



## Evaluation of off – season and cropping season weed management approaches in irrigated cotton

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### Abstract

Field experiments were conducted to study the effect of integrated weed management practices in cotton. The experiments were laid in split plot design with five main plot treatments (off –season land management practices) viz., fallow, pressmud application, glyphosate spraying, twice summer ploughing and soil solarization with TPE of 0.05 mm thickness for 40 days and six sub – plot treatments (cropping – season weed management practices) viz., unweeded check, twice hand weeding at 25 and 45 DAS, pre – sowing soil incorporation of fluchloralin 1.5 kg/ha, fluchloralin 0.75 kg/ha + intercropping (Black gram), fluchloralin 0.75 kg/ha+ mulching with sugarcane trash on 21 DAS, fluchloralin 0.75 kg/ha + one hand weeding on 45 DAS and the treatments were replicated thrice. Results of the experiments revealed that the off – season soil solarization with transparent white polyethylene sheets followed by pre soil incorporation of fluchloralin 0.75 kg/ha + black gram intercropping performed the best in recording the least total weed parameters, the highest yield parameters, mean seed cotton yield and net income.

**Keywords:** off– season land management, soil solarization. integrated weed management

### Introduction

Cotton (*Gossypium hirsutum*L.) is an important commercial crop in India and contributes more than 80 per cent of raw materials to textile industry. The productivity of cotton is 501 kg/ha, implying the necessity for inclusion of better technology for narrowing down the productivity gap. Cotton, being a wide spaced and relatively slow growing crop in early stages, is subjected to a severe weed menace. Weed infestation in commercial crops, particularly in cotton has been reported of offer severe competition and causing yield reduction. The period of weed interference, crop damage and the critical time of crop – weed competition were 30 to 90 days which occupied 50 per cent of the whole cotton growing period (Wn Jian Rong *et al.*, 2001) [6]. Continuous use of the same method leads to build up of tolerant weeds. Integrated weed management is gaining momentum due to its effectiveness in controlling weeds and safer to the environment. With this background, the present study was undertaken.

### Materials and Methods

The field experiments were conducted at Annamalai University Experimental Farm, Annamalai Nagar, which is located at 11°24' North latitude and 79°41' East longitude, at an altitude of 5.79 meters above mean sea level. The soil of the experimental field was clayey in texture with 0.71 per cent organic carbon, neutral in soil reaction (7.0 pH), low in available N, and medium in available P and high in available K. Field experiments were laid in split plot design replicated thrice. Five off – season land management practices (Main plot treatments) namely, fallow, pressmud (6 t/ha – was applied after ploughing then incorporated to soil by hand hoe), glyphosate spray (1.5 kg/ha with ammonium sulphate at 2.5 kg/ha as an additive using 500

litres per hectare of water and repeated once again after a fortnight), twice summer ploughing with an interval of 15 days after the receipt of summer showers and soil solarization by spreading with white transparent polythene sheet of thickness 0.05 mm over the strip of land for 40 days and securing them airtight by folding and inserting the edges underneath the bunds, after initial wetting of the soil at 70 per cent available soil moisture. After 40 days polyethylene sheet was removed from soil and cotton variety LRA 5166 (165 days) was sown. The sub-plot treatments consists of cropping season weed control measures namely, unweeded control, twice hand weeding at 25 and 45 DAS, pre-sowing soil incorporation of fluchloralin (1.5 kg/ha), fluchloralin 0.75 kg/ha+ mulching with sugarcane trash at 25 DAS, half dose of fluchloralin 0.75 kg/ha + intercropping with black gram (ADT - 3) was sown in between two rows of cotton crop (2:1) and fluchloralin (0.75 kg/ha) + one hand weeding on 45 DAS.

All the herbicides were applied with manually operated knapsack sprayer fitted with flood jet nozzle at a spray volume of 500 l/ha. Weed count and weed biomass were recorded at 60 DAS. Weed count was subjected to  $\sqrt{x+0.5}$  transformation. Weed control index was calculated by using the formula suggested by Mishra and Tosh, 1979.

$$WCI (\%) = \frac{\text{Weed biomass in unweeded control plot} - \text{Weed biomass in treated plot}}{\text{Weed biomass in unweeded control plot}} \times 100$$

Weed growth, yield parameters and economic yield were recorded in respective treatment. Cost of cultivation was calculated by taking current market prices of inputs while monetary return was obtained by multiplying grain yield with market price of grain and stover. The cost of polyethylene sheet was apportioned over a period of three years which is the expected longevity of the sheet. The

benefit: cost (B: C) ratio was calculated by dividing the net returns by cost of cultivation. The critical difference at 5 per cent level of profitability was calculated for testing the significance of difference between any two means where ever 'F' test was significant.

## Results and Discussion

### Effect on weeds

The weed spectra in the experimental field comprised of 12 different weed species. Among these weed species, *Trianthema portulacastrum* was found to be predominant and *Cyperus rotundus* was found to be next in order. Soil solarization by spreading with white transparent polyethylene sheet of thickness 0.5 mm over the strip of land for 40 days was recorded significantly reduced weed count, weed biomass and increased weed control efficiency at 60 DAS (Table 1). This was followed in pressmud application at 6 t/ha. This is may be due to application of pressmud at a higher dosage performed superior by suppressing weed seed germination and weed growth. It showed that next in order in recording the least total weed count, total weed biomass and the highest weed control efficiency. Soil solarization was most effective in reducing the infestation of all the dominant weed species namely *Cyperus rotundus*, *Cleome viscoa*, *Cynodon dactylon* and *Trianthema portulacastrum*. This could be attributed to the direct killing of seeds stimulated to germinate in the moistened mulched soil and killing of germinating seeds whose dormancy is broken in the heated soil as suggested by Katan and Devay (1994) [1]. Soil solarization reduced the viability of weed seeds in the top 5 cm soil layer used to increased soil temperature upto 50.1°C by soil solarization. Off – season soil solarization was recorded lowest total weed count (4.50/m<sup>2</sup>), total weed biomass (29.4 g/m<sup>2</sup>) and the highest weed control efficiency (82 per cent). In respect of cropping season weed control measures, fluchloralin at 0.75 kg/ha+ intercropping with blackgram performed

superior by registering the lowest total weed count (6.48/m<sup>2</sup>), total weed biomass (52.6/m<sup>2</sup>) and the highest weed control efficiency (66 per cent) at 60 DAS. The interaction effects were found to be significant influencing the total weed count, total weed biomass and weed control efficiency. Soil solarization followed by fluchloralin at 0.75 kg/ha + intercropping with blackgram recorded lowest weed parameters. This could be attributed to efficient and prolonged weed control by the herbicide efficiently supplemented by intercrop. Intercropping of short duration legume as live mulch in between wide spread cotton reduces weed intensity with increased yield of cotton. This interaction effect of solarization with weed control measures was reported to result significant interaction and synergistic weed control by Nanjappa *et al.*, (2001) [4]. Fallow followed by unweeded control recorded the highest weed count and weed biomass.

### Effect on growth parameters, yield attributes and yield

With respect to off season land management practices, soil solarization recorded the tallest plant height (56.13 cm) and the highest LAI (4.62) at flowering. Among, the cropping season weed management practices, fluchloralin 0.75 kg/ha + intercropping with blackgram recorded the tallest plant height of 53.15 cm and the highest LAI of 4.86. The interaction effect found to be significant. With regards to yield attributes, soil solarization recorded the highest number of sympodial branches/plant (14.6), number of squares/plant (44.1), boll weight (4.06g/m), number of bolls per plant (30.1), seed cotton yield of 1771 kg/ha followed by pressmud application (Table 2). The least number of yield parameters and seed cotton yield were registered in fallow. In respect of cropping season weed control measures, fluchloralin at 0.75 kg/ha+ intercropping with blackgram recorded the highest number of bolls per plant (29.8) and seed cotton yield of 1741 kg/ha.

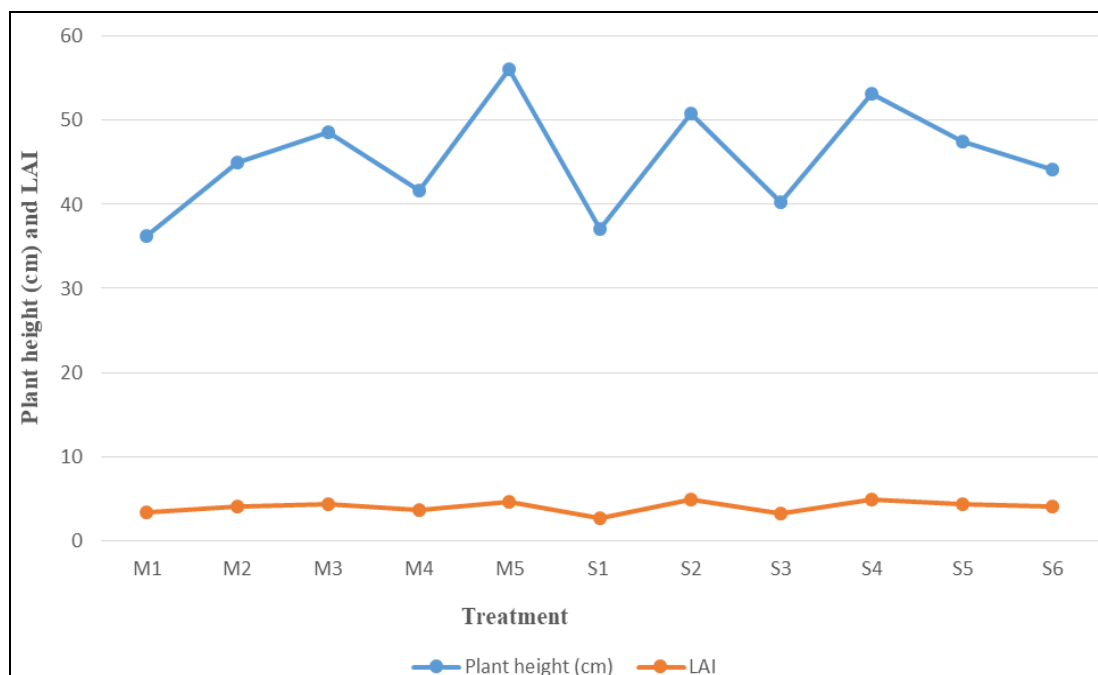


Fig 1: Effect of different weed management practices on growth parameters of cotton at flowering (pooled data of two years)

This was on par with twice hand weeding. The lowest number of bolls per plant and seed cotton yield was

recorded in unweeded control. The interaction also altered the seed cotton yield significantly. Soil solarization

followed by fluchloralin 0.75 kg/ha + intercropping with blackgram registered the highest seed cotton yield. The lowest seed cotton yield was recorded in fallow followed by unweeded control. The increased yield of cotton as a result of weed control through soil solarization is in conformity with that obtained in groundnut (Mudalagiriappa *et al.*, 1999; Suresh Kumar, 2004) [3, 5]. This is primarily because of better weed control and suppression of weed competition. Besides increased mobility of nutrients, disease and pest control due to solarization also played a role. Elimination of weeds perfectly by pre – sowing application of fluchloralin (0.75 kg/ha) + intercropping with blackgram during crop

duration providing a weed free environment throughout the crop growth might have led to the highest yield.

**Conclusion**

Soil solarization for 40 days with 0.05 mm thickness of white transparent polythene sheet during off-season interacted well with pre-sowing soil incorporation of fluchloralin 0.75 kg/ha + intercropping with blackgram during cropping season and offering an efficient, economic and eco-friendly control over all the weeds in cotton. Hence, the same could be recommended as an integrated weed management programme for cotton.

**Table 1:** Effect of different weed management practices on weed observations (pooled data of 2 years)

Treatment	Total weed count (m/2) at 60 DAS	Total weed biomass (g/m) at 60 DAS	Weed control efficiency (per cent)	Number of symspodial branches/plant	Number Of squares	Number of bolls/plant	Boll weight (g)
Main treatment (Off-season land management practices)							
M <sub>1</sub>	(98.46) 9.94	89.8	-	11.4	35.5	18.4	3.07
M <sub>2</sub>	(42.68) 6.57	32.4	57	13.5	40.1	25.2	3.56
M <sub>3</sub>	(27.48) 5.29	66.3	73	14.0	42.5	27.5	3.77
M <sub>4</sub>	(67.22) 8.23	85.3	49	12.4	38.2	20.8	3.31
M <sub>5</sub>	(19.74) 4.50	29.4	82	14.6	44.1	30.1	4.06
SEm +	0.13	4.34	-	0.14	0.68	0.97	
LSD(P=0.05)	0.29	1.89	-	0.32	1.60	2.27	0.20
Sub- treatment (Cropping season weed management practices)							
S <sub>1</sub>	(63.46) 7.99	71.6	-	9.24	31.5	15.9	2.61
S <sub>2</sub>	(41.87) 6.51	53.8	66	14.9	45.1	29.5	4.20
S <sub>3</sub>	(58.42) 7.67	65.9	51	11.5	36.0	20.6	2.86
S <sub>4</sub>	(41.46) 6.48	52.6	66	15.0	45.7	29.8	4.23
S <sub>5</sub>	(48.23) 6.98	57.4	60	14.4	42.7	26.9	3.93
S <sub>6</sub>	(53.36) 7.34	62.5	56	13.9	39.6	23.6	3.50
SEM +	0.16	4.2	-	0.21	1.15	1.28	0.09
LSD(P=0.05)	0.32	2.1	-	0.43	2.34	2.1	2.60

\*Figures in the parentheses indicate original values

M<sub>1</sub>, Fallow; M<sub>2</sub>, Pressmud application; M<sub>3</sub>, Glyphosate spray; M<sub>4</sub>, Summer ploughing twice; M<sub>5</sub>, Soil solarization; S<sub>1</sub>, Unweed control; S<sub>2</sub>, Twice hand weeding (25 DAS and 45 DAS); S<sub>3</sub>, Pre-sowing soil incorporation of fluchloralin @ 1.5 kg/ha; S<sub>4</sub>, Pre-sowing soil incorporation of fluchloralin

@ 0.75 kg/ha + Intercropping (Black gram); S<sub>5</sub>, Pre-sowing soil incorporation of fluchloralin @ 0.75 kg/ha+ mulching (25 DAS); S<sub>6</sub>, Pre-sowing soil incorporation of fluchloralin @ 0.75 kg/ha+ one hand weeding (45 DAS)

**Table 2:** Effect of different weed management practices on yield and economics (pooled data of 2 years)

Treatment	Seed cotton yield (kg/ha)	Cost of cultivation (× 10 <sup>3</sup> ₹/ha)	Gross income (× 10 <sup>3</sup> ₹/ha)	Net income (× 10 <sup>3</sup> ₹/ha)	B:C ratio
Main treatment (Off-season land management practices)					
M <sub>1</sub>	1078	15,012	27,248	12,236	1.82
M <sub>2</sub>	1391	16,712	35,178	18,466	2.10
M <sub>3</sub>	1537	16,316	38,767	16,173	2.37
M <sub>4</sub>	1226	16,512	31,060	14,547	1.88
M <sub>5</sub>	1771	20,344	45,607	25,263	2.24
SEM +	5509	-	-	-	-
LSD (P=0.05)	131	-	-	-	-
Sub- treatment (Cropping season weed management practices)					
S <sub>1</sub>	943	15,186	22,627	7,441	1.49
S <sub>2</sub>	1737	17,186	41,678	2,449	2.43
S <sub>3</sub>	1104	10,252	26,500	16,248	2.58
S <sub>4</sub>	1741	17,176	53,563	36,387	3.12
S <sub>5</sub>	1538	17,676	36,907	19,231	2.09
S <sub>6</sub>	1341	17,876	32,158	14,282	1.80
SEM +	70.2	-	-	-	-
LSD (p=0.05)	142.5	-	-	-	-

M<sub>1</sub>, Fallow; M<sub>2</sub>, Pressmud application; M<sub>3</sub>, Glyphosate spray; M<sub>4</sub>, Summer ploughing twice; M<sub>5</sub>, Soil solarization; S<sub>1</sub>, Unweed control; S<sub>2</sub>, Twice hand weeding (25 DAS and 45 DAS); S<sub>3</sub>, Pre-sowing soil incorporation of fluchloralin @ 1.5 kg/ha; S<sub>4</sub>, Pre-sowing soil incorporation of fluchloralin

@ 0.75 kg/ha + Intercropping (Black gram); S<sub>5</sub>, Pre-sowing soil incorporation of fluchloralin @ 0.75 kg/ha+ mulching (25 DAS); S<sub>6</sub>, Pre-sowing soil incorporation of fluchloralin @ 0.75 kg/ha+ one hand weeding (45 DAS)

**References**

1. Katan J, Devay J. Soil solarization. Boca Raton: CRC press, 1994.
2. Mishra A, Tosh GC. Chemical weed control studies of dwarf wheat. J. Res. Orissa Univ. Agric. Tech, 1999;10:1-6.
3. Mudalagiriappa, Nanjappa HV, Ramachandrappa BK. Effect of soil solarization on weed growth and yield of Kharif groundnut (*Arachis hypogaea*). Indian J. Agron, 1999;44:396-399.
4. Nanjappa HV, Ramachandrappa BK, Shiva Kumar HK, Appaji Gowda HC. Efficiency of soil solarization for weed control in groundnut. First bienn. Conf. In the new millennium on eco-friendly weed management options for sustainable agri. Bangalore, 2001, 206.
5. Suresh Kumar SM. Soil solarization for efficient cultivation of groundnut. Ph. D. (Ag.) Thesis. Annamalai University, 2004.
6. Wn Jain Rong, Hanjuan Shen Junming, Mao Yuxiang, Zhang Xae You. A study on the critical period of competition between crabgrass and transplanted cotton interplanting with Wheat. Jiangsu J. Agric. Sci, 2001;15(2):87-91.