Short Note

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The Critical Period for Weed Competition in Relation to Fibre Yield of Jute (*Corchorusolitorius* L.)

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ABTRACT

Field experiment was carried to determine the critical time for weed competition in jute (*Corchorus Olitorius* L.). Two set of treatments were applied in one set weeds were allowed to infest the crop and in second set crop was kept weed free for an increasing duration of time i.e.10, 20,30,40,50 days after sowing (DAS) and up to harvest The beginning and the end of critical period of weed competition, were determined by fitting logistic and Gompertz equations, respectively. A total of 11 weed species were observed in experimental field, Grass weeds this *Eleusine Indica* was the dominant with relative density of 32.9 % followed by *Echinochloa Colona* (16.5 %). The reduction in fibre yield was recorded to be 74% when weed interference allowed up to harvest as compared to weed free period. The minimum days or start of critical period was 7 DAS which was calculate using logistic equation and end of critical period/time for weed free period was 42 DAS, which was calculated using Gompertz equation.

Keywords: Jute, critical period, weeds competition, weed dry weight

Weeds are one of the major constraints for higher productivity of jute. It can reduce the fibre yield of jute up to 70%, if not controlled properly (Ghorai *et al.*, 2013 and Singh *et al.*, 2015). However, the yield loss depends on the infesting weed species, their population density and duration of infestation; type of crops as well as on the soil conditions including its type, pH value and salinity levels (Evans *et al.*, 2003). Manual/hand weeding is prevailing practices for weed control in jute, however, labour shortage and intermittent rain during critical period of weed control hampered the manual weeding practices. So, farmers adjust time of weeding accordingly without realizing the exact time of weeding and its benefits. An understanding of the critical period of weed control (CPWC) and the factors affecting it are essential for making proper decision on appropriate timing of weed control and efficient use of herbicide (Knezevic *et al.*, 2002and Kumar *et al.*, 2014). The critical period of weed control is a period in the crop growth cycle, in which weeds must be controlled to prevent economic crop yield loss due to weed competition (Knezevic *et al.*, 2002). Thus, the CPWC is an important consideration in the development of appropriate weed management strategies (Swanton and Weise, 1991, Rao *et al.*, 2010). Therefore, sustainable weed management strategies should be adopted for controlling weeds at the proper time in right manner depending on soil condition and weed predominance to avoid environmental hazards as well as economic loss (Swanton and Weise, 1991). It has been observed that weed interference outside this critical period had a negligible effect on crop yield. Meager of information available regarding CPWC in jute, though, this is an important strategy for reducing the yield loss and the weeding cost in crop production. Hence, there is need to find out critical period for jute to avoid maximal competition between crop and weeds and also to provide guidelines and enable farmers to make more efficient use of resources for weed control.

The field experiment was conducted at experimental field of CRIJAF in 2012. The maximum temperature 31 to 35^{0}C and Maximum RH varied from 87-94% during crop growing season (Fig. 1). The soil was clay loam in texture, with medium organic carbon (0.65%), available N (295 kg/ha) and K (180 kg/ha), while the available P content in soil was high (35 kg/ha). Two types of weed interference treatments were applied starting at sowing of crop. In order to evaluate the onset of the critical

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period of weed removal, plots were left weedy (W) up to 10, 20, 30, 40 50 days after sowing (DAS) and harvest. To determine the end of the critical period plots were kept weed-free (WF) up to 10, 20, 30, 40, 50 DAS and harvest. A total of 12 (6 weedy and 6 weed free) treatments were designated in Randomized Block Design (RBD) with 3 replications. Jute crop (cv. JRO 204) was sown in 7th April 2012 and harvested on 4th august 2012. Crop was applied with recommended doses of fertilizer 80:40:40: N: P_2O_5: K_2O kg/ha. Irrigation and crop protection measured taken whenever necessary. Species wise weed population was recorded from two randomly selected quadrats (0.50 m × 0.50 m) from each plot of 4× 3m size. Data for weedy treatments were taken at the time of weed removal, whereas data for weed-free treatments were taken at the time harvest. Nonlinear regression was performed using SPSS 16.0 (IBM SPSS Statistics, Armonk, New York) to evaluate the critical period for weed control. Gompertz equation (Eq. 1) was used for describing the effect of increasing duration of weed free period control on fibre yield

$$Y = [A\times \exp (b\times\exp (- k\times T))] \quad [Eq.1]$$

Where, Y is % relative yield of weed free, A is the asymptote, T is time of weed free period in days; b and k are constants. The logistic equation (Eq. 2) for describing the effect of increasing duration of weed interference on fibre yield was used as suggested by Hall (1992) and modified by Knezevic *et al*, (2002).

$$Y = [(1/ (\exp (c \times (T - d) +f)) + (f -1)/f)) \times 100] \quad [Eq.2]$$

Where Y, is % relative yield of weed free; T is time of weed free period in daysof weed interference, d is the inflection point (days) or days at 50% yield reduction was obtained and c and f are constants. The experimental data were analyzed by applying the technique of 'analysis of variance' and significance was tested by variance ratio, *i.e.* F value at 5% level. Data were analyzed using analysis of variance (ANOVA), and means were compared based on Duncan Multiple Range Test (DMRT) at $P \leq 0.05$. Analysis of variance for weed density and dry weight was carried out after square root transformation to normalize the data.

A total of 11 weed species were observed in experimental field (Table 1), which comprised of five grasses *Eleusine indica, Echinochloa colona, Digitaria sanguinalis,Cynodon dactylon* and *Brachiaria reptance*; five broad leaved; *Physalis minima, Amaranthus viridis, Trianthema portulacastrum, Portulaca olerarea,Phyllanthus niruri* andonly one sedge *Cyperusrotundus*.Grass weedswere dominant weed

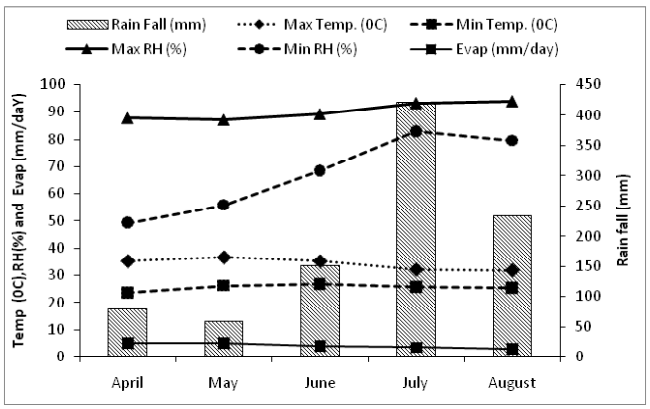

Fig.1: Weather parameter during jute crop growing season

species having average relative density of 67.1 %, among this *Eleusine indica* was the dominant with relative density of 32.9 % followed by *Echinochloa colona* (16.5 %).Among broad leaved weeds; *Physalis minima* was the dominant weed (11.4 %) followed by *Amaranthus viridis* (3.8%).

Table 1: Weed composition in season long weedy plots of jute

Sr. No.	Weed Species	Weed density (plants/m²)	Relative density (%)
1	*Eleusine indica*	104	32.9
2	*Echinochloa colona*	52	16.5
3	*Digitaria sanguinalis*	36	11.4
4	*Cynodon dactylon*	12	3.8
5	*Brachiaria reptance*	8	2.5
6	*Physalis minima*	36	11.4
7	*Amaranthus viridis*	12	3.8
8	*Trianthema portulacastrum*	8	2.5
9	*Portulaca olerarea*	8	2.5
10	*Phyllanthus niruri*	16	5.1
11	*Cyperus rotundus*	24	7.6

Total weed dry weight increased with increasing the weed interference periods and decreased with increasing weed free period (Table 2). Similarly, significant increase in grass weed dry matter was recorded with increasing days of weed interference up to harvest and vice versa with increasing weed free period. The highest total dry weight (311 g/m²) was recorded in weedy treatment and the lowest in weed free. The fibre yield of jute reduced with increasing duration of weed interference and increased with increasing weed free period (Table 2).

Table 2: Effect of duration of weed competition on dry weight of weeds and fibre yield of jute

Treatments	Weed dry weight (g/m²)				Fibre yield (q/ha)
	Grass	BLW	Sedge	Total	
Weedy up to 10 DAS	7.85^{d} (56)	2.35^{bc} (5)	2.71^{cd} (2.02)	8.03^{cd} (64)	42.45^{ef}
Weedy up to 20 DAS	8.77^{e} (76.5)	4.30^{ef} (18)	2.56^{cd} (3)	9.85^{e} (96.5)	33.00^{d}
Weedy up to 30 DAS	13.03^{g} (178)	2.12^{b} (4)	2.87^{c} (4)	13.62^{g} (185)	25.80^{c}
Weedy up to 40 DAS	12.98^{g} (168)	3.87d^{e} (14.5)	2.48^{c} (3)	13.64^{g} (185.5)	23.20^{c}
Weedy up to 50 DAS	14.68^{i} (215)	3.08^{cd} (9)	3.75^{d} (5)	15.30^{h} (229)	17.23^{b}
Weedy up to Harvest	15.67^{j} (245)	7.59^{h} (54)	4.10^{d} (12)	17.97^{i} (311)	7.81^{a}
Weed Free up to 10 DAS	14.09^{h} (198)	5.80^{g} (32)	3.92^{d} (6)	15.38^{h} (236)	13.73^{b}
Weed Free up to 20 DAS	10.61^{f} (112)	3.54^{de} (12)	3.09^{bc} (9)	11.55^{f} (133)	26.20^{c}
Weed Free up to 30 DAS	8.28d^{e} (68)	3.81^{de} (14)	2.61^{b} (6.5)	9.41^{de} (88)	37.33^{de}
Weed Free up to 40 DAS	4.74^{c} (22)	4.95^{f} (24)	2.21^{b} (6)	7.25^{c} (52)	38.37^{e}
Weed Free up to 50 DAS	3.25^{b} (8)	3.54^{de} (12)	1.48^{ab} (1)	4.64^{b} (21)	40.83^{ef}
Weed Free up to harvest	0.71^{a} (0.0)	0.71^{a} (0.0)	0.71^{a} (0.0)	0.71^{a} (0.0)	44.20^{f}

Original data in parentheses was transformed square root transformation before analysisbefore statistical analyses. Within a column values sharing same alphabets are not significantly different at $P = 0.05$ probability level according to Duncan Multiple Range Test (DMRT).

It confirms the high sensitivity of jute crop to weed interference and weed competition free period. The reduction in fibre yield was recorded to be 74% when weed interference allowed up to harvest as compared to weed free period. Although, the decreasing pattern of fibre yield was not significant in between weedy up to 30 and 40 DAS and 40 and 50 DAS. Significant increased in fibre yield was also observed with increasing weed free period up to 30 DAS thereafter the increased in fibre yield in h weed free period up to harvest was non-significant. This indicated that weed control during whole cropping season is not required, the secondary flushes of weeds comes were not much competitive to the crops or in other ways crops are able to suppress all those weeds. The critical period of weed competition was determined based on arbitrarily chosen yield loss levels (AYL) of 10%, which are judged to be acceptable considering the present economics of weed control. Predicted and observed relative jute fibre yield as affected by weed interference and weed free periods is shown in Fig 2.Fibre yield was reduced as the days of weed interference increased and the pattern of reduction of fibre yield was fitted into logistic equation. Fibre yield was increased as weed free period was increased up to 50 DAE, thereafter, increased in fibre yield was reached at plateau and increasing pattern of fibre yield was fitted in Gompertz equation. The minimum days or start of critical period was 7 DAS which was calculate using logistic equation and end of critical period/time for weed free period was 42 DAS, which was calculated using Gompertz equation.The earlier report of Gogoi and Kalita (1992) reported that critical period of crop weed competition in jute ranges between 15-60 DAS. The beginning and end of critical period varied, as it's depend upon the earlier establishment of weeds and to the weed flora composition at this site, type of weeds infestation, type of crops and variety etc. Martin *et al.* (2001), who reported that weed density appears to be important in determining the beginning of the CPWC; similar results are reported by Hall *et al.* (1992) in *Zea mays* L.

Lindquist *et al.* (1999) point out that relative time of weed and crop emergence and densities, may explain the variation in crop-weed interference relationship among years and locations. The importance of weed emergence timing in affecting the CPWC is highlighted by Knezevic *et al.* (2002), who reported that earlier weed emergence can lead to earlier beginning of critical period.

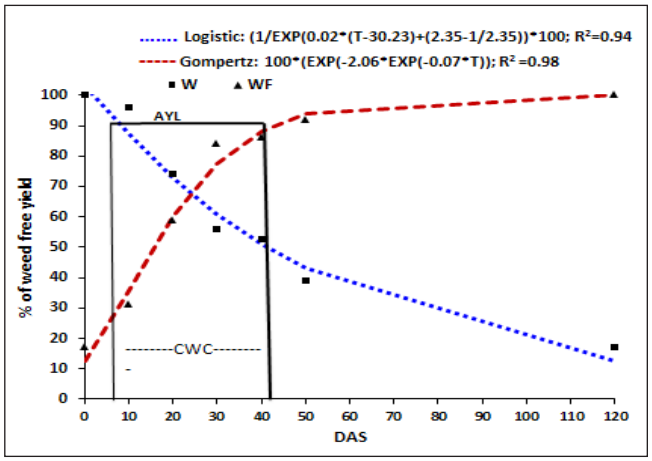

Fig. 2: Influence of period of weed infestation on relative yield of jute. Symbols represent observed data; dotted lines represent fitted curves;(elogistic equation for increasing duration of weed interference (■); Gompertz equation for increasing weed-free period (□)]; AYL= Acceptable yield loss level (10%); CWC- Critical period for weed control

Thus, from the present study we may conclude that critical period for weed competition in jute ranged 7 to 42 days after sowing. The weeding practice should be adopted during this period for getting optimum fibre yield (10% acceptable yield loss).

REFERENCES

Evans SP, Knezevic SZ, Lindquist JL, Shapiro CA and Blankenship EE. 2003. Nitrogen application influences the critical period for weed control in corn. *Weed Science* **51**: 408–417.

Ghorai AK, Rajib De and Chowdhury H, Majumdar B, Chakraborty A and Kumar M. 2013. Integrated management of weeds in raw jute. *Indian Journal of Weed Science* **45** (1): 47-50.

Gogai AK and Kalita H. 1992. Crop weed competition in *capsularis* jute. *Indian Journal of Weed Science* **24** (2&3):74-76.

Hall MR, Swanton CJ and Anderson GW. 1992. The critical period of weed control in grain corn (*Zea mays*). *Weed Science* **40**:441–447.

Knezevic SZ, Evans SP, Blankenship EE, Van Acker RC and Lindquist JL. 2002. Critical period for weed control: the concept and data analysis. *Weed Science* **50**: 773–786.

Kumar P, Singh O and Ahlawat IPS. 2014. Weed dynamics, growth and yield of wheat crop as influenced by different tillage and herbicide management under rice-wheat cropping system. *Journal of AgriSearch***1**(3): 161-167.

Lindquist JL, Mortensen DA and Westar P. 1999. Stability of corn (*Zea mays*) and foxtail (*Setaria*spp) interference relationships. *Weed Science***47**: 195-200.

Martin SG, Van Acker RC, Friesen LF. 2001. Critical period of weed control in spring canola. *Weed Science***49**:326-333.

Rao AN and Nagamani A. 2010 Integrated Weed Management in India–Revisited *I. Indian Journal of Weed Science***42** (3 & 4): 123-135.

Singh P, Singh L, Singh P, Lone BA, Qayoom S, Ahmad L, Ganai MA, Kanth RA and Fayaz A. 2015. Response of lentil (*Lens culinaris* Medik) and weeds to different weed management practices under temperate conditions. *Journal of Agrisearch***2** (1): 72-74.

Swanton CJ and Weise SF. 1991. Integrated weed management: The rationale and approach. *Weed Technology.* **5**: 657–663.

Citation:

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