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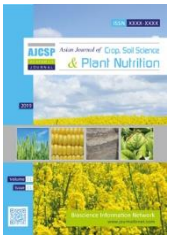

Effect of different weed management techniques for jute seed production

Md. Abul Fazal Mollah[1], Md. Zahid Al Rafiq[1], A. K. M. Shahadat Hossain[2], Md. Nazmul Haq Rony[3], Kaniz Fatema[4] and Md. Abu Sadat[3]

[1]Jute Research Regional Station, Bangladesh Jute Research Institute, Rangpur, Bangladesh
[2]Farm Management Unit, Bangladesh Jute Research Institute, Dhaka, Bangladesh
[3]Basic and Applied Research on Jute Project, Bangladesh Jute Research Institute, Dhaka, Bangladesh
[4]Jute Agriculture Experimental Station, Bangladesh Jute Research Institute, Jagir, Manikganj, Bangladesh

✉ Article correspondence: sadat@snu.ac.kr (Sadat, MA)
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ABSTRACT

This study was carried out at Jute Research Regional Station (JRRS), Rangpur during 2020 kharif-2 season to optimize cost effective weed management techniques for jute seed production through weeding and herbicide management. Randomized complete block design (RCBD) was used for this experiment having three replications. BJRI tossa pat-8 was used for this experiment. There were six weed management treatments viz. T_1 = Weedicide + hand operated weeder + thinning, T_2 = Weedicide + hand operated weeder + thinning + hand operated weeder, T_3 = Weedicide + hand operated weeder + thinning + one hoeing, T_4 = Weedicide + hand operated weeder + thinning + one hand weeding, T_5 = Weedicide + thinning and T_6 = Jute seed grown with natural practice. Significant seed yield difference was observed among the treatments. Results revealed that T_5 treatment was the best option for higher productivity and maximum economic return.

Key Words: *Jute seed, weed management, seed yield and cost-return.*

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I. Introduction

Seed is used for various purposes, including crop production in agricultural sector and as food globally (Uddin et al., 2021). As food, seeds generally provide calories and proteins in the human diet, such as grains, legumes or beans (Hartman et al., 2010; Sabelli and Larkins, 2009). On the other hand, healthy seeds can yield more production than unhealthy seeds (Jaim and Akter, 2012). In addition, seed can play an important role as earning money through seed business and more profit can be earned through good quality of seed (Singh et al., 2015). It was reported that good quality seeds could yield 20% more in crops (Hossain et al., 1994). Good quality of seed is also termed as healthy seed that is genetically pure, disease-free with proper moisture content and high germination rate (Dalrymple,

1979). However, bad quality of seed not only hampers the optimum crop yield but also introduces new diseases worldwide (Sadat and Choi, 2017; Singh et al., 2015).

Jute (*Corchorus* sp.) is considered the most valuable fibre crop of Bangladesh after cotton. Jute and its product earn 6% of the overseas currency through exports in different countries (Islam, 2009). Bangladeshi jute and jute products have good demand in the international market, meeting nearly 95% of global raw jute and 60% of jute requirement, respectively (Rahman, 2010). Every year, 5000-5500 tons of jute seed is needed for jute cultivation in Bangladesh. However, Bangladesh Agricultural Development Corporation (BADC) can supply only about 12-15% of the required seeds and the remaining seeds are produced and supplied by the farmers (Saha, 2011). However, the quality of these seeds are not confirmed and the total jute production decrease (Sikder et al., 2008). Due to the lack of healthy jute seed, farmers prefer to cultivate other crops especially vegetables, than the jute as seed crop. Although BJRI developed different techniques of late jute seed production like direct seeding, stem cutting and seedling transplanting method are promising but the late sowing of jute seed crops usually hindered by continuous rainfall in the late season (Singh et al. 2019). To overcome this situation direct seeding or seeding transplanting in the puddled field during August to September can be considered an alternative way for quality seed production in the late season.

During jute cultivation in field, jute faces several biotic and abiotic stresses (Sadat et al., 2021). Along with these stresses, weed infestation in jute field is one of the major factors in seed production during the late seed crop season of jute (Islam, 2014). If weed is not managed properly during jute seed cultivation, seed yield performance is severely affected. Weed can be managed through different ways, including the application of weedicide and an effective way of weed control practice is important for higher crop yield leading to better economic benefit (Gaffer et al., 1988). However, most efficient and economic cultural methods for controlling weed have not been known to farmers of Bangladesh. So, it is necessary to find out an alternative method to control weed with minimum cost. Weed management technique assessment trial is one of the main objectives of the present research work.

II. Materials and Methods

Study area and period

The research was done at Jute Research Regional Station (JRRS), Rangpur (Latitude: 25043.251N, Longitude: 089^{0}15.735 E and Altitude: 29 m) in 2020 to find out an alternative method to control weed with minimum cost during jute seed production. The research field was common high land residing to Tista Meander Flood-plain (AEZ-03) having sandy loam soil with pH 5.6. BJRI tossa pat-8 was sown on last week of September in 2020. Unit plot size was 3m x 3m = 9 m^2.

Design of experiment and treatments

The research was kept in Randomized Complete Block Design (RCBD) with three replications. Six weed management treatment viz.

T_1 = Weedicide + hand operated weeder + thinning,
T_2 = Weedicide + hand operated weeder + thinning + hand operated weeder,
T_3 = Weedicide + hand operated weeder + thinning + one hoeing,
T_4 = Weedicide + hand operated weeder + thinning + one hand weeding,
T_5 = Weedicide + thinning and
T_6 = Jute seed grown with natural practice were used in this research.

Weedicide application and cultural practices

All weedicide/herbicides (Ethoxy sulfuron-Sunrice 150WG + Quizalofop-p-ethyl-Sonet 50EC) were applied as post-emergence spray at 15-20 days after sowing (DAS), when the grass weeds were 3 to 4 leaf stage. Recommended production technique and all other standard agronomic practices were followed.

Data collection and analysis

Data was collected on different parameters in the last week of January, 2021. Recorded data were analyzed through the Analysis of Variance Technique and differences among the treatment means were adjudged with Duncan's Multiple Range Test (DMRT) followed by statistical computer package program MSTAT-C (Gomez and Gomez, 1984).

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III. Results and Discussion

In the current research, the effect of different weed management practices was evaluated on the jute seed yield contributing parameters, seed quality, and cost-benefit ratio. For doing this, experiments were executed at the Jute Research Regional Station (JRRS) research field, Rangpur, during September 2020 to January 2021.

Effect of weed management practices on jute seed yield

Weed management practices showed a significant effect on jute seed yield contributing characters. Analysis showed a higher plant population in T_4 treatments; however, plant height and base diameter were higher in T_5 treatments (Table 01). Pod length was higher in T_1 treatment and pod diameter was found higher in T_6 treatment. Results also revealed that number of branches and number of pod was higher in T_6 treatment. Seed yield was higher in T_6 treatment, whereas lower yield was found in T_1 treatment (Table 01). These results indicate that the number of branches significantly increasing the pod number resulted in a higher seed yield of jute.

In this research, natural practices of weed management increased the plant branches, leading to increased number of pods with higher number of seeds resulting in higher seed yield. Number of plant branches has a positive and significant effect on number of pods in a plant leading to total seed yield (Gan et al., 2006). In addition, number of pods in each plant is the most significant factor for higher yield (Quddus et al., 2019).

Table 01. Yield and yield contributing characters of BJRI tossa pat-8 (plant population, plant height and base diameter, number of pods plant^{-1}, Number of seeds pod^{-1} and Seed yield)

Treatment	Plant population (m^{-2})	Plant height (m)	Base diameter (mm)	Number of branch plant^{-1}	Number of pods plant^{-1}	Number of seeds pod^{-1}	Pod length (cm)	Pod diameter (mm)	Seed yield (kg ha^{-1})
T_1	36.33	1.44	8.14	2.90	19.13	197.67	7.35	5.39	752.67
T_2	36.67	1.51	7.99	2.90	18.63	197.00	7.25	5.48	798.00
T_3	36.00	1.45	7.83	2.87	18.80	193.47	7.15	5.50	796.00
T_4	39.33	1.47	7.50	2.90	18.47	195.93	7.10	5.62	824.67
T_5	35.67	1.54	8.56	3.03	19.53	198.60	7.23	5.65	832.33
T_6	38.33	1.50	8.18	3.07	20.10	201.20	7.24	5.71	854.00
LSD (5%)	5.614	0.261	1.233	0.353	3.964	8.791	0.5022	0.322	53.82
CV (%)	8.80	10.12	8.91	6.92	12.04	2.59	4.03	3.35	3.86

CV = Coefficient of variation, LSD = Least significant difference
Note: T_1 = Weedicide + hand operated weeder + thinning,
T_2 = Weedicide + hand operated weeder + thinning + hand operated weeder,
T_3 = Weedicide + hand operated weeder + thinning + one hoeing,
T_4 = Weedicide + hand operated weeder + thinning + one hand weeding,
T_5 = Weedicide + thinning and
T_6 = Jute seed grown with natural practice.

Effect of weed management techniques on jute seed quality

Weed management effect on jute seed quality was assessed and summarized in table 02. No significant variation was observed in seed germination, seed vigor index (SVI), and field emergence percentage of seed from the analysis. All treatments showed a similar and positive effect on studied characteristics. From these results, it can be concluded that seed quality of jute was not affected by weed management practices.

Seed quality is an important factor for getting optimum yield from the field. Plant morphology at the field level indicates the varietal purity and strength of the seed applied for crop production (Anitha et al., 2018). Weed control during seed production ensures the highest yield and secures the quality seed in the crop field. Weed can be maintained through different strategies, including application of herbicides (Duary, 2014). Application of herbicide may also decrease seed health in respect of

germination and seed vigor index (Ratnayake and Shaw, 1992). However, weed management strategies in the current study did not affect the jute seed quality.

Cost and return analysis in respect to weed management strategies

Cost and return analysis is a systematic process of understanding economic benefit obtained from the produced crop. The cost of crop cultivation through weed management is considered as one of the vital factors to the farmers for net return (Rao and Ladha, 2013). Cost and return of jute seed production of the present experiment were described in Table 03. Among the six treatments, the highest gross margin was obtained from T_5 (106387 Tk. ha^{-1}) due to lower cost of seed production, whereas the lowest gross margin (56992 Tk. ha^{-1}) was observed from T_6 due to the highest cost of seed production.

Table 02. Weed management effect on germination of seed, seed vigor index and field emergence of BJRI tossa pat-8 seeds

Treatments	Germination (%)	Seed vigor Index	Field emergence (%)
T_1	87	45	84
T_2	88	46	84
T_3	88	46	84
T_4	86	46	83
T_5	87	45	83
T_6	88	46	84
LSD (5%)	3.256	4.589	1.889
CV (%)	2.55	6.90	1.54

CV = Coefficient of variation, LSD = Least significant difference

Note: T_1 = Weedicide + hand operated weeder + thinning,
T_2 = Weedicide + hand operated weeder + thinning + hand operated weeder,
T_3 = Weedicide + hand operated weeder + thinning + one hoeing,
T_4 = Weedicide + hand operated weeder + thinning + one hand weeding,
T_5 = Weedicide + thinning and
T_6 = Jute seed grown with natural practice.

Table 03. Per hectare (ha^{-1}) cost and return of jute seed production under different weed management practices

Treatment	Seed yield (kg ha^{-1})	Gross return (Tk. ha^{-1})	Total variable cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})
T_1	752.667	156770	73816	82954
T_2	798.000	172730	95596	77134
T_3	796.000	171875	102021	69854
T_4	824.667	176138	101406	74732
T_5	832.333	178116	71729	106387
T_6	854.000	187314	130322	56992

Note: T_1 = Weedicide + hand operated weeder + thinning,
T_2 = Weedicide + hand operated weeder + thinning + hand operated weeder,
T_3 = Weedicide + hand operated weeder + thinning + one hoeing,
T_4 = Weedicide + hand operated weeder + thinning + one hand weeding,
T_5 = Weedicide + thinning and
T_6 = Jute seed grown with natural practice.

IV. Conclusion

Considering the results, it can be concluded that T_5 treatment was the best option for higher productivity and maximum economic return. However, more trial needs to be done to confirm the higher economic benefit.

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