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Influenced of different Weed Management Practices for Higher Productivity of Jute (*Corchorus olitorius*) in West Bengal

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ABSTRACT

Jute, a principal crop in pre *kharif* season of West Bengal delta is predominantly a rainfed crop and is seriously affected by weeds and drastically reduced green biomass and fibre yields. A field experiment was conducted during the pre *kharif* season of 2015 and 2016 under randomized block design with ten treatments mainly pretilachlor 50% EC @500 ml/ha , pretilachlor 50% EC @1000 ml/ha, pretilachlor 50% EC @500 ml/ha + one hand weeding at 35 DAS, pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS, nail weeder 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS, nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS, quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS, quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, weed free and un-weeded control. With various treatments, quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS, nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS, and pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS, become very effective to control weed density and biomass throughout the growth phase of plant. Green biomass production with quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS (664.18 q/ha) was significantly better to all other treatments except weed free situation (700.07 q/ha). These treatments record, 62.52 and 71.02 % more biomass over the unwedded check, respectively. Fiber yield was highest observed with weed free situation (38.86 q/ha), and was at par with quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS (36.94 q/ha) and nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS (34.55 q/ha). These treatments registered, 70.06, 61.16 and 51.20 % more yield over the control plot. Economics revealed that, highest net return (₹ 1,34,284) and B:C ratio (1.67) observed with the quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS and was followed by pretilachlor 50% EC @1000 ml/ha. By adoption of above mentioned techniques the jute growers can earn more by reducing the cost of cultivation of jute.

Keywords: Jute; nail weeder, herbicide, fibre, yield.

Jute (C*orchorus olitorius)* is an important eco-friendly bast fibre crop grown in Eastern and Northern states of India. It is cultivated in 8 lakh ha area by around 40 lakh small and marginal farmers of West Bengal, Bihar, Odisha, Assam, Uttar Pradesh and Tripura. West Bengal is the leading state of the country in acreage and production of jute. It is an annually renewable resource with a high biomass production per unit land area (Kumar *et al*. 2014). .Jute is the cheapest sources of natural fibre in the world. Jute is a crop of warm and humid climate which is grown in rainfed situation during summer to early rainy season. Small and marginal farmers of Indo-Bangladesh sub-continent and other countries like China, Thailand, Nepal, Myanmar, Brazil, Congo, *etc*. grow raw jute in humid tropical climate mainly as a rainfed crop. Conventional manual weeding in raw jute involves around 40% of the total cost of cultivation and fibre yield reduction is up to 70% under unweeded situation (Singh *et al.* 2004). The weeding operation becomes very difficult particularly when weed flora establishes prior to crop sowing due to rain. In this context, it is imperative to mention that, after controlling grassy weeds, *Cyperus*

rotundus (sedges) and other broad-leaved weeds (*Trianthema portulacastrum* and, *Ludwigia parviflora* in particular) have become menace to these fibre crops. Moreover, lack of sufficient human labour at peak weeding hour is also a bottleneck to manual weeding in jute (Ghorai, 2015). Use of chemical herbicides in management of weed flora is getting prime importance day by day (Mukherjee, 2013). Various work revealed that, proper and timely weed control with various herbicide etc become very pertinent to jute green biomass as well as fibere yield. However this weed control measures, should be taken in consideration with environment safety. Use of indiscriminate amount of herbicide becomes threat to our ecosystem, so eco-friendly approach with lesser dose of herbicide become imperative under such situation (Mukherjee, 2005). Some viable chemical weed management technology is thus imminent to sustain jute fibre production by the small and marginal farmers (Kumar *et al*. 2014). Experiments were thus conducted to screen out suitable chemical weed control methods integration with other practices, to combat composite weed problem.

MATERIALS AND METHODS

Field experiments were conducted during *kharif* season of 2015 and 2016 at Mondouri Teaching farm under the aegis of Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India with the objective to find out an appropriate weed control measure for olitorius jute in this region. The farm is situated at approximately 22° 56′ N latitude and 88° 32′ E longitude with an average altitude of 9.75 m above mean sea level. The experimental soil was sandy clay loam in texture with 48% sand, 25% silt and 27% clay. Its available nitrogen, phosphorus and potassium content was 188.58, 24.14 and 163.98 kg/ha, respectively (Jackson 1973). Experiments were conducted in randomised block design with ten treatments replicated thrice. The treatment setup was: pretilachlor 50% EC @500 ml/ha, pretilachlor 50% EC @1000 ml/ha, pretilachlor 50% EC @500 ml/ha + one hand weeding at 35 DAS, pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS, nail weeder- 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS, nail weeder- 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS, quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS, quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, weed free and un-weeded control. The CRIJAF-ICAR made nail weeder and scrapper were used in the experiment (Ghorai *et al*. 2013). The jute cultivar cv. '*JRO-204*' were grown in the experiments. The crop was sown on 15th March in the first year and on 22nd March in the second years of experiments. The RDF based application of plant nutrients was taken in practice. Crop was harvested at 120 and 124 DAS in 1st and 2nd year, respectively. Traditional method of retting in pond water was followed. Observations on plant height, basal diameter and green biomass production in jute were recorded following destructive plant sampling method on the basis of average of 5 plants before harvesting. Data on periodic production of weed biomass at 15, 30, 45 DAS and at harvest were also recorded. Weed samples were collected at 15 Days after emergence of jute following standard procedure for count. Whole plot weeds were collected to find out the weed dry matter production/m^2. The crop was harvested near 120 to 124 days of crop age. The experimental data were analyzed statistically by applying the technique of analysis of variance (ANOVA) prescribed for the design to test the significance of overall difference among treatments by the F test and conclusions were drawn at 5 % probability level. Benefit: cost ratio (B: C) was obtained by dividing the gross income with cost of cultivation. The effect of treatments was evaluated on pooled analysis basis on growth, yield attributes and yields. The experimental site

Table 1: Meteorological information during crop season (March-August) of the experimentation (Mean value of two years)

Year	Mean temperature		Bright sunshine hours (hrs)	Total rainfall (mm)	Total number of rainy days	Mean evaporation (mm/month)	Relative Humidity (%)	
	Max. (°C)	Min. (°C)					RH-I	RH-II
2015	33.02	26.16	5.1	989.3	61	89.59	93.30	69.13
2016	34.42	27.12	6.4	1339.4	69	25.36	89.13	62.56

was with the following meteorological situation during the whole growing season of the crop (Table 1).

RESULTS AND DISCUSSION

Weed flora

Weed flora consisted of (i) Grasses: *Echinochloa colona*, *Digitaria* spp. (ii) Sedges: *Cyperus difformis* and *Cyperus rotundus.* (iii) Broad-leaved weeds: *Ludwigia purviflora*, *Trianthema* spp. Broad-leaved weeds and *Cyperus difformis* dominated the weed population in the experimental plots.

Weeds and its parameters

With various treatment of integrated approach of weed control measures, at 15 DAS lowest weed population registered with the nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS, and was at par only with quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS (Table 2). AT 30 DAS, quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS registered least weed density and showed parity with the quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, and at 45 DAS its showed parity only with nail weeder 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS and significantly better to other option of weed management measures except hand weed free situation (Table 2). Total weed population at harvest stage revealed that, quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS gave least and was at par only with weed nail weeder 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS.

Weed biomass production with various integrated approach, least observed with quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, and was at par with all the treatments except pretilachlor 50% EC @500 ml/ha and weedy check. At 30 and 45 DAS, least weed biomass per plot recorded with the quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS and was at par with, quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS, pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS and pretilachlor 50% EC @500 ml/ha + One hand weeding at 35 DAS. Moreover, at harvest stage least weed dry biomass production observed with the quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS and showed parity only with pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS. Maximum, weed control efficiency registered with the , quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, and was followed by pretilachlor 50% EC @1000 ml/ha + One hand weeding at 35 DAS, and statistically superior to all other treatments except weed free situation. Weed index, amongst all integrated approach of weed management least found with quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS and was followed by nail weeder first at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS.

Growth and yield parameters

Plant height utmost recorded with the weed free situation and was at par only with nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS and significantly better to all other options of weed control measures in jute crop (Table 3). Results depicted in Table 3 reveals that impact of all the weed control treatments were noteworthy on basal diameter of crop plants during both the seasons of data recording, and the highest values were recorded in weed free situation. Basal diameter was highest observed with weed free situation and was statistically similar with quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS, nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS and pretilachlor 50% EC @500 ml/ha + one hand weeding at 35 DAS. Threat by the weeds as exhibited in terms of rivalry for the cause of basic needs with the jute crop, when lessened by the use of quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS, influenced the dimensional growth of stem favorably and ultimately the basal diameter of plants. This corroborate with the finding of Sarkar (2006). Observations on green biomass production of jute are presented in Table 3, and the result explains that quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS recorded

Table 2: Effect of various weed management practices on weed population and biomass production of jute (pooled data of two years)

Treatments	Weed population (No./ m²)				Weed biomass production (g/ m²)				Weed control efficiency (%)	Weed index (%)
	15DAS	30 DAS	45 DAS	At harvest	15DAS	30 DAS	45 DAS	At harvest		
Pretilachlor 50% EC @500 ml/ha	4.43** (19.11)*	6.64 (43.57)	7.05 (49.21)	5.96 (34.98)	1.34 (1.29)	1.92 (3.18)	2.23 (4.48)	4.08 (16.12)	71.63	32.63
Pretilachlor 50% EC @1000 ml/ha	3.45 (11.42)	6.30 (39.23)	6.69 (44.22)	7.08 (49.69)	1.28 (1.13)	1.81 (2.79)	2.04 (3.67)	3.74 (13.52)	76.24	27.07
Pretilachlor 50% EC @500 ml/ha + one hand weeding at 35 DAS	3.62 (12.58)	6.81 (45.76)	5.86 (33.83)	7.27 (52.36)	1.17 (0.87)	1.57 (1.97)	1.73 (2.50)	3.41 (11.08)	80.50	22.52
Pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS	3.50 (11.74)	6.59 (42.89)	4.87 (23.17)	6.12 (36.98)	1.21 (0.94)	1.62 (2.11)	1.92 (3.19)	2.84 (7.59)	86.64	14.75
Nail weeder- 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS	3.68 (13.02)	5.27 (27.24)	6.95 (47.87)	5.55 (30.25)	1.31 (1.21)	1.96 (3.33)	2.07 (3.80)	4.02 (15.68)	72.41	25.09
Nail weeder- 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS	2.04 (3.65)	6.22 (38.21)	5.83 (33.46)	7.52 (55.98)	1.26 (1.10)	1.81 (2.79)	2.05 (3.69)	3.39 (10.96)	80.71	11.09
Quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS	2.17 (4.21)	4.99 (24.39)	5.74 (32.45)	6.89 (46.95)	1.21 (0.96)	1.62 (2.13)	1.76 (2.61)	3.34 (10.63)	81.29	21.23
Quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS	2.61 (6.33)	5.06 (25.08)	4.35 (18.44)	5.64 (31.26)	1.16 (0.85)	1.30 (1.18)	1.52 (1.80)	2.56 (6.04)	89.37	4.94
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100.00	0.00
Un-weeded control	5.58 (42.84)	10.51 (108.94)	13.21 (173.50)	10.49 (109.66)	2.52 (5.84)	3.20 (9.77)	3.82 (14.13)	7.57 (56.83)	0.00	41.21
SEm ±	0.14	0.13	0.19	0.32	0.05	0.13	0.16	0.14	2.19	1.63
CD (P=0.05)	0.43	0.39	0.56	0.99	0.16	0.49	0.47	0.43	5.66	4.74

**Figure in parenthesis are original values. **Square root transformed value √(x+0.5).*

highest quantum of production though all the treatment effects were significantly encouraging over unweeded check. Quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS (664.18 q/ha) was significantly better to all other treatments except weed free situation, which had highest green biomass production (700.07 q/ha). These treatments record, 62.52 and 71.02 % more biomass over the unwedded check, respectively. Lowest green biomass production observed with the unweeded check (408.71 q/ha) and was followed by pretilachlor 50% EC @500 ml/ha (426.78 q/ha). Fiber yield was highest observed with weed free situation (38.86 q/ha), and was at par with quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS (36.94 q/ha) and nail weeder 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS (34.55 q/ha) and significantly better to all other treatments. These treatments registered, 70.06, 61.16 and 51.20 % more yield over the control plot. Differential absorption owing to variable degree and type of selectivity towards various weeds was probably the key factor behind this expression (Islam, 2014). Encouraged plant

Table 3: Effect of various weed management practices on growth, yield and economics of jute (pooled data of two years)

Treatments	Plant height (cm)	Basal diameter (cm)	Green biomass production (q/ha)	Fiber yield (q/ha)	Cost of cultivation (Rs./ha)	Net returns (₹/ha)	B:C ratio
Pretilachlor 50% EC @500 ml/ha	240.11	1.11	426.78	26.18	40,780	95,548	1.34
Pretilachlor 50% EC @1000 ml/ha	304.15	1.32	486.61	28.34	41,975	1,03,324	1.46
Pretilachlor 50% EC @500 ml/ha + one hand weeding at 35 DAS	318.64	1.39	522.10	30.11	48,890	1,09,696	1.24
Pretilachlor 50% EC @1000 ml/ha + one hand weeding at 35 DAS	325.32	1.51	561.55	33.13	50,575	1,20,568	1.38
Nail weeder- 1st at 10 DAS and 2nd at 20 DAS + one hand weeding (within the row) at 35 DAS	312.93	1.33	526.89	29.11	52,950	1,06,096	1.00
Nail weeder- 1st at 10 DAS + scrapper at 20 DAS + one hand weeding (within the row) at 35 DAS	339.26	1.46	599.40	34.55	54,635	1,16,896	1.14
Quizalofop ethyl 5% EC @ 40 g/ha at 20 DAS + one hand weeding at 35 DAS	244.81	1.34	539.26	30.61	49,590	1,11,496	1.25
Quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS	326.63	1.52	664.18	36.94	50,325	1,34,284	1.67
Weed free	349.33	1.54	700.07	38.86	68,250	1,41,196	1.07
Un-weeded control	211.06	1.12	408.71	22.85	39,303	83,380	1.12
SEm ±	4.11	0.05	9.11	1.41			
CD (P=0.05)	11.39	0.16	27.26	4.22			

growth as indicated by the observations regarding improvement in height as well as basal diameter of plants was the accelerating factor behind the total biomass production and fiber yield by the crop. Lowest weed population observed with control plot (22.85 q/ha), and was followed by pretilachlor 50% EC @500 ml/ha (26.18 q/ha).

Economics

Economics revealed that, highest net return (Rs. 1,34,284) and B:C ratio (1.67) observed with the quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS and was followed by pretilachlor 50% EC @1000 ml/ha with net return of Rs. 1,03,324 and B: C ratio of 1.46 (Table 3). It was mainly due to less operational cost as there was less cost incurred towards land preparation and other expenses of jute cultivatgion. By adoption of above mentioned techniques the jute growers can earn more by reducing the cost of cultivation of jute.

CONCLUSION

The wind up may be drawn in this way that quizalofop ethyl 5% EC @ 60 g/ha at 20 DAS + one hand weeding at 35 DAS may be a promising measure of weed management in olitorius jute in this region. Further study may be of prime importance in this regard.

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