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# Evaluation of Off-season and Cropping Season Weed Management Practices in Irrigated Cotton

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Cotton has a pride of place among the commercial crops in India as it provides almost 80% of raw material for textile industries in the country. Cotton can also be called as "money spinner". The productivity of cotton is 410 kg $ha^{-1}$, which is lower than the world average of 595 kg $ha^{-1}$, consisting 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 to the extent upto 74% in the cotton crop (Shelke and Bhosle, 1990). 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. Off-season land management followed by cropping season weed management practices controlled the weeds effectively and economically.

Soil solarization is a non-pesticidal cultural method of controlling weeds during off-season. The basic phenomenon helping weed control upon soil solarization is build up of lethally high temperature in topsoil where most of the dormant and viable weed seeds are present. The possible mechanism of weed control by soil solarization is breaking dormany of weed seeds and solar scorching of emerged weeds, direct killing of weed seeds by heat and indirect microbial killing of weed seeds weakened by heating. Being a tropical country, many locations in India experience hot summer and soil solarization can be best practised for efficient weed control. Hence, this investigation was carried out to determine the effect of off-season weed management practices alongwith cropping season weed control measures on weed control, growth and yield of cotton.

A field experiment was carried out during April 2002 to November 2002 at Annamalai University Experimental Farm, Annamalainagar. The soil of the experimental farm was clayey in texture with 0.71% organic carbon, neutral in soil reaction (7.5 pH), low in available N, medium in available P and high in available K. Field experiemnt was conducted in split plot design with five off-season land management practices (main plot treatments) viz., fallow, application of pressmud at 6 t $ha^{-1}$, glyphosate at 1.5 kg $ha^{-1}$ with ammonium sulphate at 2.5 kg $ha^{-1}$ (as an additive) using 600 l water $ha^{-1}$ 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 0.05 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% ASM. After 40 days, polyethylene sheet was removed from soil. Then cotton variety LRA 5166 was sown during June 2002 and six sub-plot treatments (cropping season weed control measures) viz., unweeded control twice hand weeding (25 and 45 DAS), pre-sowing soil incorporation of fluchloralin (1.5 kg $ha^{-1}$), half dose of fluchloralin (0.75 kg $ha^{-1}$)+mulching with sugarcane trash (12 t $ha^{-1}$) on 25 DAS, half dose of fluchloralin (0.75 kg $ha^{-1}$)+intercropping with

blackgram ADT-3 and fluchloralin 0.75 kg $ha^{-1}$+one hand weeding on 45 DAS.

Soil solarization by spreading with white transparent polyethylene sheet of thickness 0.05 mm over the strip of land for 40 days recorded significantly reduced weed count, weed biomass and increased weed control efficiency at 30 and 60 DAS. This was followed by pressmud application. Soil solarization was effective in reducing the infestation of all the dominant weed species, namely, *Cyperus rotundus, Cleome viscosa, Cynodon dactylon* and *Trianthema portulacastrum*. Least total weed counts of 8 $m^{-2}$ on 30 DAS and 14 $m^{-2}$ on 60 DAS (Table 1) were recorded in off-season soil solarization treatment. 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 (1991). Soil solarization reduced the viability of weed seeds in the top 5 cm soil layer due to increased soil temperature upto 49.9°C by soil solarization. In respect of cropping season weed control measures, half dose of fluchloralin (0.75 kg $ha^{-1}$)+intercropping with blackgram performed superior by registering the lowest weed count of 12 $m^{-2}$ on 30 DAS and 34 $m^{-2}$ on 60 DAS. This could be attributed to efficient

Table 1. Effect of treatments on weeds and cotton

| Treatment | Total weed count ($m^{-2}$) | | Total weed biomass ($g\ m^{-2}$) 60 DAS | Number of bolls $plant^{-1}$ |
|---|---|---|---|---|
| | 30 DAS | 60 DAS | | |
| **Main treatments** | | | | |
| Off-season fallow | 29 (5.43) | 62 (7.90) | 89.3 | 16.1 |
| Off-season pressmud application | 9 (3.08) | 20 (4.53) | 32.9 | 26.0 |
| Off-season glyphosate spray | 16 (3.94) | 35 (5.96) | 68.7 | 22.8 |
| Off-season summer ploughing twice | 21 (4.06) | 60 (7.78) | 86.0 | 19.6 |
| Off-season soil solarization | 8 (2.91) | 14 (3.81) | 30.0 | 30.3 |
| LSD (P=0.05) | 0.25 | 0.63 | 1.8 | 3.12 |
| **Sub-treatments** | | | | |
| Unweeded control | 24 (4.95) | 54 (7.38) | 71.0 | 17.4 |
| Twice hand weeding (25 and 45 DAS) | 12 (3.53) | 35 (5.95) | 54.6 | 26.8 |
| Pre-sowing soil incorporation of fluchloralin at 1.5 kg $ha^{-1}$ | 20 (4.53) | 41 (6.44) | 67.1 | 19.7 |
| Pre-sowing soil incorporation of fluchloralin at 0.75 kg $ha^{-1}$+ intercropping (blackgram) | 12 (3.53) | 34 (5.87) | 53.0 | 26.9 |
| Pre-sowing soil incorporation of fluchloralin at 0.75 kg $ha^{-1}$+ mulching (25 DAS) | 14 (3.81) | 37 (6.12) | 58.3 | 24.5 |
| Pre-sowing soil incorporation of fluchloralin at 0.75 kg $ha^{-1}$+ one hand weeding (45 DAS) | 17 (4.18) | 39 (6.28) | 64.0 | 22.4 |
| LSD (P=0.05) | 0.36 | 0.71 | 2.1 | 2.0 |

Figures in parentheses indicate square root transformed values.

Table 2. Effect of treatments on cotton yield (kg ha$^{-1}$)

| Main treatments (off-season) | Sub-treatments (Weed management practices) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Unweeded control | Twice hand weeding | Fluchloralin 1.5 kg ha$^{-1}$ | Fluchloralin 0.75 kg ha$^{-1}$ + intercropping | Fluchloralin 0.75 kg ha$^{-1}$ + mulching | Fluchloralin 0.75 kg ha$^{-1}$ + one HW | Mean |
| Fallow | 605 | 1204 | 719 | 1349 | 1044 | 879 | 967 |
| Pressmud application | 1180 | 1842 | 1345 | 1948 | 1682 | 1513 | 1585 |
| Glyphosate spray | 970 | 1635 | 1135 | 1757 | 1472 | 1307 | 1379 |
| Summer ploughing | 760 | 1405 | 925 | 1545 | 1245 | 1085 | 1161 |
| Soil solarization | 1390 | 2053 | 1556 | 2065 | 1887 | 1723 | 1779 |
| Mean | 981 | 1628 | 1136 | 1733 | 1466 | 1301 | |
| | Main treatments | | Sub-treatments | | Interaction | | |
| | | | | | S x M | | M x S |
| LSD (P=0.05) | 194 | | 154 | | 210 | | 226 |

HW–Hand weeding.

and prolonged weed control by the herbicide, efficiently supplemented by intercrop. Intercropping of short duration legume as live mulch in between wide spaced cotton reduces weed intensity with increased yield of cotton. This treatment was on par with twice hand weeding and this could be attributed to efficient and prolonged weed control supplemented by hand weeding for the control of the late emerging weeds. The interaction effects were also found to be significant with soil solarization followed by fluchloralin at 0.75 kg ha$^{-1}$+intercropping with blackgram recorded the least total weed count of 6 and 12 m$^{-2}$ on 30 and 60 DAS, respectively, followed by pressmud application+fluchloralin at 0.75 kg ha$^{-1}$+ intercropping with blackgram. The integration of solarization with crop-weed control measures was reported to result in significant interaction and synergistic weed control by Yaduraju and Ahuja (1990).

Significant variation in seed cotton yield was observed due to different off-season land management and cropping season weed control measures in **kharif** season. Among the off-season land management practices compared, soil solarization recorded the highest number of bolls per plant (30.3) and seed cotton yield of 1779 kg ha$^{-1}$ (Tables 1 and 2) followed by pressmud application. The least number of bolls per plant and seed cotton yield were registered in fallow. Among the cropping season weed control measures, fluchloralin at 0.75 kg ha$^{-1}$ + intercropping with blackgram recorded the highest number of bolls per plant (26.9) and seed cotton yield of 1733 kg ha$^{-1}$. This was on par with twice hand weeding. The lowest number of bolls per plant (17.4) and seed cotton yield of 981 kg ha$^{-1}$ were recorded in unweeded control.

The interaction between the main and sub-plot treatments also altered the seed cotton yield significantly. Soil solarization followed by fluchloralin at 0.75 kg ha$^{-1}$+intercropping with blackgram registered the highest seed cotton yield (2065 kg ha$^{-1}$). The lowest seed cotton yield was recorded in fallow followed by unweeded control. 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. Elimination of weeds perfectly by pre-sowing application of fluchloralin+intercropping with blackgram during crop duration providing a perfect weed-free environment all throughout the crop growth led to the highest yield. Carry-over effect of off-season land management supplementing the efficient weed control measures through half dose of herbicide on succeeding crop season contributed for

significant interaction among the main and sub-treatments. This treatment is considered to be efficient, economic and eco-friendly. The increased yield of cotton as a result of weed control through soil solarization is in line with that obtained in groundnut (Mudalagiriyappa *et al.*, 1999).

## REFERENCES


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