

## Effect of Weed Control Measures in Jute Under Terai Zone of West Bengal, India

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**Abstract** Jute is a major crop in the terai zone of West Bengal covering more 0.15 million hectares of cropped area. High occurrence of pre-monsoon showers coupled with high humidity results in huge weed growth and farmers have to go for a huge expenditure for controlling weeds through hand weeding. An on farm trial has been carried out for two consecutive years to evaluate cost-effective and eco-friendly weed control measures in jute. The experiment was laid out in a randomized block design (RBD) with 12 replicates and straw mulch after thinning as well as application of post-emergence herbicides was assessed against the farmers' practice of manual weeding only. Application of quizalofop ethyl 5% @ 50 g a.i. ha<sup>-1</sup> at 15-20 days after sowing (DAS) followed by one hand weeding at 35-40 DAS was found to be more effective in controlling the weed population than hand weeding only or straw mulching as reflected from lesser weed dry matter production (11.58 g m<sup>-2</sup>) with increased height (306 cm) and basal diameter (12.63 mm)

leading to higher fiber yield (3.26 t ha<sup>-1</sup>). Similarly, the highest net return (Rs 65,600.00 and Rs 37,920.00 during 2010 and 2011, respectively) and benefit-cost ratio (3.99 and 2.64 during 2010 and 2011, respectively) were also recorded with herbicides treated plots.

**Keywords** Herbicides, Jute, On farm trial, Straw, Mulching.

### Introduction

Jute (*Corchorus capsularis* L.) termed "Golden Fiber" is second only to cotton in terms of most of the important fiber-yielding crop in terai zone of West Bengal. Jute-paddy is the dominant cropping sequence in Coochbehar and Jalpaiguri district covering an area of 0.15 million hectare [1]. Weeds in jute crops offer strong competition to the crop plant for several growth factors. weed-crop competition has been reported to cause 56% and 87% reduction in yield under irrigated and rainfed conditions respectively. Therefore, low yield of jute appeared to be attributed to heavy infestation of weeds. High occurrence of pre-monsoon showers coupled with high humidity results in huge weed growth and farmers have to go for a huge expenditure for controlling weeds as hand weeding is the most common practice for keeping the weeds under control. However, some post-emergence herbicides like quizalofop ethyl (5% EC) were found to be effective in controlling the grassy weeds of jute [2 & 3]. Considering this huge economic loss in hand weeding, an on farm trial has

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been planned to evaluate cost-effective and eco-friendly weed control measures in jute. On-farm conditions are different from research station ones in that the real farming situations are influenced by many out-sourced problems which are not under the control of the farmers that influence the output from the input supply for raising the crop [4]. Participatory research needs to be strengthened for effective technology delivery and on farm trials are one of the means to assure farmers' participation in a location specific technology development.

### Materials and Methods

The on farm trial (OFT) on evaluation of cost-effective and eco-friendly weed control measures in jute under *terai* region were carried out during two consecutive years during 2010 and 2011, at four villages of Cooch Behar district, viz., Khagribari & Dhangdhinguri (Cooch Behar-II), Elajaner kuthi (Cooch Behar-I) and Barashakdal (Dinhata-II). Before implementing the OFT, the need for conducting OFTs were assessed through agro-ecosystem analysis using Participatory Rural Appraisal (PRA) tools. After thorough discussion with the villagers the major problems in jute cultivation were identified and high weed pressure was deemed to be the major jindrance in jute cultivation.

In each year three innovative and receptive farmers from each of the villages were selected for conducting the trial to ensure their active participation. The selected farmers were imparted training on the aspect of integrated crop management for jute. Farmers' perspective, farmers' participation, farmers' management status and suitability of site-these four basic considerations were hincluded in the trial.

The experiment was laid out in a Randomized Block Design (RBD) with 12 replicates and the treatments were allotted randomly to the experimental fields accordingly. Under the OFT, the treatments were as follows : T<sub>1</sub>- Two to three hand weeding in between 20-50 DAS\* (Farmers' practice), T<sub>2</sub>- Quizalofop ethyl 5% @ 0.50 g a.i.ha<sup>-1</sup> at 15-20 DAS + one hand weeding at 35-40 DAS, T<sub>3</sub>-Hand weeding and thinning at 15-20 DAS followed by straw mulching. \*DAS- Days After Sowing.

In both the years the crop (jute cv JBO 2003H) was sown during first week of April. Recommended package of practices other than weed control measures were adopted for successful growth of the crop. The crop received a rainfall of 1639 mm (54 rainy days) and 997 mm (37 rainy days) during 2010 and 2011 respectively. The herbicides were applied as post-emergence spray with high volume sprayer (550 L ha<sup>-1</sup>). For determining the weed dry matter production, weed samples were taken from each plot during 6 WAS with the use 0.5 m × 0.5 m quadrant. Jute plant height and basal diameter were recorded during harvest while the fiber yield was assessed after proper retting. Production economics were calculated based on prevailing market price of inputs like seeds, fertilizers, etc and sale price of jute fiber.

### Results and Discussion

Weed flora of experimental field consisted of *Cynodon dactylon*, *Digitaria ciliaris*, *Setaria glauca*, *Cyperus rotundus*, *Cyperus iria*, *Ageratum conyzoides*, *Ludwigia parviflora*, *Polygonum persicaria*. In the initial growth stage, *Cyperus rotundus* was very common and *Cynodon dactylon* took rapid growth and became an important weed at 30 DAS. Application of

**Table 1.** Plant height, basal diameter, weed dry matter and fiber yield of jute under various treatments. \*Treatments were given in Materials and Methods.

Treatments*	Plant height (cm)		Basal diameter (mm)		Weed dry matter at 6WAS (gm <sup>-2</sup> )		Fiber yield (t ha <sup>-1</sup> )	
	2010	2011	2010	2011	2010	2011	2010	2011
T <sub>1</sub>	301	290	11.52	11.73	11.55	12.85	3.02	3.12
T <sub>2</sub>	314	298	11.95	13.30	11.20	11.50	3.13	3.39
T <sub>3</sub>	309	293	11.90	12.11	12.10	11.95	3.05	3.37
CD ( <i>p</i> =0.05)	NS	NS	NS	0.97	NS	1.10	NS	2.14

**Table 2.** Production economics of jute cultivation. \*market price of jute fiber @ Rs. 2800.00/q during 2010 and Rs 1800.00/q during 2011.

Treatments	Cost of cultivation (Rs/ha <sup>-1</sup> )		Gross income (Rs ha <sup>-1</sup> )*		Net income (Rs ha <sup>-1</sup> )		Benefit-cost ratio	
	2010	2011	2010	2011	2010	2011	2010	2011
T <sub>1</sub>	27500	29400	85400	56106	57900	26706	3.11	1.91
T <sub>2</sub>	21900	23100	87500	61020	65600	37920	3.99	2.64
T <sub>3</sub>	23750	25300	84560	60678	60810	35378	3.56	2.40

quizalofop ethyl 5% @ 50 g a.i ha<sup>-1</sup> at 15-20 DAS followed by one hand weeding at 35-40 DAS was found to be more effective than manual weeding alone or straw mulching in controlling the weed population as reflected from the weed dry matter production at 6 WAS (Table 1). The herbicides treated plots produced minimum weed dry matter (11.58 g m<sup>-2</sup>) at 6 WAS. During initial growth stages the selective grass killer herbicides like quizalofop ethyl have a good knock down effect on the grassy weed flora particularly *Cynodon dactylon* and *Digitaria ciliaris*. It was revealed that hand weeding employed during initial growth stages failed to minimize the growth of weeds and as in farmers' field it was not truly a weed-free control. Weed competition during the first 15 days did not differ significantly from season long weed free situation in terms of yield attributing characteristics and fiber yield [5]. Mean plant height and basal diameter of the jute crop did not vary significantly under various weed control measures though maximum plant height (306 cm) and basal diameter (12.63 mm) was recorded in the plots treated with herbicides during both years of experimentation.

Fiber yield did not vary significantly under various treatments during the first year, however, herbicides treated plots produced significantly higher fiber yield in the second year. In the first year of experimentation high rainfall (1639 mm) throughout the growing period resulted in uniform yield in all the treatments leading to non-significant difference between different weed management practices. However, in the second year the effect of mulching was more pronounced due to less and late receipt of rainfall. The highest fiber yield (339 t ha<sup>-1</sup>) was achieved in plots where quizalofop ethyl was applied (Table 1) followed by one hand weeding and it was closely

followed by and on par with mulch treated plot fiber yield (3.37 t ha<sup>-1</sup>). The higher yield was attributed to increased height and basal diameter of the crop. It was reported that efficacy of quizalofop ethyl was higher in controlling grassy weeds [6].

Among the weed control treatments, the highest net return of Rs 65,600 and Rs 37,920 ha<sup>-1</sup> with benefit-cost ratio of 3.99 and 2.64 during 2010 and 2011, respectively was fetched with herbicides treated plots (Table 2). Huge expenditure towards manual weeding increased the production cost and thereby reduced the net return. Though the yield obtained under straw mulch treated plots was quite similar to that of chemical treated plots, extra cost incurred towards mulching materials reduced the return and benefit-cost ratio. High net return and benefit-cost ratio during the first year of experimentation was due to higher market price of jute fiber. It was also reported that the higher net return per rupee investment was higher in herbicide treated plots [7].

Application of quizalofop ethyl 5% @ 0.50 g a.i.ha<sup>-1</sup> at 15-20 DAS followed by one hand weeding at 30-40 DAS was found to be the best weed control measure in jute under *terai* zone of West Bengal particularly in fields where the grassy weeds are predominant. In these areas mulching could be tried as it has a tremendous weed suppressing ability was reflected from the OFT. The jute farmers of this region could use the mulching technology as it is more cost effective than manual weed control, the usual practice by the farmers.

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