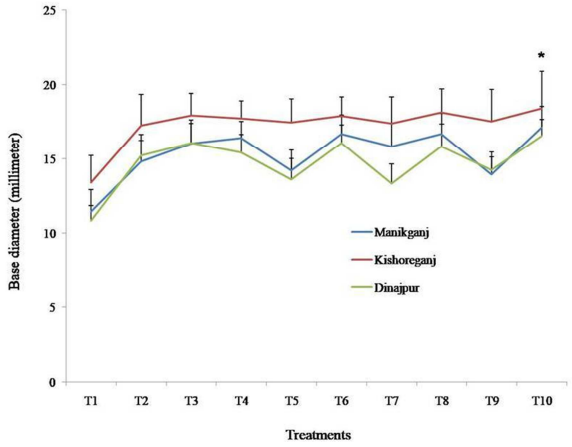

Figure 2. *Base diameter of olitorius breeding line O-043-7-9 using different chemical fertilizer treatments. Each datum was calculated from three independent experiments. The results are expressed as the mean ± S.E.M. *p<0.05 significance by the Student's t-test.*

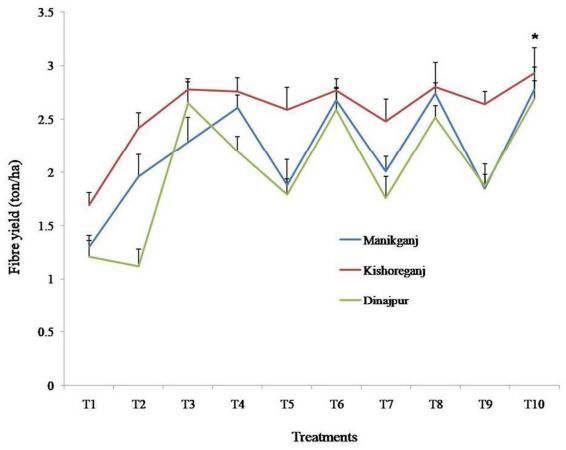

Figure 3. *Fibre yield of olitorius breeding line O-043-7-9 using different chemical fertilizer treatments. Each datum was calculated from three independent experiments. The results are expressed as the mean ± S.E.M. *p<0.05 significance by the Student's t-test.*

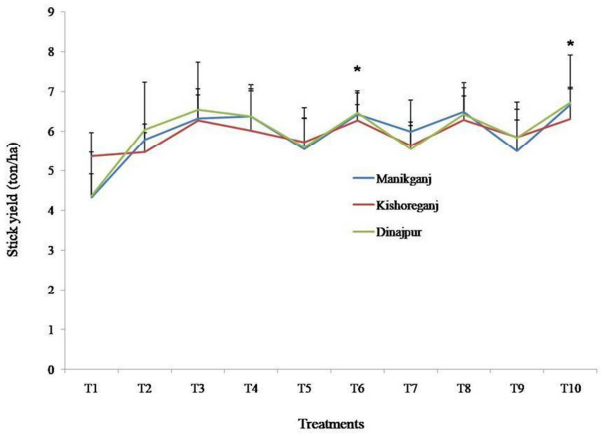

Figure 4. *Stick yield of olitorius breeding line O-043-7-9 using different chemical fertilizer treatments. Each datum was calculated from three independent experiments. The results are expressed as the mean ± S.E.M. *p<0.05 significance by the Student's t-test.*

The yield and yield influencing factors of O-043-7-9 were affected due to addition of different phosphorus levels. The dose of P 10 kg/ha contributed maximum yield of fibre (2.78t/ha) and stick (6.67 t/ha) at Manikganj (Figure 3 & Figure 4). Results also explored that the longest plant (3.14m) and base diameter (18.39mm) were found significantly higher with 10 kg P/ha at Kishoreganj (Figure 1 & Figure 2).

To observe potassium (K) requirement, there was applied three rates of K, such as 0, 30, and 45 kg/ha. The rate 30 kg K/ha gave the statistically highest plant height (3.08m), base diameter (16.56mm) fibre yield (2.69 t/ha) and stick yield (6.72 t/ha) at Dinajpur. But the supreme rate of K 45 kg /ha yielded lower fibre yield (2.52 t/ha) compare to K 30 kg/ha (Figure 3). Study noticed that the advance olitorus breeding line O-043-7-9, needs K 30 kg/ha to produce maximum yield.

Figure 5. *Intensive supervision signifying in experimental field for good agronomic practices by Dr. Md. Mahbubul Islam, Chief Scientific Officer & Head of Agronomy Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, Bangladesh.*

Highest plant height (3.14m), base diameter (18.39mm) fibre yield (2.93t/ha) and stick yield (6.31t/ha) were observed with 15 kg S/ha (Figures 1-4). Results showed that the combined dose of NPK and S 100-10-30-15 kg/ha may be a suitable dose for the cultivation of advance breeding line O-043-7-9. The nutrient combination and their ratio is one of the key factors for olitorus breeding line O-043-7-9 production that is supported by previous report [4, 32, 33]. This outcome is owing to competent direction and time to time suggestion about experimental events (Figure 5)

4. Conclusion

The overall treatments had significant positive impact over nitrogen control (T_1) on growth and yield and effect of combined fertilizers on them were explained. The most important parameter, fibre yield (2.93 t/ha) and stick yield (6.72 t/ha), were recorded highest with T_{10}:$N_{100}P_{10}K_{30}S_{15}$ treatment. Considering all these aspects, specially yield, T_{10}:$N_{100}P_{10}K_{30}S_{15}$ kg/ha treatment seems to be the best combination for the yield potential of the advance breeding line O-043-7-9.

Author Contributions

All authors contributed equally.

Conflict of Interest Statement

The authors declare that they have no competing interests.

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