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RESEARCH ARTICLE

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Effect of irrigation regimes and different levels of nitrogen on seed yield of jute (*Corchorus olitorius*)

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ABSTRACT

A field experiment was conducted to study the effect of irrigation regimes and nitrogen levels on jute (*Corchorus olitorius*, variety JRO-524) seed production at Central Research (CR) Farm, B.C.K.V. Gayeshpur, West Bengal during August to December 2008. The results showed that yield attributes *i.e.* no. of pods per plant, no. of seeds per pod, 1000 seed weight and seed yield significantly increased with the increasing dose of nitrogen and irrigation level. An increase in irrigation frequency increased the total water use but decreased the water use efficiency. Maximum jute seed yield was obtained under irrigation regime I_3 (ψm = -0.03 Mpa at 30 cm soil depth) which received 2 irrigations with 40 kg nitrogen ha^{-1} (N_4 level). I3 irrigation regime increased the seed yield by 39.83% over rainfed situation.

KEY WORDS : Irrigation regimes, Nitrogen levels, Jute seed production, Vegetative mean

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INTRODUCTION

Jute is natural product of commercial importance which plays an important role in Indian economy. Jute is cultivated in 0.835 million ha area in India. Though West Bengal is the leading state in jute fibre production, but the major seed growing areas are Gunter Prakasham district of Andhra Pradesh, Akola Amaravati of Maharastra and Bellary and Raichur of Karnataka. So seed production of this state need to be increased for efficient and economic fibre production. Jute seed production by vegetative propagation is an alternative method, suitable for production of high quality seeds with out deteriorating the fibre yield and quality (Majumder 1978). Therefore, this experiment was carried out to find the suitable level of irrigation and dose of nitrogen for higher jute seed yield by vegetative mean (top cutting method) in West Bengal condition.

MATERIALS AND METHODS

The field experiment was conducted at Central Research (CR) Farm, B.C.K.V. Gayeshpur, during August to December of 2008. The soil was sandy-loam in texture having moderate drainage with pH 6.9, organic carbon 0.64%, total nitrogen 0.08%, available P_2O_5 21.10 kg ha^{-1}, available K_2O 190.65 kg ha^{-1}. Total rainfall was 44.25 cm received during the experimental period. The experiment was laid out in split-plot design replicated three times. There were three main plots of irrigation treatment *viz.*, I_1: rainfed, I_2: ψm = -0.05Mpa at 30 cm soil depth (1irrigation of 5cm), I_3 : ψm = -0.03 Mpa at 30 cm soil depth (2 irrigation, each of 5 cm) and four levels of nitrogenous fertilizer were given in sub-plots *viz.*, N_1 : 10 kg ha^{-1}, N_2 : 20 kg ha^{-1}, N_3 : 30 kg ha^{-1}, N_4 : 40 kg ha^{-1}. The top portion (upper 15 cm) of jute plant (variety JRO – 524) which was grown for fibre purpose (100 – 110 days plant age) was cut and used as planting material. Planting was done at a spacing of 30cm × 15cm. Before planting the top portion of jute were treated with IBA (rooting hormone) 1000 mg per l water then fungicide (Bavistin). Half of nitrogen (urea) as per treatment was applied at the time of planting and remaining half was top-dressed at 30 days after planting. The crop was fertilized with a uniform dose of 20 kg ha^{-1} P_2O_5 and 30 kg ha^{-1} K_2O. Water use efficiency was calculated on the basis of seed yield per cm water used (irrigation water + effective rainfall + soil profile contribution) by the jute crop. Due to low intensity, all the rain received was considered as effective rainfall.

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RESULTS AND DISCUSSION

The results obtained from the present study have been presented under following heads :

Effect of irrigation regimes:

Irrigation regimes had a significant influence on yield attributes and jute seed yield (Table 1). Among the irrigation treatments, the highest no. of pods plant^{-1} (67.27) was recorded in I_3 treatment (irrigation at ψm = -0.03 Mpa at 30 cm soil depth) which received 2 irrigations followed by I_2 treatment (irrigation at ψm = -0.05 Mpa at 30 cm soil depth) with 1 irrigation. Highest seed yield (3.30 q ha^{-1}) also was obtained under I_3 treatment (irrigation at ψm =-0.03 Mpa at 30 cm soil depth). The result reported confirms the findings of Mostafa *et al.* (2002). More over irrigation at ψm = -0.03 Mpa at 30 cm soil depth (I_3 regime) increased seed yield by 39.83 % over rainfed situation (I_1 regime).

Effect of nitrogen levels:

Nitrogen is vitally important plant nutrient. The crop responds favourably to application of nitrogen fertilizer (Ali *et al.,* 2007). All the yield attributes increased significantly with nitrogen application upto 40 kg N ha^{-1} (Table 1). Highest seed yield (3.02 q ha^{-1}) was obtained with 40 Kg nitrogen owing to the beneficial effect of nitrogen nutrition in exploiting inherent potential of the crop. Similar result was also reported by Ray *et al.* (1995).

Water use and water-use efficiency:

An increase in level of irrigation markedly increased the total water use. Highest water use was recorded under I_3N_4 treatment (Table 2). Increase in water use with increase in the level of N was probably owing to improved crop growth, extension of the active growth period and

Table 1: Effect of irrigation regimes and nitrogen levels on yield attributes and seed yield of jute

Treatments	No. of pods plant^{-1}	Length of pod (cm)	No. of seeds pod^{-1}	1000 seed weight (g)	Jute seed	
					Yield (q ha$^{-1)}$	% increased over control
Irrigation regimes						
I_1: Rainfed	43.08	5.69	205.91	1.83	2.36	
I_2 : Irrigation at Ψ_m = -0.05 Mpa at 30 cm soil depth	53.12	5.86	226.5	1.86	2.75	16.52
I_3 : Irrigation regime Ψ_m = -0.03 Mpa at 30 cm soil depth	67.27	6.42	245.91	1.91	3.30	39.83
S.E. (±)	0.20	0.02	0.65	0.03	0.01	
C.D. (P=0.05)	0.81	0.07	1.80	0.11	0.03	
Nitrogen levels						
N_1 : 10 Kg N ha^{-1}	45.50	5.64	198.11	1.73	2.52	-
N_2 : 20 Kg N ha^{-1}	55.29	5.80	214.66	1.80	2.76	-
N_3 : 30 Kg N ha^{-1}	57.34	6.12	235.12	1.94	2.92	-
N_4 : 40 Kg N ha^{-1}	59.82	6.40	256.54	2.01	3.02	-
S.E. (±)	0.18	0.01	1.27	0.01	0.01	
C.D. (P=0.05)	0.53	0.02	2.66	0.02	0.03	

Table 2 : Total water use and water use efficiency of jute seed crop

Treatments	Profile contribution(cm)	Irrigation water (cm)	Total water use (cm)	Water use efficiency (Kg ha^{-1}cm^{-1})
I_1N_1	2.05	0	46.30	4.83
I_1N_2	2.14	0	46.39	5.56
I_1N_3	2.84	0	47.09	5.77
I_1N_4	2.92	0	47.17	5.97
I_2N_1	0.84	5	50.09	4.71
I_2N_2	0.91	5	50.16	5.50
I_2N_3	1.10	5	50.35	5.58
I_2N_4	1.23	5	50.48	5.88
I_3N_1	1.78	10	56.03	4.60
I_3N_2	1.86	10	56.11	5.22
I_3N_3	1.93	10	56.18	5.62
I_3N_4	1.98	10	56.23	5.74

better root ramification for the utilization of moisture from different soil layers. Maximum water-use efficiency (5.97 kg $ha^{-1}cm^{-1}$) was observed under rainfed condition and decreased with the increasing no. of irrigation. Increasing nitrogen levels improved the water-use efficiency. This could be attributed due to relatively higher increase in seed yield than water use resulting from nitrogen application.

Conclusion:

Based on findings of the study, it may be concluded that jute can be fertilized with 40 kg nitrogen and irrigated at ψm = -0.03 Mpa at 30 cm soil depth, so as to achieve higher seed yield under the Agroclimatic conditions of West Bengal.

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