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Effect of weed management practices on yield attributes and yield of irrigated cotton

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Abstract
A field experiment was conducted to study the effect of weed management practices on yield attributes and yield of irrigated cotton. The experiments were laid in split plot design with five main off-season land management practices and six subplots -cropping season weed management practices replicated thrice. Results of the experiment revealed that the off-season soil solarization with transparent white polyethylene sheets followed by pre- sowing soil incorporation of fluchloralin 0.75 kg / ha + blackgram intercropping performed the best in recording the least total weed counts and the highest mean seed cotton yield and net income.

Keywords: Off-season land management, soil solarization, IWM and yield

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 410 kg / ha, which is lower than world average of 595 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 to 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. It is, therefore necessary to combine or integrate two or more methods of weed control. 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 experiment was conducted at Annamalai University Experimental Farm, Annamalainagar, which is located at 11º24´ North latitude and 79º41´ East longitude, at an altitude of 5.79 metres above mean sea level. Field experiment was laid in split plot design with five off-season land management practices (Main plot treatments) namely, fallow, pressmud (6t/ha- was applied after ploughing then incorporated to soil by hand hoe), glyphosate spray (1.5kg/ ha with ammonium sulphate at 2.5 kg /ha as an additive using 600 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 polyethylene sheet of thickness 0.05mm 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 LRA5166 (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 days after sowing (DAS), pre-sowing soil incorporation of fluchloralin (1.5 kg / ha), half dose of fluchloralin (0.75 kg / ha)+ mulching with sugarcane trash (12 t / ha) at 25 DAS, half dose of fluchloralin (0.75 kg / ha)+ intercropping with blackgram (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. Observation were recorded on No. of sympodial branches/plant, No. of bolls/plant, boll weight and seed cotton yield.

Results and Discussion

Effect on yield attributes and yield

Number of sympodial branches plant^{-1}

All the treatments significantly influenced the number of sympodial branches plant^{-1}. Among the off-season land management practices, soil solarization for 40 days recorded the highest number of sympodial branches plant^{-1} of 14.53. This was followed by glyphosate spray recorded sympodial branches plant^{-1} of 14.02. The lowest number of sympodial branches of 11.21 was recorded in fallow during off-season period.

Among the cropping season weed management practices, fluchloralin 1.5 kg ha^{-1} + intercropping with blackgram recorded the highest number of sympodial branches plant^{-1} (15.02). This was on par with twice hand weeding. The least number of sympodial branches (9.17) was observed in unweeded control. Significant interaction was observed among the main and sub plot treatments. Soil solarization for 40 days followed by fluchloralin 1.5 kg ha^{-1} + intercropping with blackgram registered the highest number of sympodial branches plant^{-1} of 16.35. The least number of sympodial branches plant^{-1} of 7.26 was recorded in fallow followed by unweeded control plot.

Number of bolls plant^{-1}

Number of bolls plant^{-1} was significantly altered by the treatments. Among the off-season land management practices, soil solarization for 40 days recorded the highest number of bolls plant^{-1} (30.04). This was followed by glyphosate spray.

The lowest number of bolls plant^{-1} of 17.59 recorded in fallow. In respect of cropping season weed management practices, fluchloralin 1.5 kg ha^{-1} + intercropping registered the highest number of bolls plant^{-1} of 29.36. This was on par with twice hand weeding. Interaction effects between main plot and sub plot treatments were significant. Soil solarization for 40 days followed by fluchloralin 1.5 kg ha^{-1} + intercropping recorded the highest number of bolls plant^{-1} (36.94). The lowest number of bolls was registered in fallow followed by unweeded control treatment.

Boll weight

Among the main plot treatments, soil solarization for 40 days registered the highest boll weight (4.04 g) followed by glyphosate spray (3.76 g). The lowest boll weight of 3.04 g was recorded in fallow treatment.

With respect to sub-plot treatments, fluchloralin 1.5 kg ha^{-1} + intercropping with blackgram recorded the highest boll weight (4.23 g). This was on par with twice hand weeding. The lowest boll weight was recorded in unweeded control plot. Interaction effects also found to be significant. Soil solarization for 40 days followed by fluchloralin 1.5 kg ha^{-1} + intercropping with blackgram recorded the highest boll weight (4.71 g).

Seed cotton yield

All the treatments differed significantly in influencing the seed cotton yield. Among the off-season land management practices, soil solarization for 40 days recorded the highest seed cotton yield (1738 kg ha^{-1}) followed by glyphosate spray (1524 kg ha^{-1}). Pressmud application and summer ploughing came next in order. The least seed cotton yield was registered in fallow treatment. In respect of cropping season weed control measures, fluchloralin at 0.75 kg / ha + intercropping with blackgram recorded the seed cotton yield (1743 kg ha^{-1}). However, this was on par with hand weeding twice. The lowest 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 increased yield of cotton as a result of weed control through soil solarization is in conformity with that obtained in groundnut (Mudalagiriyappa *et al*., 1999; Suresh Kumar, 2005) [3, 5]. This is primarily because of better weed control and suppression of weed competition.

Among the off-season weed management practices, soil solarization for 40 days with 0.05 mm thickness of white transparent polyethylene sheet recorded the highest of all growth and yield parameters. This is primarily because of better weed control and suppression of weed competition. However, increased mobility of nutrients, disease and pest control due to solarization might have also added for the better performance of the crop.

The remarkable increase in the performance of cotton due to soil solarization for 40 days, as revealed by the growth parameters discussed above, are in agreement with (Katan *et al*., 1983) [2]. They observed that even in the absence of pathogens, there were 56 per cent increase in plant growth mainly because of weed control achieved due to solarization by increasing soil temperature. Soil solarization, through several modes of action including thermal inactivation of weed seeds and weakening of propagules alters the plant root environment and results in better crop response in terms of increased growth (Stapleton and Devay, 1985) [4]. Among the cropping season weed control measures, pre-sowing soil incorporation of fluchloralin 1.5 kg ha^{-1} + intercropping with blackgram and twice hand weeding performed better with higher and comparable crop growth and yield characters *viz*., plant height, dry matter production, leaf area index, number of sympodial branches plant^{-1}, number of bolls plant^{-1}, boll weight, seed cotton yield and nutrient uptake by crop. The better performance of these treatments could be attributed to efficient control of weeds. Further, enhanced crop vigour due to better nutrient mobility, pest and disease control might have also contributed for the significant interaction imparting better weed control. This finding was in accordance with Giri *et al.* (2007) [1] who found that lowest weed density, highest weed control efficiency and the highest seed cotton yield could be obtained with cotton + blackgram intercropping system.

Table 1: Effect of different weed management practices on yield attributes and yield of irrigated cotton.

Treatment	Number of sympodial branches plant^{-1}	Number of bolls plant^{-1}	Boll weight (g)	Seed cotton yield (kg / ha)
Main treatments (Off -season land management practices)				
M_1- Fallow	11.21	17.59	3.04	1068
M_2- Pressmud Application	13.27	24.82	3.54	1355
M_3- Glyphosate spray	14.02	27.50	3.76	1524
M_4- Summer ploughing twice	12.20	20.09	3.29	1214
M_5- Soil solarization	14.53	30.04	4.04	1738

S.Ed	0.16	1.03	0.10	59.19
CD (P=0.05)	0.37	2.41	0.23	138.5
Sub-treatments (Cropping season weed management practices)				
S_1- Unweeded control	9.17	15.49	2.58	914
S_2- Hand weeding twice (25and 45 DAS)	14.87	29.30	4.20	1710
S_3-Fluchloralin at1.5kg / ha	11.39	20.39	2.84	1083
S_4-Fluchloralin at 0.75 kg / ha + Intercropping (Blackgram)	15.02	29.36	4.23	1743
S_5-Fluchloralin at 0.75 kg / ha + mulching (25 DAS)	14.18	26.31	3.88	1521
S_6-Fluchloralin at 0.75 kg / ha + one hand weeding (45DAS)	13.66	23.21	3.48	1308
S.Ed	0.23	1.30	0.12	73.50
CD (P=0.05)	0.46	2.64	0.25	149.2

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