

EFFECT OF WEED MANAGEMENT PRACTICES ON NUTRIENT DEPLETION BY WEEDS, GROWTH, YIELD, ECONOMICS AND QUALITY OF WINTER COTTON (*GOSSYPIUM HIRSUTUM*)

P.K. Sadangi, KC. Barik, P.K. Mahapatra, B.S. Rath and L.M. Gamayak

Department of Agronomy,
Orissa University of Agriculture and Technology, Bhubaneswar - 751 003, India

ABSTRACT

A field experiment was conducted during winter season of 2001-02 to study the effect of herbicidal weed management practices in irrigated cotton. Different weed management treatments reduced weed density and their dry weight as compared to unweeded control. Post emergence directed spray of paraquat dichloride 0.2 kg/ha (at 30 DAS) with one hand weeding at 60 DAS recorded lowest weed population (28.6/m²). maximum weed control efficiency (81.8%) and highest seed cotton yield of 1487 kg-ha with B:C ratio (2.41). Weeds if not controlled within 60 DAS can deplete the major nutrients to the extent of 87.1, 17.9 and 61.7 kg NPK per hectare. The quality parameters of cotton were not influenced by the different weed control practices.

Cotton (*Gossypium hirsutum* L.), the white gold, is commercially cultivated as one of the major rainy season cash crops in Orissa. But being a day neutral, indeterminate forced annual, cotton has the greater potential as a sole winter irrigated crop. Among different production constraints weeds pose serious problem during initial 60 days of crop growth because of the slow growth of crop with an yield reduction of 40-85 per cent under different agro-climatic conditions (Brar and Brar, 1992). Therefore, a field experiment was conducted to find out effective chemical weed control in *rabi* cotton.

The field experiment was conducted during winter season of 2001-02 at the Orissa University of Agriculture and Technology, Bhubaneswar in a sandy loam soil having pH 5.7, organic carbon 0.39 per cent, available nitrogen, phosphorus and potassium of 234, 9.0 and 167.4 kg/ha, respectively. The experiment using MCU-5 cotton with ten weed control treatments was laid out in a randomised complete block design with three replications. The crop was sown on 30 October 2001 with 60 cm x 45 cm spacing. The weed control treatments were viz., T₁, post emergence directed spray of paraquat dichloride @ 0.2 kg/ha at 30 days after sowing (DAS); T₂, post

emergence directed spray of paraquat dichloride @ 0.3 kg/ha at 30 DAS; T₃, post emergence directed spray of paraquat dichloride @ 0.4 kg/ha at 30 DAS; T₄, pre planting soil application of fluchloralin @ 0.8 kg/ha; T₅, pre emergence spray of alachlor @ 1.0 kg ha at 3 DAS; T₆, T₁ + hand weeding at 60 DAS; T₇, T₄ + hand weeding at 40 DAS; T₈, T₅ + hand weeding at 40 DAS; T₉, two hand weedings at 20 and 40 DAS; and T₁₀, unweeded control. An uniform recommended fertilizer dose of 120 kg nitrogen, 17.2 kg P and 33.2 kg K/ha was applied to all the crops. The crop was grown under irrigated condition with need-based plant protection measures. Observations on weed flora, crop growth and seed cotton yield were recorded. Data on weed population and dry weight (figures in parentheses) were subjected to square root and log transformation, respectively. Nitrogen, phosphorus and potassium content in weeds at 90 DAS were analysed and their uptake were calculated. Comparative economics of all weed control treatments was worked out on the basis of prevailing input cost and market price of cotton. Weed control efficiency, weed index, Bartlett's index, ginning percentage and lint index were also worked out to assess the efficiency of different weed control treatments.

Table 1. Effect of weed management practices on weed population, their dry weight, weed control efficiency and nutrient depletion by weeds in cotton at 90 DAS

Treatment	Weed population/m ²				Total weed dry matter (kg/ha)	Weed control efficiency (%)	Nutrient depletion by weeds (kg/ha)		
	Grasses	Sedges 1	Broad leaved	Total			N	P	K
T ₁	26.5 (5.16)	22.0 (4.74)	54.6 (7.42)	103.1 (10.15)	1647 (3.21)	51.9	21.3	4.2	26.8
T ₂	17.5 (4.21)	17.7 (4.22)	40.2 (6.37)	75.4 (8.71)	1512 (3.17)	55.9	18.3	3.0	23.6
T ₃	13.4 (3.69)	11.5 (3.46)	32.5 (5.74)	57.4 (7.60)	952 (2.97)	72.2	14.2	2.5	20.9
T ₄	44.9 (6.72)	32.2 (5.75)	77.7 (8.83)	154.8 (12.48)	1324 (3.12)	61.3	19.8	4.1	18.3
T ₅	31.7 (5.67)	24.5 (4.99)	86.6 (9.33)	142.8 (11.98)	1213 (3.08)	64.6	17.1	3.3	13.9
T ₆	8.6 (3.02)	4.9 (2.33)	15.1 (3.94)	28.6 (5.40)	621 (2.79)	81.8	6.4	1.7	4.52
T ₇	21.5 (4.68)	18.7 (4.38)	31.7 (5.66)	71.9 (8.47)	814 (2.91)	76.2	13.9	1.8	8.9
T ₈	19.6 (4.47)	13.7 (3.77)	26.8 (5.22)	60.1 (7.54)	689 (2.83)	79.9	12.7	1.6	6.3
T ₉	40.0 (6.36)	31.7 (5.66)	73.3 (8.58)	145.0 (12.08)	1125 (3.05)	67.2	15.7	4.1	16.9
T ₁₀	102.7 (10.14)	72.8 (8.55)	228.5 (15.12)	404.0 (20.10)	3429 (3.53)		87.1	17.9	61.7
CD (P=0.05)	0.92	0.73	1.26	1.03	0.08		2.35	0.99	3.87

Details of the treatments are given in the text;
DAS - Days after sowing.

Table 2. Effect of weed management practices on growth parameters, seed cotton yield, quality and economics of cotton

Treatments	Plant height (cm)	Leaf area index	No. of sympodia/plant	Bolls/plant	Boll weight (g)	Seed cotton yield (kg/ha)	Weed index (%)	Bartlett's index	Ginning percentage	Lint index	Net return (Rs./ha)	B:C ratio
T ₁	91.9	3.62	12.4	13.7	4.0	834	43.9	0.59	34.48	4.97	6445	1.48
T ₂	92.4	3.90	14.2	14.1	4.2	993	33.2	0.57	34.39	5.12	10110	1.75
T ₃	99.6	4.01	14.8	14.6	4.3	1269	14.6	0.50	34.40	5.06	16545	2.21
T ₄	89.5	3.79	13.6	12.9	4.0	1034	30.4	0.58	33.53	4.89	10812	1.78
T ₅	93.6	3.86	14.0	13.6	4.2	1126	24.2	0.61	33.89	5.05	13014	1.94
T ₆	104.2	4.14	16.9	16.6	4.4	1487	-	0.59	34.47	5.08	20704	2.41
T ₇	94.5	4.04	16.0	14.9	4.2	1292	13.1	0.58	34.21	4.96	15940	2.08
T ₈	103.6	4.12	16.7	16.0	4.2	1398	5.9	0.66	34.50	5.08	18474	2.25
T ₉	88.6	3.97	14.7	15.3	4.0	1184	20.3	0.62	34.08	5.12	13532	1.93
T ₁₀	72.2	1.62	10.7	7.8	3.9	597	59.9	0.60	24.25	5.07	1190	1.09
CD (P=0.05)	4.29	0.22	1.96	1.71	0.41	155.3		NS	NS	NS	2250	

Details of the treatments are given in the text.

The weed flora of the experimental field consisted of 22 different species, out of which 14 were broad leaved. 6 were grasses and 2 were sedges with a relative density of 56.6, 25.4 and 18.0 per cent respectively. *Ageratum conyzoides* L., *Eleusine indica* (L.)

Gaertn. and *Cyperus rotundus* L. were the predominant species with absolute densities of 56.3, 28.6 and 48.1 number of weeds/m², respectively.

Different weed control treatments significantly reduced weed density and their dry weight at 90 DAS compared to unweeded control (T₁₀), which recorded the highest total weed population of 404/m² and weed dry matter of 3429 kg/ha (Table 1). The weeds in control plot continued their growth till maturity of the crop indicating the need for timely weed control. Post emergence directed spray of paraquat dichloride @ 0.2 kg/ha at 30 DAS with a follow-up hand weeding at 60 DAS significantly reduced both the population (28.6/m²) and dry matter (621 kg/ha) of a wide spectrum of weeds comprising of grasses, sedges and broad leaved with a highest weed control efficiency of 81.8 per cent. Paraquat dichloride being a non selective contact herbicide, caused the mortality of weeds by the directed spray and the subsequent follow-up hand weeding was highly effective in checking the further regeneration and growth of weeds conforming the results of Singh *et al.* (1992). Among the other herbicidal treatments, pre emergence spray of alachlor @ 1.0 kg/ha with a hand weeding at 40 DAS (T₈), pre planting incorporation of fluchloralin @ 0.8 kg/ha with hand weeding at 40 DAS and post emergence directed spray of paraquat dichloride @ 0.4 kg/ha at 30 DAS alone (T₃) were also found effective and statistically at par with a weed control efficiency of 79.9, 76.2 and 72.2 per cent, respectively. Hand weeding twice (T₉) and other herbicidal treatments alone (T₁, T₂, T₄ and T₅) were found to be ineffective in containing the weed growth and their dry matter at this stage due to gradual

regenerated weed population under favourable soil moisture provided by irrigation. Directed spray of paraquat dichloride @ 0.2 kg/ha followed by hand weeding at 60 DAS (T₆) also significantly reduced the depletion of nitrogen, phosphorus and potassium nutrients by the weeds to the maximum of 80.7, 16.2 and 57.2 kg/ha, respectively at this stage due to lowest weed population and their dry weight compared to unweeded control as well as other treatments (Singh and Brar, 1990).

Weed control treatment T₆ also significantly improved all the growth characters and yield attributes like plant height, LAI, number of sympodia, bolls/plant and boll weight that resulted in the highest seed cotton yield of 1487 kg/ha followed by T₈ and T₇ with 149, 134 and 116 per cent increase in seed cotton yield over unweeded control (Table 2) with 597 kg seed cotton/ha and the highest weed index of 60 per cent. The follow up hand weeding after herbicide application is the important reason for higher yields as it removed chemically uncontrolled weeds as well as the regenerated ones providing effective control for a prolonged period. Directed spray of paraquat dichloride (T₆) also accrued maximum net return (Rs. 20704/-) and benefit: cost ratio (2.41) due to effective control of weeds followed by T₈, T₇ and T₃, respectively. The quality characters like Bartlett's index, lint index and ginning per cent were not influenced by varying weed competition levels commensurate with different weed control treatments indicating their independence characters from weed competition. Singh and Nagwaker (1989) reported that chemical weed control methods had no effects on ginning percentage of cotton.

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