

Critical period of crop-weed competition in zero-till cotton

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ABSTRACT

A field study was carried out to determine the critical period of crop weed competition in cotton (*Gossypium hirsutum* L.) during the summer season (February to July) of 2007. Twelve treatments consisting of weed free and weedy periods at 20, 40, 60, 80 and 100 DAS and at harvest along with a weedy and weed free check were arranged in randomized block design with three replications. The predominant weed species in the experimental field were *Echinochloa colona*, *Leptochloa chinensis*, *Cyperus rotundus*, *Trianthema portulacastrum*, *Rotala densiflora*, *Eclipta alba* and *Phyllanthus maderaspatensis*. Seed cotton yield loss increased in the duration of competition and maximum loss (96.5%) occurred due to full season competition. Seed cotton yield increased significantly with the increase in initial duration of weed free condition upto 80 DAS. Beyond 80 DAS, seed cotton yield was reduced considerably due to lower boll setting percentage. Critical period of weed competition was found to be 20 to 60 days after sowing.

Key words : Cotton, Weed, Weed index, Critical period.

Cotton (*Gossypium hirsutum* L.) the 'white gold' or 'money spinner' enjoys a predominant position amongst all cash crops in India and cultivated since Indus valley civilization. Cotton occupies the prime in India constituting more than 70% of the total fibre consumption in the textile sector. Cotton being a wide spaced and relatively slow growing crop during its initial stages, weeds growing with cotton offer severe competition causing yield reduction to an extent of 74% (Shelke and Bhosle 1990). In India, cotton is grown under varied environments and seasons. In Tamil Nadu, the zone of summer rice-fallow cotton is confined to the delta districts of Thanjavur, Thiruchirapalli, Villupuram and Vellore. Karaikal is located in the tail end of Cauvery delta zone. Cotton, in Karaikal region, is often grown only under rice-fallow condition. The cotton area in Karaikal region is 134 ha (SCR 2003). Rice-fallow cotton cultivation is a unique system of cultivation, wherein the cotton seeds are dibbled amidst the rice stubbles without tilling the soil to effectively utilize the residual soil moisture. Thus, in this system, cotton faces a severe competition from the early emerging weeds and weeds that are already present in rice field at the time of harvest. The problem of weed menace in rice-fallow cotton would be aggravated if the previous rice were not weeded adequately. Weed management during the early stages of cotton growth is more important. Hence, it was necessary to find out the critical period of crop weed competition to make weed control method more effective and economical.

The field experiment was conducted during the summer season of 2007 at Pandit Jawaharlal Nehru

College of Agriculture and Research Institute, Karaikal. The soil of the experimental field was sandy clay and high in phosphorus (33kg/ha) and potassium (373kg/ha). Twelve treatments consisting of weed free and weedy periods at 20, 40, 60, 80 and 100 DAS and at harvest along with a weedy and weed free check were done in randomized block design with three replications. The cotton variety 'MCU7' was sown at 15 kg/ha with a spacing of 60 × 30 cm. The recommended dose of 60 kg N, 30 kg P and 30 kg K/ha was applied. Half of nitrogen was applied at sowing and remaining half was top dressed at 41 days after sowing (DAS). The weed dry matter from each plot was periodically recorded by using a quadrat of 0.25m².

Major weed flora

The major weed flora of the experimental field constituted of grasses, sedges, broad leaved weeds. The grasses were found to be predominant weeds followed by broad leaved weeds throughout the crop growth period. The two grasses *Echinochloa colona*, *Leptochloa chinensis*, and four broad leaved weeds *Trianthema portulacastrum*, *Rotala densiflora*, *Eclipta alba* and *Phyllanthus maderaspatensis* were observed in the experimental field. The only one sedge *Cyperus rotundus* L., was found out 40 DAS onwards.

Weed dry matter

The total dry weight of weeds increased upto harvest. However, rapid increase was recorded upto 40 days after sowing under weed infestation treatment. Weed free treatment for the first 20,40, 60 days after sowing resulted

in significant reduction in total dry matter accumulation compared to weed free only up to 20 DAS and unweeded control. This is probably because when weed free periods were extended up to 60 days after sowing or longer, strong canopy cover of cotton smothered the later emerging weeds, which significantly lowered dry matter of weed. Similarly, the weed index was lowest in weed free treatment up to 60 days after sowing and highest in unweeded control (Table 1).

Yield and yield attributes

Initial weed free treatments resulted in significant improvement in yield attributes, viz., mean boll weight, boll setting percentage, seed cotton yield, stover yield and weed index. Weedy period of initial 20 days and more resulted in significant reduction of these yield attributes. On rice fallow conditions weed seeds germinate earlier than cotton and there will also be grown up weeds of

previous season rice. Slow growth of cotton during early stage further aggregate the problem and make more susceptible to the weed competition when left unchecked reduced the seed cotton yield by 96.5% (Table 2). The loss in the yield decreased with increase in the duration of weed free condition during the initial period of crop growth. Srinivasalu and Rao, (2000), Virk *et al.* (2002), Bryson *et al.* (2003) and Latha (2005) also reported that weeds reduced the cotton yield up to 85%.

Seed cotton yield was adversely affected in plots maintained weed free only for 20, 40 and 60 days after sowing as compared to 80 DAS and weed infestation for 20 days after sowing or weed free treatments. This was because of re-emergence of large number of weeds under these plots. Weed free check treatment recorded maximum yield, followed by weed free up to 60 DAS and weedy up to 20 DAS.

Table 1. Effect of different weed-free and weedy periods on total weed dry weight (g/m²) at different dates of observation.

Treatments	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS	At harvest
Weedy for 20 DAS	5.2(26.4)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Weedy for 40 DAS	5.1(25.9)	12.7 (160.6)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Weedy for 60 DAS	5.2(26.6)	12.5 (158.2)	12.6 (159.4)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Weedy for 80 DAS	5.3(28.3)	12.6 (159.3)	12.5 (155.4)	18.9 (356.2)	0.7 (0.0)	0.7 (0.0)
Weedy for 100 DAS	5.3(27.6)	12.6 (157.9)	12.3 (151.7)	19.0 (359.2)	18.1 (327.5)	0.7 (0.0)
Weedy upto harvest	5.6(31.0)	12.7 (161.1)	12.8 (162.6)	18.7 (351.4)	17.9 (330.5)	17.3 (299.1)
Weed free upto 20 DAS	0.7(0.0)	9.7 (93.7)	10.3 (105.3)	14.7 (216.1)	17.3 (300.4)	16.7 (278.2)
Weed free upto 40 DAS	0.7(0.0)	0.7 (0.0)	5.3 (27.3)	11.7 (136.0)	12.5 (155.7)	13.3 (177.2)
Weed free upto 60 DAS	0.7(0.0)	0.7 (0.0)	0.7 (0.0)	7.2 (52.6)	11.5 (131.8)	9.8 (100.9)
Weed free upto 80 DAS	0.7(0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	9.2 (84.3)	3.6 (12.2)
Weed free upto 100 DAS	0.7(0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	3.1 (9.0)
Weed free upto harvest	0.7(0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
LSD (P=0.05)	0.6	0.8	0.8	1.2	2.1	1.7

DAS - Days after sowing

Critical period

Weed interference for only first 20 days caused no significant loss in seed cotton yield. The yield was reduced significantly when weeds were allowed to remain beyond 20 days or longer. The LSD (P=0.05) for seed cotton yield was 3 kg 52kg or 13% of weed free check. By using this LSD=13%, we can see that the seed cotton yield was statistically at par with weed free check when weedy period last only up to initial 20 days and weed free period onward up to 60 days or more weed competition worked out to be between 20 and 60 DAS in rice fallow cotton

(Fig. 1). Chhokar *et al.* (1995) and Wanjari *et al.* (2001) also used LSD (P=0.05) to find out the critical period of weed competition. If the chemical methods of weed control are to be adopted for control of weeds the herbicides should have residual effect, so at least up to the end of this critical period. The season long weed infestation caused 96.5% reduction in the yield. The presence of weeds for the first 40 days caused reduction in yield indicating that initial weed infestation was harmful to the crop.

Table 2. Effect of weed free and weedy periods on seed cotton yield and yield attributes of rice-fallow cotton

Treatments	Seed cotton yield (kg/ha)	No. of bolls/plant (at harvest)	Weed index (%)
Weedy for 20 DAS	2342	14.6	12.5
Weedy for 40 DAS	1173	10.9	56.2
Weedy for 60 DAS	462	8.1	82.7
Weedy for 80 DAS	266	5.9	90.1
Weedy for 100 DAS	131	2.6	95.1
Weedy upto harvest	94	1.2	96.5
Weed free upto 20 DAS	353	4.5	86.8
Weed free upto 40 DAS	2058	13.9	23.1
Weed free upto 60 DAS	2336	17.1	12.7
Weed free upto 80 DAS	2676	21.8	0.0
Weed free upto 100 DAS	2393	17.5	10.6
Weed free upto harvest	2308	17.3	13.7
LSD (P=0.05)	352	1.6	-

DAS - Days after sowing

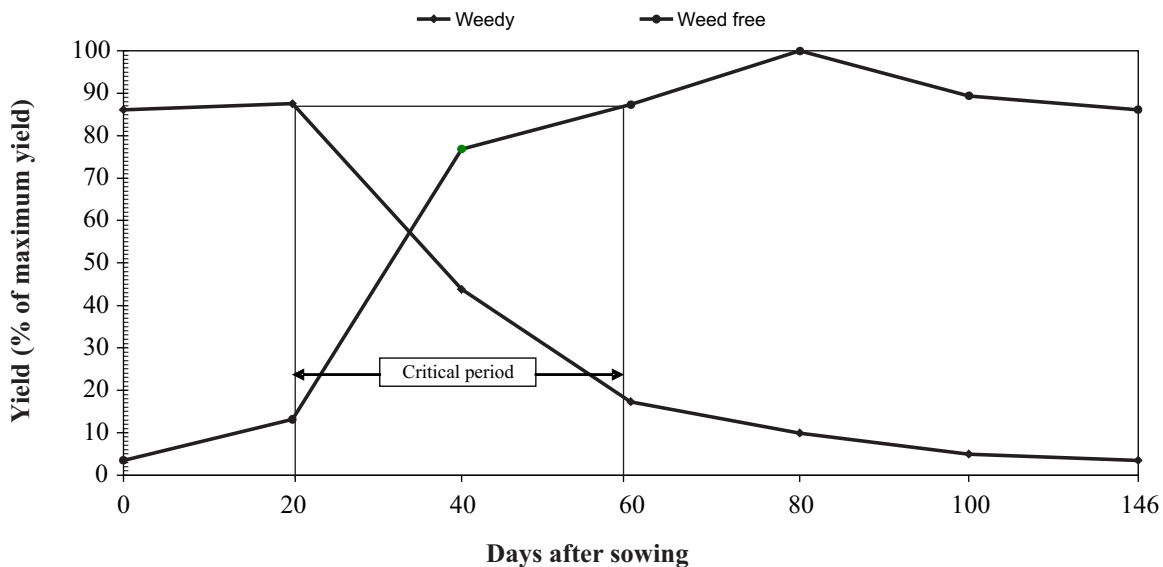


Fig. 1 Critical period of cotton-weed competition under rice-fallow conditions

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