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Effect of Levels and Split Application of Potassium along with Nitrogen on Potassium Uptake, Yield and Grade of Jute (*Corchorus olitorius*) Fibre

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ABSTRACT

Field experiment conducted for two years during *pre-kharif – kharif* seasons of 1999 and 2000 at Mohanpur (22.93°N, 88.53°E), West Bengal indicated that plant height, basal diameter of *olitorius* jute (cv JRO 524) were increased significantly with increasing levels of N and K. Split application of potassium was better than full basal application. Fibre yield and stick yield of jute were increased significantly with increasing levels of N and K. In case of K application, the highest fibre yield (2.67 t ha^{-1}) and the highest stick yield (6.42 t ha^{-1}) were found in treatments with 60 kg K_2O ha^{-1}, which was closely followed by 30 kg K_2O ha^{-1}. The highest grade (TD_2, total score 85) jute fibre was obtained with 40 kg N ha^{-1} + 60 kg K_2O ha^{-1} (along with 30 kg P_2O_5 ha^{-1}) when the potassium was applied either as basal or split application. The highest uptake of potassium (115 kg ha^{-1}) was observed at 60 kg K_2O and the K uptake was not differed significantly between the methods (basal/split) of potassium application. The maximum net production value (2.60) was obtained with 80 kg N ha^{-1} + 60 kg K_2O ha^{-1}, where potassium was applied as basal.

Key words: Fibre quality, fibre yield, jute, K uptake, potassium, split K-application

INTRODUCTION

Jute (*Corchorus olitorius*) is one of the most important commercial fibre crop for the eastern part of India. To be competitive in the international market, it is important to raise productivity and improve the quality of jute fibre. Balanced plant nutrition allows all production inputs to operate more efficiently. The potassium requirement of jute is well established and its requirement is quite high (Mandal *et al.*, 1970). In India, the most common practice is to apply the full dose of potash together with phosphate as basal during final land preparation, thus it is subjected to loss due to leaching and fixation, resulting in poor response. In this context, an experiment was conducted to assess the effect of levels and split application of potassium along with nitrogen on growth, yield and fibre quality of jute in the jute growing alluvial soil of West Bengal.

MATERIALS AND METHODS

The experiment was conducted for two years during *prekharif-kharif* seasons of 1999 and 2000 at Mohanpur (22.93°N, 88.53°E, 9.75 m above mean sea level), West Bengal on a alluvial sandy clay loam (56.4% sand, 24.1% silt and 19.5% clay) soil with 0.07% total nitrogen, 17.78 kg ha^{-1} available phosphorus and 181.84 kg ha^{-1} available potassium. The soil pH was 6.8.

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The experiment was laid out in a split plot design with 5m x 3.5m main plots and 3.5m x 2.5m sub-plots, replicated thrice. In the main plots 3 levels of nitrogen (20, 40 and 80 kg N ha^{-1}) + 3 levels of potassium (15, 30 and 60 kg K_2O ha^{-1}) and in the sub-plots method of potassium application (basal and split; 1/2 as basal + 1/2 at 35 DAS) were considered. The most popular tossa jute variety JRO-524 (Navin) was used in this experiment. Half of the dose of nitrogen as urea and full dose of phosphorus (30 kg P_2O_5 ha^{-1} common for all plots) as single super phosphate were applied at the time of sowing. Remaining half dose of nitrogen was top dressed at 35 DAS. Potassium as muriate of potash was applied as per the treatment details. Ten plants from each plot were selected at random and labeled with aluminum tags to record plant height, basal diameter and other biometric observations at 60, 90 and 120 (harvest) DAS. The quality of jute fibre (strength, fineness, root content, defects, colour and density) was tested at National Institute of Research for Jute and Allied Fibre Technology (ICAR), kolkata, India as per the scoring system of 'ISI Standard 271-1975'. The net production value was calculated by dividing net profit with total cost of cultivation.

RESULTS AND DISCUSSION

Yield Components (plant height and basal diameter)

At 60, 90 and 120 DAS, the plant height of jute differed significantly with increasing levels of nitrogen and potassium (**Table 1**). At 60 DAS, the maximum plant height (127.3 cm) was obtained with the application of 60 kg K_2O ha^{-1} and it was statistically at par with the plant height (117.34 cm) at 30 kg K_2O ha^{-1}. Similar observations were obtained at 90 and 120 DAS. The maximum plant height of 241.34 and 311.53 cm were recorded at 90 and 120 DAS, respectively with 60 kg K_2O ha^{-1}. Similar finding was reported earlier in other situation (Das and Guha, 1995). At different growth stages, the plant height of jute differed significantly with the method of application of potassium. The highest

Table 1: *Effect of levels of nitrogen and potassium and that of methods of K application on plant height, basal diameter, fibre and stick yield of jute*

Treatments (kg ha^{-1})	Plant height (cm)			Basal diameter (cm)			Fibre yield (t ha^{-1})	Stick yield (t ha^{-1})
	60 DAS	90 DAS	120 DAS	60 DAS	90 DAS	120 DAS		
	Levels of N							
N_{20}	92.38	184.67	254.37	2.73	3.92	4.83	2.10	4.80
N_{40}	110.17	209.48	282.33	2.98	4.24	5.00	2.43	5.78
N_{80}	133.37	238.44	309.43	3.36	4.70	5.23	2.85	7.00
C.D. at 5%	9.09	19.10	20.56	0.18	0.17	0.20	0.09	0.18
	Levels of K							
K_{15}	100.33	176.04	248.67	2.82	4.00	4.49	2.22	5.38
K_{30}	117.34	227.43	289.35	2.99	4.30	5.13	2.61	6.24
K_{60}	127.30	241.34	311.53	3.40	4.72	5.61	2.67	6.42
C.D. at 5%	9.09	19.10	20.56	0.18	0.17	0.20	0.09	NS
	Methods of application							
Basal	110.38	200.00	267.33	2.90	4.30	4.91	2.42	5.80
Split119.85	224.00	294.50	3.02	4.32	5.25	2.49	5.97	
C.D. at 5%	7.81	10.19	12.13	NS	NS	0.15	NS	NS

DAS, days after sowing

plant height (294.50 cm) was obtained with split application of potassium. At all the growth stages, the basal diameter of jute varied significantly with increasing levels of nitrogen and potassium (**Table 1**). Maximum basal diameter (5.61 cm) was found associated with the highest dose of potassium (60 kg K_2O ha^{-1}. It was reported that increasing level of potassium increased the basal diameter at 50 kg K_2O ha^{-1} (Das and Guha, 1995). The basal diameter of jute varied significantly at 120 DAS with split application of potassium. Significantly the highest basal diameter (5.25 cm) was obtained with split application of potassium along with nitrogen. Similar findings were reported in the recent past (Maitra *et al.*, 1999).

Fibre Yield

The fibre yield of jute increased significantly with increasing levels of nitrogen and potassium (**Table 1**). The maximum fibre yield (2.85 t ha^{-1}) was recorded with 80 kg N ha^{-1}. In case of potassium, the maximum fibre yield (2.67 t ha^{-1}) was found with 60 kg K_2O ha^{-1} and it was at par with the fibre yield from treatments receiving 30 kg K_2O ha^{-1}. Higher fibre yield, though non-significant, was obtained with split application of potassium along with nitrogen as compared to basal application of potassium. Similar finding was reported by Maitra *et al.*, 1999. Levels of nitrogen and potassium interacted significantly regarding the fibre yield of jute (**Table 2**). At all levels of potassium the yield increased significantly with increased levels of nitrogen up to 80 kg N ha^{-1}. In all levels of nitrogen, fertilization with 60 kg K_2O ha^{-1} recorded the maximum fibre yield. However, there was non-significant difference between K_{30} and K_{60} levels of potassium. The maximum fibre yield (3.11 t ha^{-1}) was obtained with the application of 80 kg N ha^{-1} along with 60 kg K_2O ha^{-1}.

Table 2: *Interaction effect of levels of nitrogen and potassium on fibre yield (t ha^{-1}) of jute*

Levels of potassium (kg K_2O ha^{-1})	Levels of nitrogen (kg K_2O ha^{-1})		
	N_{20}	N_{40}	N_{80}
K_{15}	1.88	2.22	2.63
K_{30}	2.16	2.44	2.84
K_{60}	2.29	2.60	3.11
C.D. at 5% = 0.15			

Stick Yield

Jute stick, an agro-waste, has several uses. The stick yield of jute varied significantly with increasing levels of nitrogen and potassium (**Table 2**). The maximum stick yield (7.00 t ha^{-1}) was found when the crop was fertilized with 80 kg N ha^{-1}. In case of potassium, the maximum stick yield (6.42 t ha^{-1}) was obtained with the application of 60 kg K_2O ha^{-1}. The stick yield difference between K_{30} and K_{60} was not significant. The method of potassium application failed to exhibit any significant differential response in jute stick production. However, the maximum jute stick yield (5.97 t ha^{-1}) was obtained with split application of potassium along with nitrogen as compared to basal application.

Quality and Grade of Jute Fibres

The quality of jute fibre was influenced due to different treatment combinations and with methods of application of potassium (**Table 3**). The best quality (TD_2, total score = 85) of fibre was obtained from the crop fertilized with 40 kg N ha^{-1} and 60 kg K_2O ha^{-1} with basal or split application of potassium and the grade schedule for this total score point was TD_2. There was no difference of fibre quality due to basal or split application of potassium.

Net Production Value

Farmers are interested to get more return per unit of their investment. So, it is of great concern to evaluate the net profit per unit of investment or the net production value (NPV). The maximum NPV (2.60) was obtained when the crop was fertilized with 80 kg nitrogen + 30 kg P_2O_5 and 60 kg K_2O ha^{-1} with basal application of potassium (**Table 3**). As the split

Table 3: *Effect of levels of nitrogen and potassium and of methods of application (of potassium) on fibre quality and net production value*

Treatments	Total scores of quality characters*	Grade of fibre	Net production value
N_{20} K_{15} B	50	TD 5	1.54
N_{20} K_{15} S	50	TD 5	1.51
N_{20} K_{30} B	53	TD 5	1.90
N_{20} K_{30} S	54	TD 4	1.83
N_{20} K_{60} B	70	TD 3	1.99
N_{20} K_{60} S	70	TD 3	1.88
N_{40} K_{15} B	66	TD 4	1.96
N_{40} K_{15} S	66	TD 4	1.84
N_{40} K_{30} B	66	TD 4	2.31
N_{40} K_{30} S	66	TD 4	2.24
N_{40} K_{60} B	85	TD 2	2.37
N_{40} K_{60} S	85	TD 2	2.30
N_{80} K_{15} B	66	TD 4	2.40
N_{80} K_{15} S	70	TD 3	2.24
N_{80} K_{20} B	78	TD 3	2.47
N_{80} K_{30} S	78	TD 3	2.42
N_{80} K_{60} B	80	TD 3	2.60
N_{80} K_{60} S	84	TD 3	2.45

*Scoring system as per the ISI specification (ISI Standard 271-1975)

application of potassium demands more labourers, the net profits reduced through increased cost of production.

Potassium Content and Uptake in Jute Plant

Application of 60 kg K_2O ha^{-1} recorded highest potassium content (0.89%) in jute plant at harvest though not significant as compared to 15 and 30 kg K_2O ha^{-1} (**Table 4**). Potassium uptake increased non-significantly with increasing levels of potassium application. Application of 60 kg K_2O ha^{-1} recorded the highest K uptake (115 kg ha^{-1}) by jute. In an earlier report (Chaudhury, 1986), the highest uptake of potassium was noted with 40 kg K_2O ha^{-1}. Split application of potassium along with nitrogen recorded the highest potassium content (0.89%) in jute plant at harvest, though non-significant, as compared to basal application. Similarly split application of potassium along with nitrogen was found superior regarding potassium uptake by jute. Potassium uptake was only 92.94 kg ha^{-1} in case of basal application, whereas, it was 108.23 kg ha^{-1} due to split application of potassium.

Table 4: *Effect of potassium and method of its application on potassium content and uptake by jute*

Treatments	K content (%)	K uptake (kg ha^{-1})
Levels of potassium (kg ha^{-1})		
K_{15}	0.73	88.43
K_{30}	0.83	102.94
K_{60}	0.89	115.00
C.D. at 5%	NS	NS
Methods of K-application		
Basal	0.75	92.94
Split0.89	108.23	
C.D. at 5%	NS	NS

Yield Response Curve

The quadratic response curve was drawn in a XY plane, considering levels of potassium in X axis and expected yield of jute in Y axis (**Fig. 1**). It revealed that potassium level giving maximum yield (2.67 t ha^{-1}) was 57.92 kg K_2O ha^{-1}. The economic optimum level of potassium was 56.53 kg K_2O ha^{-1} and its corresponding yield was 2.65 t ha^{-1}.

From the above results it can be concluded that application of 80 kg N ha^{-1} and 30 kg K_2O ha^{-1} could be most profitable from the economic point of view for optimum growth and productivity of *olitorius* jute fibre in sandy loam soil. Split application of potassium was found beneficial in potassium uptake and yield of jute fibre over only basal application.

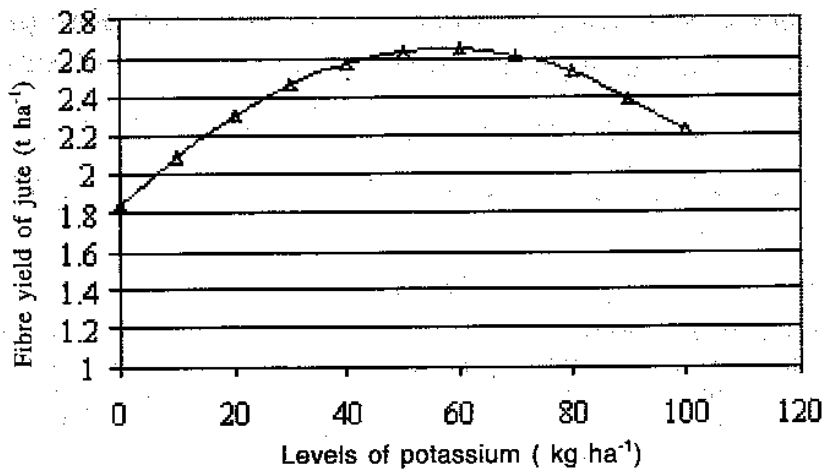

Fig. 1: *Response of potassium on the expected yield of jute* [$Y=1.84+0.028x-0.00024x^2$]

REFERENCES

Chaudhury, J. (1986). Studies on the effect of K, Ca, Mg on growth, yield and nutrient uptake by *capsularis* jute. *Indian Agriculturist* **30**: 275-280.

Das, K., Guha, B. (1995). Potash for high fibre yield and control of disease in jute. *Indian Farming*, December issue, pp. 6-7.

Maitra, D.N., Chaudhury, J., Saha, A.R. (1999). Effect of levels and split application of K on fibre yield and uptake of K by jute. *Journal of Potassium Research* **15**: 135-138.

Mandal, A.K., Doharey, A.K., Pal, H. (1970). Response of jute to potash application. *Fertilizer News* **15**: 30-36.