

IMPACT OF HERBICIDE APPLICATION ON FIBRE YIELD OF JUTE (*Corchorus spp.*) IN WEST BENGAL

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Abstract: The present study was carried out by ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore in major jute growing districts of West Bengal to know the yield gap of jute plots with herbicidal method of weed management under frontline demonstration and manual method of weed management. It was observed that herbicidal method of weed management resulted in 8.91% more fibre yield over manual method of weeding. The extension gap was 2.43 q/ha. Adoption of herbicidal method of weed management (1.60) in jute cultivation recorded higher B: C ratio as compared to manual method of weeding (1.21). Also, net return through herbicidal method of weed management (₹25,459/ha) was more than manual method of weed management (₹13,564/ha). Respondents were satisfied with the performance of herbicide and wanted support from input suppliers. This experiment showed that higher profitability in jute cultivation can be achieved by the adoption of recommended herbicidal method of weed management.

Keywords: Client satisfaction index, Economics, Extension gap, Front Line Demonstration, Fibre yield.

INTRODUCTION

Jute (*Corchorus spp.*) is an annual bast fibre crop grown primarily by small and marginal farmers of India, Bangladesh and other countries like China, Thailand, Nepal, Myanmar, Brazil, Congo, etc. In India, the state of West Bengal ranks first in area (around 6 m ha) and production (8 lakh bales, where 1 bale=180 kg) of jute. Around 30 percent of annual agricultural income of farmers of the state comes from cultivation of jute (Das *et al.*, 2006).

Weeds are of special significance in jute cultivation because yields are adversely affected if weeding is not done timely or efficiently. Normally, in jute field grassy weeds dominate over sedge and broadleaf weeds and reach upto 90 percent. During the initial critical growth phase jute being a C₃ plant cannot compete with C₄ weeds, which ultimately reduces the fibre yield of jute crop. Conventional manual weeding in jute, involves around 40 percent of the total cost of cultivation (Saraswat, 1974) and fibre yield reduction is up to 70 percent under unweeded situation and generates poor net return from jute cultivation (Ghorai *et al.* 2004). A wide variation in yield level of jute has been observed in jute growing districts of the state.

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The difference between realizable potential and current productivity is about 20 q/ha. This yield gap can be narrowed down through faster adoption of improved agricultural technologies (Ghorai *et al.*, 2013). Now-a-days, availability of manual labour and ever rising cost has made the jute cultivation non-profitable. Under such condition application of safer herbicides (pre and post) for jute production is a very good option.

Ignorance about herbicidal method of weed management among jute growers is one of the major reasons of low profitability of jute cultivation. Studies have indicated that the adoption of recommended jute production technologies has the potential to give higher yield and income to the farmers (Jha *et al.*, 2008 and Chapke, 2012). Higher extension gap identified in jute growing areas indicated that solution lies in adoption of jute production technologies (Chapke *et al.*, 2009).

Demonstration is one of the most powerful extension tools in communication of new ideas, methods and techniques in agricultural development. It helps to convince the farmers faster than any other method through the process of observing, hearing, learning by doing and experiencing things (Pathak 1999). Frontline demonstrations (FLDs) on herbicide application for weed management in jute were conducted during 2011-14 by ICAR-Central Research Institute for Jute and Allied Fibres (ICAR-CRIJAF), Barrackpore in major jute growing districts of West Bengal to enhance the productivity and economic returns and also to convince the jute growers for adoption of herbicidal/chemical method of weed management. The present study has been conducted to assess the impact of herbicide on fibre yield of jute.

MATERIALS AND METHODS

Jute crop is primarily grown under rainfed situation (>90%). This limits the scope of pre emergence herbicide application even though reliable pre emergence and pre plant herbicides are available. Thus, post emergence herbicides have greater role to combat weed problem in jute provided they are nontoxic to jute plants. In this regard, frontline demonstrations (46.66 units/annum) on cluster basis were laid out at farmers' fields during 2011-12, 2012-13, and 2013-14 in Murshidabad, Nadia, North 24 Parganas and Hooghly districts of West Bengal. The soils of the demonstration plots were sandy loam in texture with medium to low in NPK. Prior to conducting field demonstrations group meetings and specific skill training was conducted to the selected jute growers regarding package of practices of jute crop.

All the jute growers participating in the demonstration programmes were provided with critical inputs of jute cultivation. Jute growers sown the seeds of jute @ 3-4 kg/ha in mid March-mid April at the spacing of 10-15 cm X 20 cm. In the demonstration plots, Quizalofop

ethyl 5% EC (45 g - 60 g a.i. /ha)/ Quizalofop ethyl 10% EC (38 g a.i. /ha) with adjuvant @ 1.0 ml/l was applied at 15 - 21 days after emergence for the management of grassy weed. To ensure proper field moisture before sparying of herbicide, the application was done in the early morning/ late afternoon hours. Chemical fertilizer (NPK) was applied @ 60:30:30/ha. Plant protection measures were taken as per the need. Regular visit by the Scientists of ICAR-CRIJAF, Barrackpore helped in proper implementation of demonstration at jute growers' fields. Jute growers' opinion was documented on the performance of technology. The performance of the technology was judged by them visually as well as quantitatively. After harvesting of 120 days old crops, green jute plants were retted and fibre yield of individual jute plot was recorded. Data of fibre yield have been presented in Table 2.

The extension gap was calculated using the following formula as suggested by *Samui et al.* (2000).

Extension gap (q/ha) = Demonstration yield (q/ha) - yield of local check (q/ha)

The satisfaction level of participating jute growers regarding the performance of technology was assessed. Total 40 jute growers were selected each year to measure their satisfaction level with respect to herbicidal method of weed management in jute. The selected respondents were interviewed personally with the help of pre-tested and well-structured interview schedule. Client satisfaction index (CSI) provides a quantative measurement to judge the satisfaction level of jute growers with respect to performance of herbicide application. It was calculated as below:

Client satisfaction index= (Individual score obtained/Maximum score possible) X100

Constraints in application of herbicide in jute production were ranked using Rank Based Quotient (R.B.Q.) technique (Sabarathnam, 1998) as given in the following formula:

$$RBQ = [\sum f_i (n+1-i) / N n] \times 100$$

Wherein,

f_i =Frequency of respondents for the i^{th} rank of a constraint,

N =number of respondents

n = number of constraints

The data on fibre yield of jute were recorded and analysed to interpret the results. The economic-parameters (gross return, net return and B: C) were worked out on the basis of prevailing market prices of inputs and minimum support prices of outputs.

RESULTS AND DISCUSSION

Jute yield

The fibre yield of jute in the Table 1 showed that herbicide application for weed management was superior over manual method of weeding (check) in terms of giving

Table 1: Yield performance of jute from FLDs on jute growers's field

Year	No. of FLDs	Mean fibre yield (q/ha)		% increase over mean	Extension gap (q/ha)
		Check	Herb. Appl. [#]		
2011-12	42.5	26.39	29.17	10.53	2.78
2012-13	50	27.33	29.72	8.74	2.39
2013-14	47.5	27.76	29.88	7.63	2.12
Mean	46.66	27.16	29.59	8.95	2.43

Herb. Appl. =Herbicide application

higher yield due to better utilization of plant nutrition and soil moisture regime. In the demonstration areas, this method enhanced fibre yield by 10.53%, 8.74% and 7.63% respectively in the year 2011-12, 2012-13 and 2013-14 over manual method of weeding. The results are in close conformity with the research results of Chapke (2012).

Extension gap

Table 1 reveals that extension gap in the study area was 2.43 q/ha. This gap might be due to poor extension services available to the jute growers. It is assumed that by improving the field level extension services yield level of demonstration plots can be enhanced. It indicated the necessity of making jute growers aware regarding herbicide application for weed management. Skill oriented training programme may be needed to inculcate a particular skill involved in weed management. Problem of conviction or fear of loss by the jute growers may be overcome by conducting large scale adaptive trials or demonstrations. Thus, more and more use of this technology can bring down the extension gap. The technology will lead the jute growers to discontinue the old practices for the sake of profit maximization. This finding is in corroboration with the results reported earlier by Chapke *et. al.* (2006).

Economic analysis

At the farm level, the relative profitability, which is determined by the value of output and the cost of cultivation, influences farm decision making ability of a jute grower for the allocation of resources. Thus, cost of cultivation plays a major role in adoption of a particular farm technology. Across the locations, higher cost of cultivation of jute was involved in manual method over herbicide application for weed management. Perusal of Table 2 showed that

herbicide application gave higher mean gross return (₹ 78,045/ha) and net return (₹ 25,459/ha) with higher benefit cost ratio (1.60) as compared to manual

Table 2: Economics, additional cost and returns of herbicide application for weed management in jute under FLDs Vs manual method

Year	Total cost of cultivation (₹)		Gross return (₹)		Net return (Rs.)		Additional cost of herbicide (₹)	Additional return (₹)	B:C	
	Herb. Appl. #	Check	Herb. Appl.	Check	Herb. Appl.	Check			Herb. Appl.	Check
2011-12	41,395	48,361	73,414	62,008	31,131	17,530	1,264	13,601	1.77	1.28
2012-13	51,678	57,254	75,881	69,678	24,204	12,425	2,940	11,779	1.46	1.21
2013-14	53,825	69,596	84,841	80,334	21,041	10,738	1,705	10,303	1.57	1.15
Mean	48,966	58,404	78,045	70,673	25,459	13,564	1,969	11,894	1.60	1.21

Herb. Appl.=Herbicide application

method of weeding. In manual method of weeding mean gross return, net return and benefit cost ratio was ₹ 70,673/ha, ₹ 13,564/ha and 1.21, respectively. The finding of present study is in conformity with the findings of Chapke (2012) and Mitra and Samajdar (2013) who reported higher net return and B: C ratio in the FLDs on improved technologies in jute compared to the farmer's practices.

Additional cost of cultivation and returns

Normally, jute growers did not use herbicides in the study area. Manual method of weeding (90-150 mandays/ha) were done to manage the weed flora depending on the field situation, which was costly as well as time consuming. It can be inferred from Table 2 that additional investment of ₹ 1,969/ha on herbicide a jute growers was able to get additional net returns of ₹ 11,894/ha. With respect to total cost of cultivation, there was saving of ₹ 9,438/ha because newer method minimized the requirement of manual labour for weeding operation. Also, it eliminated the weeds quickly which helped in devoting more time by the beneficiaries to fulfill their social responsibilities in better way. Thus, the demonstrated technology proved its worthiness at jute growers's fields. It means adoption of herbicidal method of weed management at proper stage increases the profitability of jute cultivation.

Jute grower's satisfaction Index

With respect to performance of FLDs, majority of respondents were in the category of high (86.77%) followed by medium (13.33%) level of satisfaction. Majority of them showed stronger conviction, physical and mental involvement in the frontline demonstrations. It is assumed that these factors will motivate them for adoption of herbicidal method of weed management in jute. Client (jute growers) satisfaction index has been presented in Table 3.

Table 3. Extent of jute growers' satisfaction of FLDs (n=40)

Satisfaction level	Number	Percent
High	104	86.66
Medium	16	13.33
Low	-	-

Constraints in application of herbicide in jute production

Constraints are limiting factors which put barriers in achieving its potential with reference to a specific goal. Restrictions perceived and prioritized by the jute growers with regard to herbicide application have been presented in Table 4. Poor knowledge of identification of weed species, lack of knowledge of appropriate herbicide for target weeds and lack of

Table 4. Constraints in application of herbicide in jute production (n=40)

S.No.	Constraints	RBQ	Rank
1.	Poor knowledge about identification of weed species	97.14	I
2.	Lack of knowledge of appropriate herbicide for target weeds	84.27	II
3.	Lack of knowledge of appropriate stage of crop for herbicide spray	57.13	III
4.	Lack of knowledge about the correct dose of herbicide (Over or under dose)	56.53	IV
5.	Green leaves of jute are consumed as vegetable (waiting period 30-40 days)	44.28	V
6.	Lack of knowledge of application time	25.70	VI
7.	Specific field condition (upland/lowland/sandy soil/clay soil)	17.13	VII

knowledge of appropriate stage of crop for herbicide spray were the major constraints in application of herbicide in jute production. Strengthening of existing extension services by the line departments to overcome the above constraints will attract more and more number of jute growers to adopt the new practice.

Conclusion

Thus, it may be concluded that frontline demonstration on herbicide application in jute was capable in increasing the net return, fibre yield as well as saving of time involved in weeding

operation. Existing extension and technological gap required skill upgradation of the jute growers on large scale through organization of regular training and field demonstrations as well as quick and regular supply of herbicide at reasonable price by input agencies. Ultimately, it will attract the jute growers to adopt it which will maximize their farm income.

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