

Effect of integrated nutrient management on productivity of *tossa jute* (*Corchorus olitorius* L.) and on soil properties

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Abstract : A field experiment was conducted at the Regional Agricultural Research Station, AAU, Nagaon, Assam during 2005 and 2006 under rainfed conditions to study the effect of combined application of chemical fertilizers, bio-fertilizer and FYM on soil nutrient status, fibre yield and mineral nutrition of *tossa jute*. Application of 50% reduced dose of N and P fertilizer along with inoculation of seed with bio-fertilizer (*Azotobacter* and PSB) produced similar fibre yield and gave higher net return, B:C ratio and also improved soil nutrient status as compared to application of 100% recommended NPK fertilizer. Similarly, addition of FYM @ 3t/ha along with 50% recommended NP fertilizer and bio-fertilizer had further increased the fibre yield, income and soil nutrient status as compared to application of 100% recommended NPK fertilizer along with FYM.

Key words : Chemical fertilizers, bio-fertilizer, FYM, fibre yield, nutrient management.

Introduction

Among different fibre crops of Assam, jute is the most important one which occupies third position in the country in respect of area and production. However, the productivity of jute fibre in the state is only 1678 kg/ha as against the national average of 1938 kg/ha (Biswas, 2002). Jute growers in Assam are mostly marginal farmers who can not afford to use the recommended dose of chemical fertilizer because of its higher cost and that result in low productivity. Thus the nutrients removal by jute is not replenished by the low dose of fertilizers applied by the farmers. However, presently there is renewed interest for the use of organic manure, largely because of increasing cost of chemical fertilizers, greater incidence of multiple nutrient deficiencies and deterioration in soil physico-chemical properties.

Integrated management of organic and chemical fertilizers can contribute to the maintenance of a sustainable system while increasing farm income to above a subsistence level. The approach of integrated nutrient management through the judicious mixing of organic as well as chemical sources of nutrients is an imperative, which will not only economized the use of chemical fertilizers but also improved the physico-chemical status of the soil (Bandyopadhyay and Puste, 2002). Keeping these in mind, the present study was under taken to evaluate the effect of integrated use of organic manure, bio-fertilizer and chemical fertilizer on fibre yield and residual soil status.

Materials and Methods

A field experiment was under taken during 2005 and 2006 at the Regional Agricultural Research Station, AAU, Nagaon, Assam under

Table 1. Yield attributing characters of *tossa* jute as influenced by different treatments

Treatment	Plant height (cm)		Basal diameter (cm)		Green weight of plants (q/ha)	
	2005	2006	2005	2006	2005	2006
T ₁	287.4	329.5	1.13	1.29	361.7	339.2
T ₂	276.3	310.0	1.12	1.24	345.8	315.8
T ₃	286.8	324.5	1.13	1.29	355.8	331.8
T ₄	294.5	341.0	1.14	1.24	398.3	389.2
T ₅	282.1	334.0	1.13	1.36	383.3	355.8
T ₆	293.6	339.3	1.15	1.36	401.7	367.5
SEm ±	2.18	8.14	0.01	0.06	12.28	12.15
CD (P=0.05)	6.60	24.50	NS	NS	36.70	36.60

Table 2. Fibre yield of *tossa* jute and economics as influenced by different treatments

Treatment	Fibre yield (q/ha)		Net return (Rs/ha)		B:C ratio	
	2005	2006	2005	2006	2005	2006
T ₁	26.80	26.32	12592	12064	1.75	1.71
T ₂	25.20	24.63	11509	10882	1.71	1.67
T ₃	26.43	25.95	12763	12235	1.78	1.75
T ₄	29.72	30.03	14504	14845	1.79	1.81
T ₅	28.68	28.05	14037	13344	1.80	1.76
T ₆	29.87	29.02	15247	14312	1.87	1.81
SEm ±	0.56	0.84	-	-	-	-
CD (P=0.05)	1.68	2.52	-	-	-	-

Note :

- T₁ - 100% Recommended dose of NPK through chemical fertilizer
- T₂ - 25% N + 50% P₂O₅ + 100% K₂O of RD through CF + biofertilizer
- T₃ - 50% N + 50% P₂O₅ + 100% K₂O of RD through CF + biofertilizers
- T₄ - T₁ + FYM @ 3 t/ha
- T₅ - T₂ + FYM @ 3 t/ha
- T₆ - T₃ + FYM @ 3 t/ha

Table 3. Nutrient status of soil and nutrient uptake by jute crop as influenced by different treatments

Treatment	2005					2006				
	Applied (kg/ha)	Before jute (kg/ha)	Uptake (kg/ha)	After jute (kg/ha)	Balance (kg/ha)	Applied (kg/ha)	Before jute (kg/ha)	Uptake (kg/ha)	After jute (kg/ha)	Balance (kg/ha)
<i>N balance sheet</i>										
T ₁	30.0	285.3	68.2	290.9	+43.8	30.0	290.9	73.5	290.2	+42.9
T ₂	7.5	285.3	66.0	286.1	+59.3	7.5	286.1	69.6	286.6	+62.6
T ₃	15.0	285.3	70.3	286.8	+56.8	15.0	286.8	75.5	288.8	+62.5
T ₄	36.3	285.3	79.7	298.2	+56.3	36.3	298.2	86.8	306.3	+58.6
T ₅	13.8	285.3	75.7	293.7	+70.3	13.8	293.7	80.0	301.6	+74.1
T ₆	21.3	285.3	81.0	293.0	+67.4	21.3	293.0	83.8	303.8	+73.3
SEm ±	-	-	1.34	2.66	-	-	2.66	1.52	1.74	-
CD(P=0.05)	-	-	4.0	NS	-	-	NS	4.6	5.22	-
<i>P balance sheet</i>										
T ₁	10.91	19.23	18.37	20.65	+8.88	10.91	20.65	17.84	20.12	+6.40
T ₂	5.46	19.23	18.50	19.92	+13.73	5.46	19.92	17.59	19.85	+12.06
T ₃	5.46	19.23	19.51	20.15	+14.97	5.46	20.15	18.71	19.90	+13.00
T ₄	13.52	19.23	22.62	22.23	+12.10	13.52	22.23	22.25	24.15	+10.65
T ₅	8.07	19.23	21.65	21.65	+16.00	8.07	21.65	20.53	22.12	+12.93
T ₆	8.07	19.23	22.94	21.00	+16.64	8.07	21.00	21.62	22.85	+15.40
SEm ±	-	-	0.28	0.68	-	-	0.68	0.19	0.44	-
CD (P=0.05)	-	-	0.86	2.04	-	-	2.04	0.57	1.34	-
<i>K balance sheet</i>										
T ₁	20.8	145.6	71.4	145.1	+50.1	20.8	145.1	65.9	145.7	+45.7
T ₂	20.8	145.6	69.0	146.1	+48.7	20.8	146.1	62.0	145.2	+40.3
T ₃	20.8	145.6	72.5	145.4	+51.5	20.8	145.4	65.5	146.8	+46.1
T ₄	26.1	145.6	84.4	150.4	+63.1	26.1	150.4	76.0	153.8	+53.3
T ₅	26.1	145.6	80.7	151.3	+60.3	26.1	151.3	70.2	152.8	+45.6
T ₆	26.1	145.6	85.0	150.8	+64.1	26.1	150.8	73.6	154.1	+50.8
SEm ±	-	-	1.35	1.99	-	-	1.99	0.35	1.34	-
CD (P=0.05)	-	-	4.1	6.0	-	-	6.0	1.1	4.04	-

Note :

- T₁ - 100% Recommended dose of NPK through chemical fertilizer
T₂ - 25% N + 50% P₂O₅ + 100% K₂O of RD through CF + biofertilizer
T₃ - 50% N + 50% P₂O₅ + 100% K₂O of RD through CF + biofertilizers
T₄ - T₁ + FYM @ 3 t/ha
T₅ - T₂ + FYM @ 3 t/ha
T₆ - T₃ + FYM @ 3 t/ha

rained condition to study the influence of chemical fertilizer, bio-fertilizer and organic manure on soil nutrient status, fibre yield and mineral nutrition of *tossa* jute. There were six treatments *viz.* T₁: 100% recommended dose (RD) of NPK through chemical fertilizer (CF); T₂: 25% N + 50% P₂O₅ + 100% K₂O of RD through CF + bio-fertilizers; T₃: 50% N + 50% P₂O₅ + 100% K₂O of RD through CF + bio-fertilizers; T₄: T₁ + FYM @ 3 t/ha; T₅: T₂ + FYM @ 3 t/ha; T₆: T₃ + FYM @ 3 t/ha. The recommended dose of fertilizer for *tossa* jute is 30 kg N, 25 kg P₂O₅ and 25 kg K₂O/ha. Bio-fertilizer was applied as seed treatment @ 50 g *Azotobacter* + 50 g PSB/kg of jute seed. The experiment was laid out in randomized block design with four replications. The nutrient content in FYM on dry weight basis was 0.72 % N, 0.30 % P and 0.61 % K. FYM was applied one week before sowing and chemical fertilizers were applied one day before sowing and thoroughly mixed with soil. Seeds of *tossa* jute variety JRO 524 were sown in the first week of April and harvested in the middle of August in both the years with a spacing of 25 cm X 5-7 cm. The soil was acidic in reaction and sandy loam in texture. The available N, P and K of the initial soil were 285.3 kg, 19.23 kg and 145.6 kg/ha respectively. Nutrient balance in the soil was calculated (Raghuwanshi *et al.*,1991) as:

$$\text{Nutrient balance in soil} = Y - (X - a) - N$$

Where,

Y = Nutrients removed by crops

X = Initial soil status of nutrient element

a = Final soil status of nutrient element

N = Mineral added through fertilizer

Results and Discussion

Application of 50% reduction in N and P fertilizer along with bio-fertilizer (T₃) produced almost similar yield as that of recommended dose of fertilizer in jute (T₁) which were on par. Reduction of 75% N and 50% along with bio-fertilizer (T₂) though produced yield as that of T₁ and T₃ it was 6.2% and 4.8% lower than the respective treatments. Addition of FYM increased fibre yield. Also, 50% reduction in N and P fertilizer along with bio-fertilizer and FYM (T₆) produced almost similar yield as that of 100% NPK fertilizer + FYM (T₄). Gangwar *et al.* (2003) also observed that 25% N through press mud or FYM resulted crop yield at par with 100% NPK applied through chemical fertilizers. The performance of nutrient combinations followed the order of 100% NPK + FYM (T₄) > 50% N and P + 100% K + BF + FYM (T₆) > 25% N + 50% P + 100% K + BF + FYM (T₅) > 100% NPK (T₁) > 50% N and P + 100% K + BF (T₃) > 25% N + 50% P + 100% K + BF (T₂). Higher fibre yield was accompanied by taller plants and higher green biomass of jute.

Nutrient balance sheet

Total N in soil showed a positive balance after 2 years of jute cultivation. The net gain of N was less where only chemical fertilizer (T₁) was applied. Addition of bio-fertilizer (T₂ and T₃) increased the N status while addition of FYM along with bio-fertilizer (T₅ and T₆) further increased in N balance in soil.

The balance sheet of available P and K was also positive as that of N. Biofertilizer application along with FYM had increased P & K balance.

It was observed that integration of chemical and bio-fertilizer (50% reduction of N and P fertilizer along with bio-fertilizer) recorded higher net return and B:C ratio as compared to 100% NPK application through chemical fertilizer. Addition of FYM @ 3 t/ha with 50% N and P fertilizer + bio-fertilizer caused further increase in net income and B:C ratio as compared to T₄ (100% NPK + FYM).

Hence it can be inferred that the integrated nutrient management can improve the soil nutrient status after the harvest of jute and also gave higher net return and B:C ratio. Application of 50% of N and P fertilizer along with bio-fertilizer and FYM was the most suitable and profitable combination. However, in scarcity of FYM, 50% recommended N, P and 100% K through chemical fertilizer with along with bio-fertilizer may be an alternate.

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