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Effect of early post-emergence herbicide for control of weeds in winter irrigated upland cotton (*Gossypium hirsutum*)

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ABSTRACT

A study was carried out to evaluate the effect of trifloxysulfuron with and without adjuvant against weeds in upland cotton *(Gossypium hirsutum* L.) during the winter seasons of 2003–04 and 2004–05 at the Tamil Nadu Agricultural University, Coimbatore. Weeds,viz. *Trianthema portulacastrum* L., *Chloris inflata* Link; syn. *C. barbata Sw.* and *Cyperus rotundus* L., were the dominant weeds of the experimental field. Trifloxysulfuron effectively controlled *T. portulacastrum* and *C. rotundus.* Trifloxysulfuron @ 10 and 20 g/ha with and without adjuvant provided 85 to 91% weed-control efficiency compared to unweeded control. Among the treatments, the maximum cotton yield of 16.89 and 17.96 q/ha was observed in trifloxysulfuron 10 g/ha + adjuvant during the winter season of 2003–04 and 2004–05 respectively. Minimum seed-cotton yield of 8.97 and 8.76 q/ha was obtained in unweeded control in first and second year.

Key words : Winter cotton, Early post-emergence, Trifloxysulfuron, Weed density, Weed dry weight, Weed-control efficiency

Cotton being a wide spaced and highly fertilized crop, provides ample space and scope for heavy weed infestation during early growth stages. About 50–85% yield loss was observed in cotton growing under unweeded condition (Joshi, 1997). Critically viewing, the manual and mechanical methods of weed control, besides being less effective, are costly and time demanding. Mechanical method was partially effective because most of the weeds growing in intra-rows escaped in weeding. Thus chemical weed control became a promising means to control weeds at initial stages of crop growth. Many pre-emergence herbicides control weeds only for a limited period and hence late-emergence weeds escape killing. So, there is ample scope for controlling weeds by application of early post-emergence herbicides. Hence present experiment was made to evaluate the efficiency of trifloxysulfuron for control of weeds in cotton and its productivity.

MAERIALS AND METHODS

The field experiment was conduced at the Tamil Nadu Agricultural University, Coimbatore, during the winter seasons of 2003–04 and 2004–05. The soil was sandy clay loam having 7.3 pH, 0.50% organic carbon, 191.6 kg/ha available N, 11.2 kg/ha available P_2O_5 and 449 kg/ha available K_2O. The experiment was laid out in randomized block design with 12 treatments and 3 replications. Cotton 'MCU 5' was sown on 15 and 10 August during 2003–04 and 2004–05 respectively. Other cultural practices and plant-protection measures were given as per recommendations. The treatments consisted of: T_1, trifloxysulfuron 5.0 g/ha at 15 days after sowing (DAS); T_2, trifloxysulfuron 5.0 g/ha + adjuvant at 15 DAS; T_3, trifloxysulfuron 7.5 g/ha at 15 DAS; T_4, trifloxysulfuron 7.5 g/ha + adjuvant at 15 DAS; T_5, trifloxysulfuron10.0 g/ha at 15 DAS; T_6, trifloxysulfuron 10.0 g/ha + adjuvant at 15 DAS; T_7, trifloxysulfuron 20.0 g/ha at 15 DAS; T_8, trifloxysulfuron 20.0 g/ha + adjuvant at 15 DAS; T_9, pendimethalin 1 kg/ha at 3 DAS + hand-weeding at 45 DAS; T_{10}, fluchloralin 1 kg/ha at 3 DAS + hand-weeding at 45 DAS; T_{11}, hand-weeding twice at 25 and 45 DAS; and T_{12}, unweeded check.

Herbicides, viz. pendimethalin and fluchloralin, each at 1 kg a.i/ha were dissolved in 500 litres water and were sprayed with knapsack sprayer using deflector nozzle at 3 days after sowing. The post-emergence herbicide trifloxysulfuron at 5, 7.5, 10 and 20 g a.i/ha was sprayed 15 days after sowing. Weed data on total weed density and weed dry weight were recorded 25 days after sowing using 0.25 m^2 random quadrate at 2 places and analysed after subjecting the original data to log transformation.

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The total rainfall received during the crop season was 321.1 mm and 559 mm during 2003–04 and 2004–05 respectively.

RESULTS AND DISCUSSION

Weed flora

Important weed species in experimental fields were *Trianthema portulacastrum, Cyperus rotundus* and *Chloris inflata; syn. C. barbata.* Out of them, *Trianthema portulacastrum* (86–89%) was predominant followed by *Cyperus roundus* and *Chloris barbata.* The weed survey conducted at Tamil Nadu indicated dominance of *Trianthema portulacastrum* and *Cyperus rotundus* in cotton gardenland conditions (AICRPWC, 1987). Sankaran and DeDatta (1984) also reported that dominance of broad-leaf weeds in the early stages of cotton was due to their fast growth and deep root-system which enabled them to tap the soil moisture.

Weed population

Effect of trifloxysulfuron was found significant in reducing sedges and broad-leaf weeds. At 25 days after sowing, pre-emergence application of pendimethalin 1 kg/ha showed lesser grass weed density, followed by fluchloralin 1 kg/ha, whereas the remaining treatments recorded higher grass weed density. The reason might be due to control of germinated as well as the germinating weed seeds. Trifloxysulfuron at higher doses (20 g/ha and 10 g/ha) with and without adjuvant showed some degree of control of grasses, but it was not comparable with pre-emergence herbicides. Post-emergence application of trifloxysulfuron @ 20 and 10 g/ha with and without adjuvant recorded lesser density of *Cyperus rotundus*, which might be due to the effective control of *C. rotundus* at early stage. Hudetz *et al.* (2000) reported suppression of purple nutsedge *(Cyperus rotundus)* and Johnson grass *(Sorghum halepanse)* with post-emergence application of CGA 362622.

The density of broad-leaf weeds was less with trifloxysulfuron 20 g/ha + adjuvant. It was more effective against broad-leaf weeds and it controlled all major broad-leaf weeds like *Trianthema portulacastrum, Digera*

Table 1. Effect of early post-emergence herbicide on the density of weeds infesting cotton

Treatment	Weed density at 25 DAS (No./m^2)*							
	Winter 2003–04				Winter 2004–05			
	Grasses	Sedge	BLW	Total	Grasses	Sedge	BLW	Total
Triflox., 5 g/ha	1.37	0.80	1.11	1.62	1.45	0.86	1.00	1.65
	(23.7)	(5.3)	(13.0)	(42.0)	(28.5)	(6.2)	(10.0)	(44.8)
Triflox., 5 g/ha + adjuvant	1.35	0.76	1.10	1.60	1.43	0.83	1.01	1.63
	(22.3)	(4.7)	(12.7)	(39.7)	(26.9)	(5.7)	(10.2)	(42.7)
Triflox., 7.5 g/ha	1.33	0.72	1.01	1.56	1.42	0.79	0.90	1.59
	(21.7)	(4.3)	(10.3)	(36.3)	(26.2)	(5.2)	(7.9)	(39.3)
Triflox., 7.5 g/ha adjuvant	1.37	0.60	0.97	1.55	1.46	0.67	0.87	1.59
	(23.7)	(3.0)	(9.3)	(36.0)	(28.6)	(3.7)	(7.4)	(39.7)
Triflox., 10 g/ha	1.37	0.43	0.73	1.48	1.44	0.48	0.62	1.53
	(23.3)	(1.7)	(5.3)	(30.3)	(27.8)	(2.0)	(4.2)	(34.0)
Triflox., 10 g/ha + adjuvant	1.35	0.36	0.67	1.45	1.43	0.41	0.56	1.51
	(22.3)	(1.3)	(4.7)	(28.3)	(26.9)	(1.6)	(3.6)	(32.1)
Triflox., 20 g/ha	1.39	0.11	0.60	1.46	1.48	0.11	0.48	1.52
	(25.0)	(0.3)	(4.0)	(29.3)	(30.3)	(0.3)	(3.0)	(33.6)
Triflox., 20 g/ha + adjuvant	1.40	0.11	0.57	1.46	1.49	0.11	0.46	1.54
	(25.3)	(0.3)	(3.7)	(29.3)	(30.6)	(0.3)	(2.9)	(33.8)
Pendi., 1 kg/ha + hand	0.23	0.89	1.39	1.52	0.30	0.95	1.29	1.47
Weeding at 45 DAS	(1.7)	(6.7)	(24.7)	(33.0)	(2.0)	(8.0)	(19.3)	(29.3)
Flu., 1 kg/ha + hand	1.01	0.97	1.40	1.64	1.10	1.04	1.31	1.63
Weeding at 45 DAS	(10.3)	(8.3)	(25.7)	(44.3)	(12.7)	(9.9)	(20.0)	(43.2)
Hand-weeding at	1.39	1.29	2.80	2.82	1.47	1.36	2.73	2.77
25 and 45 DAS	(24.7)	(18.3)	(625.0)	(668.0)	(29.7)	(21.7)	(539.3)	(590.7)
Unweeded control	1.40	1.43	2.84	2.87	1.49	1.50	2.74	2.78
	(25.3)	(25.7)	(695.0)	(746.0)	(30.6)	(30.8)	(544.1)	(605.5)
CD (P=0.05)	0.16	0.38	0.21	0.08	0.32	0.42	0.20	0.07

Triflox., Trifloxysulfuron; Pendi., Pendimethalin; Flu., Fluchloralin
BLW, Broad-leaf weed; DAS, days after sowing; *Log transformed values

Table 2. Effect of weed-control treatments on the dry-matter of weeds and yield of cotton

Treatment	Total weed dry weight at 25 DAS (kg/ha)		Weed-control efficiency (%)		Seed-cotton yield (q/ha)	
	2003–04	2004–05	2003–04	2004–05	2003–04	2004–05
Triflox., 5 g/ha	2.34 (220.4)	2.32 (208.7)	77.8	76.6	12.10	12.89
Triflox., 5 g/ha + adjuvant	2.30 (198.3)	2.27 (188.0)	80.0	78.9	12.24	13.02
Triflox., 7.5 g/ha	2.27 (184.2)	2.24 (175.2)	81.4	80.3	13.11	13.94
Triflox., 7.5 g/ha adjuvant	2.23 (169.5)	2.21 (160.5)	82.9	82.0	13.58	14.45
Triflox., 10 g/ha	2.14 (139.3)	2.12 (131.9)	85.9	85.2	15.86	16.86
Triflox., 10 g/ha + adjuvant	2.11 (130.3)	2.09 (123.6)	86.9	86.1	16.89	17.96
Triflox., 20 g/ha	2.05 (111.8)	2.03 (106.1)	88.7	88.1	15.06	16.11
Triflox., 20 g/ha + adjuvant	1.93 (85.0)	1.90 (79.9)	91.4	91.0	15.11	16.02
Pendi., 1 kg/ha + hand Weeding at 45 DAS	2.15 (142.2)	2.13 (133.4)	85.7	85.0	14.54	15.50
Flu., 1 kg/ha + hand Weeding at 45 DAS	2.19 (156.5)	2.16 (146.1)	84.2	83.6	14.30	15.19
Hand-weeding at 25 and 45 DAS	2.99 (970.6)	2.94 (874.9)	2.1	1.7	12.75	13.53
Unweeded control	3.00 (991.4)	2.95 (890.4)	0.0	0.0	8.97	8.76
CD (P=0.05)	0.07	0.07			2.90	3.07

Triflox., Trifloxysulfuron; Pendi., Pendimethalin; Flu., Fluchloralin
DAS, days after sowing; *Log transformed values

arvensis and *Parthenium hysterophorus*. Application of trifloxysulfuron 20 g/ha + adjuvant controlled the weeds (especially broad-leaf weeds and sedges) most effectively in all the season. The total weed density was less under trifloxysulfuron @ 10 and 20 g/ha with and without adjuvant (Table 1).

Weed dry weight showed a decreasing trend with increasing rate of trifloxysulfuron. Among the weed-control treatments, post-emergence application of trifloxysulfuron at 10 and 20 g/ha with and without adjuvant significantly reduced dry matter of weeds during both the years (Table 2). The weed-control efficiency could be tremendously enhanced (85–91%) due to higher dose of trifloxysulfuron at 25 days.

Seed-cotton yield

Trifloxysulfuron 10 g/ha + adjuvant significantly increased the seed-cotton yield compared to the other treatments. Culpepper (2003) obtained similar results in tomato where trifloxysulfuron applied as post-emergence @ 5.32 g/ha at 19–26 days after transplanting of tomato did not show any yield reduction. Richardson (2002) also reported that cotton yields were greater with application of CGA 362 622 as post-emergence @ 3.8–7.5 g/ha than cotton treated with 2.5 g/ha CGA 362622. Thus trifloxysulfuron 10 g/ha + adjuvant at 15 days after sowing is suitable for the fields infested with more of sedges and broad-leaf weeds than grasses and if the field is infested with more of grass than sedges and broad-leaf, the recommended herbicide, viz. pendimethalin and fluchloralin, each at 1 kg/ha is suitable for better control of weeds.

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