

Effect of cultural and intergrated methods of weed control on cotton, intercrop yield and weed-control efficiency in cotton-based cropping systems

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ABSTRACT

A field experiment was conducted on clayey soils during the rainy seasons (*kharif*) of 1999-2000 to 2002-03 at Parbhani to find out the effective and economic method of weed control for cotton (*Gossypium* spp.) + blackgram [*Phaseolus mungo* (L.) Wilczek] and cotton + soybean [*Glycine max* L.) Merr.] intercropping systems. In cotton + blackgram intercropping, integrated weed management with pre-emergence application of oxyfluorfen @ 0.100 kg/ha or pendimethalin @ 0.75 kg/ha supplemented with weeding and hoeing at 6 weeks after sowing proved as effective as that of 3 hand-weedings and hoeings at 3, 6 and 9 weeks after sowing (recommended cultural practice). This treatment also helped reduce the weed population and weight of dry weeds at first picking with highest weed-control efficiency, enhanced the cotton-equivalent yield and net monetary returns, and proved more economical than the recommended cultural practice. In cotton + soybean intercropping, pre-emergence application of oxyfluorfen @ 0.100 kg/ha supplemented with hand-weeding and hoeing at 6 weeks after sowing proved equally effective in controlling the population and dry weight of weeds, and was as economical as that of cultural practice of 3 hand-weedings and hoeings at 3, 6 and 9 weeks after sowing.

Key words : Cotton-equivalent yield, Pendimethalin, Oxyfluorfen, Integrated weed management

Cotton (*Gossypium* spp.) is an important cash crop of Maharashtra, grown mostly during rainy season, when it gets heavily infested with a number of monocot and dicot weeds. These weeds are controlled either by physical methods such as weeding and hoeing twice or thrice depending upon the situation. These are also effectively controlled by pre-plant incorporation of fluchloralin 0.90 kg/ha combined with hand-weeding and hoeing at 6 weeks after sowing (Shelke and Bhosle, 1990; Giri and Bhosle, 1997), or diuron 0.50 kg/ha (PE), fluchloralin 0.90 kg/ha (ppi) or pendimethalin 0.75 kg/ha (PE) each supplemented with weeding and hoeing at 6 weeks after sowing (Giri *et al.*, 1998). Recently farmers are growing intercrops like blackgram or soybean in Amercian cotton varieties or hybrids and are asking for the suitable and economic method of weed control for such cotton-based intercropping system. Therefore the present investigation was undertaken to find out an effective and economic method of weed control in these cotton-based cropping systems.

MATERIALS AND METHODS

A field experiment was conducted at Cotton Research Scheme, Marathwada Agricultural University, Parbhani during rainy seasons (*kharif*) 1999-2003. The soil was clayey, low in N and P and high in K content, with pH

8.0–8.2. The experiment was laid out in randomized block design, consisting of 10 treatments, viz., T₁, recommended cultural practice of three weedings and hoeings at 3, 6 and 9 weeks after sowing (WAS) cotton as the sole crop at 90×60 cm spacing; T₂, cotton intercropped with one row of blackgram unweeded control; T₃, cotton intercropped with one row of soybean unweeded control; T₄, three hand-weedings and hoeings at 3, 6 and 9 weeks after sowing to cotton intercropped with blackgram; T₅, three hand-weedings and hoeings at 3, 6 and 9 weeks after sowing to cotton intercropped with soybean; T₆, pre-emergence application of pendimethalin @ 0.75 kg/ha followed by weeding and hoeing at 6 weeks after sowing to cotton intercropped with blackgram; T₇, pre-emergence application of pendimethalin @ 0.75 kg/ha followed by weeding and hoeing at 6 weeks after sowing to cotton intercropped with soybean; T₈, pre-emergence application of oxyfluorfen @ 0.10 kg/ha followed by weeding and hoeing at 6 weeks after sowing to cotton intercropped with blackgram; T₉, pre-emergence application of oxyfluorfen @ 0.10 kg/ha followed by weeding and hoeing at 6 weeks after sowing to cotton intercropped with soybean; and T₁₀, three weedings and hoeings at 3, 6 and 9 weeks after sowing to cotton intercropped with pigeonpea in 8:2 row-to-row ratio (farmer's practice). These treat-

Table 1. Monocot and dicot weed population; dry-weed weight; weed-control efficiency; seed cotton, intercrop and cotton-equivalent yields; gross monetary returns and net returns in various treatments (pooled data of 3 years)

Treatment	Weed population/m ² (140 DAS)		Dry-weed weight (g/m ²) (140 DAS)	Weed- control effici- ency	Seed-cotton yield (q/ha)				Intercrop yield (q/ha)				Pooled mean		
	Monocot	Dicot			1999– 2000	2000– 01	2002– 03	Pooled	1999– 2000	2000– 01	2002– 03	Pooled	Cotton equiva- lent yield (q/ha)	Gross mone- tary returns (Rs/ha)	Net returns (Rs/ha)
T ₁ : Sole cotton with 3 weedings and hoeings at 3, 6 and 9 weeks after sowing	6	11	4.9	65	5.91	5.25	6.16	5.77	-	-	-	-	5.77	11,254	6,685
T ₂ : Cotton + blackgram-unweeded control	13	69	13.0	-	1.07	1.76	1.40	1.41	2.64	2.28	2.09	2.34	3.02	5,794	5,794
T ₃ : Cotton + soybean-unweeded control	23	94	15.5	-	0.57	1.36	1.05	0.99	2.07	2.20	1.86	2.04	1.91	3,663	3,663
T ₄ : Cotton + blackgram with 3 weedings and hoeings at 3, 6 and 9 weeks after sowing	7	7	4.0	69	5.22	4.55	5.71	5.16	4.24	4.01	3.48	3.91	7.83	15,206	10,637
T ₅ : Cotton + soybean with 3 weedings and hoeings at 3, 6 and 9 weeks after sowing	4	9	4.6	70	2.76	3.19	4.37	3.42	16.58	14.85	9.48	13.64	9.41	18,274	13,705
T ₆ : Cotton + blackgram–pendimethalin @ 0.75 kg/ha (PE) + weeding and hoeing at 6 weeks after sowing	2	11	3.9	70	5.74	4.07	4.61	4.80	5.44	4.55	4.27	4.75	8.08	15,703	12,458
T ₇ : Cotton + soybean–pendimethalin @ 0.75 kg/ha (PE) + weeding and hoeing at 6 weeks after sowing	2	5	3.7	76	3.25	2.64	3.17	3.02	11.38	9.96	9.21	10.18	7.58	14,795	11,545
T ₈ : Cotton + blackgram–oxyfluorfen @ 0.100 kg/ha (PE) + weeding and hoeing at 6 weeks after sowing	3	7	3.8	71	4.72	4.69	4.75	4.72	5.86	5.15	4.56	5.19	8.39	16,200	13,463
T ₉ : Cotton + soybean–oxyfluorfen @ 0.100 kg/ha (PE) + weeding and hoeing at 6 weeks after sowing	3	7	3.7	76	2.68	3.33	4.30	3.44	10.33	11.37	9.43	10.38	8.09	15,701	12,964
T ₁₀ : Cotton + pigeonea (8 : 2) with 3 weedings and hoeings at 3, 6 and 9 weeks after sowing	14	11	5.1	64	4.30	3.84	3.57	3.90	5.83	4.39	6.55	5.59	8.05	15,682	11,113
CD (P=0.05)	9	20	2.5	-	0.29	0.39	0.32	0.38	1.33	0.76	0.50	0.80	0.74	1,460	-

*Transformed values $\sqrt{x + 0.5}$
PE, Pre-emergence

ments were replicated four times. Cotton hybrid 'NHH 44', blackgram variety 'TAU 1' and soybean 'JS 335' were used in the investigation. The recommended dose of NPK used for cotton was 80:40:40 kg/ha. Complete dose of P, K and half the dose of N were applied basal to cotton at the time of sowing by ring method and complete dose of N and P to the intercrops (blackgram @ 25 : 50 : 0 and soybean @ 30 : 60 : 0 NPK kg/ha on area basis) by drilling method just before sowing, whereas half the dose of N was applied to cotton during 30-35 days after sowing by ring method. The intercrop line was sown in 90 cm row-spaced cotton in the centre. The crops were sown on 25 June 1999, 1 July 2000 and 7 July 2002. The precipitation received during the crop season was 934, 1029 and 793.9 mm in 47, 46 and 41 rainy days in the respective first, second and third year of investigation.

RESULTS AND DISCUSSION

Effect on weeds

In all 23 weed species were found associated with cotton. Amongst them 3 monocot weeds, *viz.* *shippi* [*Brachiaria eruciformis* (J.E. Sm.) Griseb.], *lona* (*Dinebra retroflexa*) and *vinchu* (*Amisophacellus cucullata*) were dominant during all the 3 years. The most predominant dicot weeds were *deepmal* (*Acalypha indica* L.), *hazardani* (*Phyllanthus maderaspatensis*), *chandvel* (*Convolvulus arvensis* L.), *kunjuru* (*Digera arvensis* Forsk.), *medium dudhi* (*Euphorbia hirta* L.), *chikta* [*Pseudothia viscidue*], *jakhmjudi* (*Tridax procumbens*) and *kurdu* (*Celosia argentea* L.). On an average 8 monocot and 23 dicot weeds/m² were observed, constituting 26 and 74% population of the total weeds respectively.

The monocot as well as dicot weed population was effectively controlled by almost all the physical as well as integrated methods of weed control in sole as well as intercropped cotton (Table 1). The dry-weed weight was significantly reduced in sole cotton with physical method of weed control as well as in intercropped cotton with integrated methods of weed control besides the physical method of three weedings and hoeings at 3, 6 and 9 weeks after sowing (recommended cultural practice, RCP). Among these methods the integrated methods proved most effective, followed by RCP in reducing dry matter of weeds and increasing the weed-control efficiency by 64-76%. Giri *et al.* (1998) earlier reported effective control of weeds in sole crop of cotton with RCP and pendimethalin @ 0.75 kg/ha supplemented with weeding and hoeing at 6 weeks after sowing at Parbhani.

Effect on crop

Pooled data showed the highest seed-cotton yield from sole crop of cotton with recommended cultural practice (RCP), which was significantly superior to all the treat-

ments. It may be attributed to the competition-free situation emerged due to effective weed control and lack of intercrops, resulting in full utilization of the resources like space, light, nutrients, moisture etc., which ultimately reflected on the yield. The next best treatment was T₄, which also proved significantly superior to all the remaining treatments except T₆.

The differences in yield of intercrops were significant, owing to the varying yield potential of each intercrop. As an intercrop soybean recorded significantly more yield than blackgram as well as pigeonpea. The highest intercrop yield was recorded by cotton intercropped with soybean with three weedings and hoeings at 3, 6 and 9 weeks after sowing, which was significantly more than that of all the treatments except T₉, T₁₀ and T₆.

All the weed-control treatments of cotton intercropped with soybean and blackgram proved significantly better than their unweeded control treatments and sole crop of cotton in respect of cotton-equivalent yield. Treatment T₅ recorded the highest cotton-equivalent yield, which was significantly superior to all the treatments. Further, T₈ recorded the maximum cotton-equivalent yield which was significantly more than that of all the remaining treatments except T₉, T₆, T₁₀ and T₄.

In cotton + blackgram intercropping system the control of weeds by integrated weed management (IWM), i.e. pre-emergence application of either oxyfluorfen @ 0.10 kg/ha or pendimethalin @ 0.75 kg/ha supplemented with weeding and hoeing at 6 weeks after sowing (WAS) proved more economical than the control of weeds by cultural methods of weed control, i.e. three hand-weedings and hoeings at 3, 6 and 9 weeks after sowing. Control of weeds with recommended cultural practice of three hand-weedings and three hoeings at 3, 6 and 9 weeks after sowing was found as effective and economical as integrated method of weed control, i.e. pre-emergence application of oxyfluorfen @ 0.10 kg/ha supplemented with weeding and hoeing at 6 weeks after sowing to cotton+soybean intercropping system.

REFERENCES

- Giri, A.N. and Bhosle, R.H. 1997. Economics of integrated weed management and nitrogen fertilization in cotton (*Gossypium hirsutum*) under rainfed conditions. *Indian Journal of Agronomy* 42 (4) : 705-708.
- Giri, A.N., Bhosle, R.H. and Lokhande, O.G. 1998. Weed management in cotton (*Gossypium hirsutum*) - sunflower (*Helianthus annuus*) cropping sequence. *Indian Journal of Agronomy* 43 (2) : 264-268.
- Shelke, D.K. and Bhosle, R.H. 1990. Emergence of summer groundnut as influenced by herbicides applied to kharif cotton. *Journal of Maharashtra Agricultural Universities* 15 (2) : 265-266.