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INFLUENCE OF WEED CONTROL METHODS AND PLANT SPACING ON THE YIELD OF WHITE JUTE (*Corchorus capsularis*)

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ABSTRACT

A field experiment was conducted at Sher-Bangla Agricultural University, Dhaka during April to August, 2009 with a view to find out the influence of weed control methods and plant spacing on the yield of white jute (var.CVL-1). The experiment consisted of four weed control methods viz. two times hand weeding with one raking, herbicide Whip Super 9 EC (Fenoxaprop-P-ethyl: $C_{18}H_{16}ClNO_5$) application at 15 DAS, two times hand weeding at 20+40 DAS and three times hand weeding at 15+30+45 DAS; and four plant spacings viz. 20 cm x 10 cm, 25 cm x 10 cm, 30 cm x 10 cm (20, 25 and 30 rows with plants spaced at 10 cm intervals in the row) and a broadcasting. The dominant grass weeds were Cynodon dactylon (43%), Echinochloa colonum (29%) and Eleusine indica (22%). Results showed that plant spacing differed significantly and 25 cm x 10 cm spacing gave highest (3.12 t ha^{-1}) fibre yield which was statistically similar with 20 cm x10 cm. Two times weeding and one raking gave highest (3.12 t ha^{-1}) fibre yield which was statistically similar with herbicide application (2.97 t ha^{-1}). Interaction effect showed that highest fibre yield (4.02 t ha^{-1}) was obtained from 20 cm x 10 cm spacing with herbicide application. Whip Super 9 EC @ 615 ml ha^{-1} effectively controlled the grass weeds providing higher fibre yield and net 7.13 Taka return per Taka invested whereas 6.51, 5.18 and 5.34 Taka from two times hand weeding with one raking, two times hand weeding and three times hand weeding, respectively.

Keywords: Herbicide, Jute, Plant spacing, Weed control methods.

INTRODUCTION

Jute (*Corchorus* sp.) is a natural long, soft, shiny vegetable fibre that can be spun into coarse, strong threads. It is produced from plants in the genus *Corchorus*, belonging to Malvaceae. Jute is considered as the main cash crop of Bangladesh. Its influence on ecology and economy is so intimate that it's effects are significantly

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related to the agro-ecology and the socio-economic life of the people. The suitable climate for growing jute (warm and wet climate) is the monsoon season.

Cultural practices are important management factors that affect the yield of a crop. The hot and humid climate coupled with intermittent rainfall during the jute-growing season, however, encourages weed growth resulting in severe crop-weed competition (Saraswat, 1999); yield losses may be up to 75 to 80% (Sahoo and Saraswat, 1988). Weeding is one of the most important cultural practices for the crop plants to take nutrients, moisture, light, space and sometimes controlling many diseases, organisms and insect pest (Alam *et al.,* 2010). But, the most effective and economic cultural practices for weed control in jute crops are not clearly known by our farmers. In Bangladesh, weeds are generally controlled by raking and niri (hand weeding) and weeding and thinning operations involve about 50% or more of the labour cost (Alam, 2003). Grasses constitute the dominant weed flora in jute fields and its management using pre-emergence herbicides is possible (Sarkar *et al.,* 2005), provided the farmers get sufficient time for land preparation and herbicide application before sowing.

Plant density is an important yield contributing factor which can be manipulated in jute to attain higher fibre production per unit area. The yield of many crops is known to be positively correlated with the number of plants per unit area in the field. If the plant population is lower or higher than the optimum, the final output is adversely affected. In order to obtain required plant density, one of the major yield components of jute is optimum seed rate, resulting in proper spacing to maintain the uniformity of stand for better growth and development of plant. Keeping all the points in mind mentioned above, the present piece of research work was under taken with the following objectives:

- Identify the optimum population density on the yield of jute
- Study the effect of weed control methods on the yield of jute
- Find out the interaction effect (if any) of population density and weed control methods on the yield of jute

MATERIALS AND METHODS

The experiment was conducted at the Agronomy field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during April to July, 2009. The soil of the experimental field belongs to the Shallow Red Brown Terrace Soils. Jute variety CVL-1 was used as the test crop. Two sets of treatments included in the experiment were as follows: A. Factor: weed management (4) W_1=Recommended practices recommended by Bangladesh Jute Research Institute (2W+1R), W_2=1

herbicide application (2-4 leaf stage of weed), W_3=2 weeding (20+40 DAS) and W_4=3 weeding (15+30+45 DAS) B. Factor: Plant spacing (4) S_1=Line sowing (20 cm x 10 cm), S_2=Line sowing (25 cm x 10 cm), S_3=Line sowing (30 cm x 10 cm), and S_4=Broadcasting. The experiment was laid out in a split plot design with three replications having spacing in the main plots, weeding in the sub-plots. There were 16 treatments combinations. The total numbers of unit plots were 48. The size of unit plot was 4 m x 3 m = 12 m^2. The plots were fertilized with the N, P_2O_5, K_2O and S at the rate of 76.50, 10.26, 18.00 and 8.09 kg ha^{-1}, respectively. One-third of N and other fertilizers were broadcasted during the time of final land preparation. The remaining two-thirds of N were top dressed in two equal splits on 20 and 35 days after sowing. Respective seed were sown on 6 April, 2009 by following different line sowing and broadcasting method. The seed rate was 7 kg ha^{-1}. At harvest each 2 m^2 area of one sample was harvested from each plot leaving adequate border for recording data on plant height, top, middle and base diameter of the plants. The plant height and diameters were recorded from 10 randomly selected plants with the help of bamboo scale and slide calipers, respectively. Prior to every harvest ten randomly selected plants from each unit plot were collected to take note of yield components. Two quadrat areas, each measuring 3 rows and 50 cm length along the row were separately harvested from each plot to record plant fibre-stick ratio and harvest index. The plants of the plots were harvested on 21 July. The yields from 10 plants and quadrats were added to the final yield. The data collected on different parameters were statistically analysed to obtain the level of significance using the MSTAT-C. The mean differences among the treatments were compared by least significant difference (LSD) test at 5% level of significance.

RESULTS AND DISCUSSION

Agronomic Performance

Effect of spacing

The plant height, base, middle and top diameter, fibre yield and stick yield were significantly influenced by different spacing (Table-1). Significantly highest fibre yield (3.12 t ha^{-1}) and stick yield (7.05 t ha^{-1}) were found when spacing was S_2 (25 cm x 10 cm). However, as regard to differences in fibre and stick yield between the spacing S_1 & S_2 were insignificant. Alam *et al.* (2010) also found similar results.

Effect of weed management

Due to different weed management practices, only plant height differed significantly but the diameter of the base, middle and top, fibre yield and stick yield remained unaffected. Highest plant height (2.62 m) was observed from W_1 (2W+1R) (Table-2).

Table-1. Effect of spacing on plant height, base, middle and top diameter, fibre yield and stick yield of jute.

Treatment	Plant height (m)	Base diameter (mm)	Middle diameter (mm)	Top diameter (mm)	Fibre yield (t ha^{-1})	Stick yield (t ha^{-1})
S_1	2.73	9.38	6.78	3.83	3.09	6.16
S_2	2.69	10.02	6.63	4.27	3.12	7.05
S_3	2.69	9.88	7.07	3.23	2.37	5.63
S_4	2.10	8.47	5.38	2.72	2.62	5.95
LSD $_{5\%}$	0.1515	0.9095	0.915	0.7680	0.5035	1.174

Table-2. Effect of weed management on plant height, base, middle and top diameter, fibre yield and stick yield of jute.

Treatment	Plant height (m)	Base diameter (mm)	Middle diameter (mm)	Top diameter (mm)	Fibre yield (t ha^{-1})	Stick yield (t ha^{-1})
W_1	2.62	9.20	6.62	3.78	2.97	5.65
W_2	2.61	9.64	6.54	3.56	3.12	6.75
W_3	2.46	9.55	6.53	3.23	2.34	6.41
W_4	2.52	9.35	6.16	3.48	2.76	5.96
LSD $_{5\%}$	0.1385	NS	NS	NS	NS	NS

Effect of spacing and weed management

The plant height, base, middle and top diameter, fibre yield and stick yield were management significantly influenced by the combination of different spacing and weed management practice (Table-3). Significantly highest fibre yield (4.02 t ha^{-1}) was obtained from the combination of S_1W_2 which similar to S_2W_1 (3.78 t ha^{-1}) and highest stick yield (7.80 t ha^{-1}) was observed from S_2W_1 which is statistically similar to S_2W_2 (7.58 t ha^{-1}). Such results are in agreement with those of Hossain *et al*., (2002).

Economic performance

Gross return was found to be the highest (Tk. 257630.55) in the W_1 weed management treatment. But, in the benefit cost ratio (BCR) this treatment was comparatively higher (7.13) than other weed management practices and also the gross return (Tk. 245037.07) was remarkable (Table-4). This result is supported by another study as reported by Hossain *et al.* (2002) and Sarkar (2006) who stated that herbicide application effectively controlled grass weeds and gave increased yields with better economic returns.

The dominant grass weeds were *Cynodon dactylon* (43%), *Echinochloa colonum* (29%) and *Eleusine indica* (22%).

It can be concluded that plant spacing of 25 cm x 10 cm gave highest (3.12 t ha^{-1}) fibre yield which was statistically similar with 20 cm x 10 cm.

Table-3. Interaction effect of spacing and weed management on plant height, base, middle and top diameter, fibre yield and stick yield of jute.

Treatment	Plant height (m)	Base diameter (mm)	Middle diameter (mm)	Top diameter (mm)	Fibre yield (t ha^{-1})	Stick yield (t ha^{-1})
S_1W_1	2.47	9.26	6.87	4.17	2.93	4.72
S_1W_2	2.82	9.30	6.57	3.50	4.02	6.85
S_1W_3	2.62	9.00	6.73	3.83	2.55	6.87
S_1W_4	2.62	10.00	6.93	3.83	2.85	6.20
S_2W_1	2.79	9.57	7.07	4.77	3.78	7.80
S_2W_2	2.77	10.77	6.83	4.83	3.18	7.58
S_2W_3	2.59	10.00	6.77	3.63	2.48	6.03
S_2W_4	2.62	9.73	5.83	3.83	3.02	6.78
S_3W_1	2.69	9.80	7.10	3.57	2.43	5.33
S_3W_2	2.78	10.13	7.47	3.37	2.45	6.83
S_3W_3	2.59	10.50	7.12	2.70	2.08	4.75
S_3W_4	2.71	9.07	6.53	3.27	2.52	5.58
S_4W_1	2.16	8.20	5.43	2.60	2.73	4.77
S_4W_2	2.06	8.37	5.30	2.53	2.82	5.75
S_4W_3	2.05	8.70	5.43	2.73	2.25	8.00
S_4W_4	2.11	8.60	5.33	3.00	2.65	5.27
LSD $_{5\%}$	0.2769	1.530	1.206	1.118	0.9562	2.718

Table-4. Cost of production and benefit cost ratio (BCR) for different weeding management of jute.

Treatment	Cost (Tk. Ha^{-1})					Gross return (Tk. ha^{-1})			BCR
	Fixed cost of production	Labor cost	Raking cost	Herbicide cost	Total cost	From fibre	From stick	Total	
W_1	31,790	7,000	560	-	39,560	167200.8	90429.7	257630.5	6.51
W_2	31,790	280	-	2312.50	34382.5	159162.3	85874.7	245037.0	7.13
W_3	31,790	7000	-	-	38790	125400.6	75693.0	201093.6	5.18
W_4	31,790	10500	-	-	42290	147908.4	79846.1	227754.5	5.34

Note: In case of all weeding method fixed cost was 31790 Tk., 1 Mon= 37.32 kg, 1 mon Fibre/Bel = 2000 Tk. i.e.,1 ton Fibre price = 2000/37.32x1000= 53590.57 Tk., 1 mon Stick= 500 Tk. i.e., 1 ton Stick = 500/37.32x1000= 13397 Tk.

Two times weeding and one raking gave highest (3.12 t ha^{-1}) fibre yield which was statistically similar with herbicide application (2.97 t ha^{-1}). Interaction effects showed the highest fiber yield (4.02 t ha^{-1}) was obtained from 20 cm x 10 cm spacing with herbicide application. Whip Super 9 EC @ 615 ml ha^{-1} effectively controlled the grass weeds providing higher fibre yield and net 7.13 Taka return per Taka invested compared to 6.51, 5.18 and 5.34 Taka from two times hand weeding with one raking, two times hand weeding and three times hand weeding respectively.

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