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Evaluation of Integrated Weed Management in Cotton

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Abstract A field experiment was conducted to evaluate the integrated weed management practices for Bt cotton during winter season of 2009-2010. Cotton growth attributes such as plant height, leaf area index and dry matter production were found to be higher in Pendimethalin 0.75 kg ha^{-1} + quizalfop – ethy l 40 g ha^{-1}.Yield characters of cotton viz., number of symbodial branches $plant^{-1}$, number of bolls $plant^{-1}$, boll weight and seed cotton yield were found to be higher in Pendimethalin 0.75 hg ha^{-1} + quizalfop – ethyl 40 g ha^{-1}.

Keywords Integrated weed management,.Weed density, Yield.

Introduction

Cotton has retained its unique fame and name as the 'king of fiber' and 'white gold' because of its higher economical value among cultivable crops for quite a longer period. Cotton is one of the most important commercial crops grown in India. India is the second largest producer of cotton in the world after china. Although India has world's largest area of 11 million hectares, it produces only 32.5 million bales of lint every year with a productivity of 503 kg ha^{-1} [1]. Cotton being a wide spaced, slow growing and highly fertilized crop provides ample space and scope for high degree of weed infestation at the early growth stages. The critical period of weed competition in cotton was found to be 15 to 60 days [2].

Yield loss of 50 to 80% was observed in cotton under unweeded condition depending upon nature and intensity of weeds [3]. Many pre – emergence herbicides are presently used in cotton for weed control that take care of weeds only for a limited period and hence late emerging weeds escape killing. So, there is ample scope for controlling weeds by the application of early post- emergence herbicide, but their effectiveness has seldom been evaluated. Hence, an investigation was made on the efficiency of post-emergence herbicides Quizalfop – ethyl and Imazethapyr for the control of weeds in Bt cotton and its productivity.

Materials and Methods

Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore to evaluate the integrated weed management practices for Bt cotton (Bunny Bt) during winter season of 2009-2010. The soil of the experimental site has sandy loam in texture with low in available nitrogen medium in available phosphorus and high in available potassium contents.

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Table 1. Effect of weed management practices on weed density, weed dry matter and weed control efficiency. Figures in parentheses are Log (x+2) transformation values, PE–Pre – emergence POE – Post emergence.

Treatments	Weed density (No. m^{-2})	Weed dry (matter (g m^{-2})	Weed control efficiency
T_1-PE Pendimethalin 0.75 kg ha^{-1} + HW at 30 DAS	21.7 (1.37)	49.0 (1.71)	74.3
T_2-PE Fluchloralion 0.75 kg ha^{-1} + HW at 30 DAS	25.7 (1.44)	53.3 (1.74)	72
T_3-PE Pendimethalin 1.0 kg ha^{-1} + HW at 30 DAS	22.0 (1.38)	46.9 (1.69)	75.4
T_4-PE Fluchloralin 1.0 kg ha^{-1} + HW at 30 DAS	27.0 (1.46)	56.8 (1.77)	70.2
T_5-PE Pendimethalin 0.75 kg ha^{-1} + POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS	7.7 (0.09)	18.8 (1.32)	90.1
T_6-PE Fluchloralin 0.75 kg ha^{-1} + POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS	9.0 (1.04)	20.7 (1.36)	89.1
T_7-PE Pendimethalin 0.75 kg ha^{-1} + POE Imazethapys 60 g ha^{-1} at 30 DAS	13.0 (1.18)	32.8 (1.54)	82.8
T_8-PE Fluchloralin 0.75 kg ha^{-1} + Imazethapyt 60 g ha^{-1} at to DAS	14.3 (1.21)	33.00 (1.54)	82.7
T_9-Power weeder weeding at 20 and 40 DAS	65.3 (1.83)	134.6 (2.14)	29.3
T_{10}-Oleotype weeder weeding at 20 and 40 DAS	67.9 (1.84)	137.7 (2.15)	27.7
T_{11}-HW at 20 and 40 DAS	62.3 (1.81)	128.9 (2.12)	32.3
T_{12}-Unweeded control	84.0 (1.93)	190.5 (2.28)	-
SEd	0.10	0.12	-
CD (p = 0.05)	0.20	0.25	-

The experiment was laid out in a randomized block design and the treatments were replicated thrice. The treatment details are T_1- PE Pendimethalin 0.75 kg ha^{-1} + HW at 30 DAS, T_2- PE Fluchloralin 0.75 kg ha^{-1} + HW at DAS, T_3- PE Pendimethalin 1.0 kg ha^{-1} + HW at 30 DAS, T_4-PE Fluchloralin 1.0 kg ha^{-1} + HW at 30 DAS, T_5-PE Pendimethalin 0.75 kg ha^{-1}+ POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS, T_6- PE Fluchloraline 0.75 kg ha^{-1} + POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS, T_7- PE Pendimethalin 0.75 kg ha^{-1} + POE Imazethapyr 60 g ha^{-1} at 30 DAS, T_8-PE Fluchloraline 0.75 kg ha^{-1} + Imazethapyr60 g ha^{-1} at 30 DAS, T_9- power weeder weeding at 20 and 40 DAS, T_{10}- Oleotype weeder weeding at 20 and 40 DAS, T_{11}- HW at 20 and 40 DAS, T_{12}-Unweeded control. The pre-emergence herbicides were mixed with water @ 500 litres ha^{-1} and sprayed over the soil uniformly by a hand operated backpack sprayer using deflector nozzle on 3 DAS of cotton. Post emergence herbicides were mixed with water @ 500 litres ha^{-1} and sprayed oven the soil uniformly by a hand operated backpack sprayer using defdlector nozzle on 30 and 60 DAS. Two types of mechanical weeding were done in treatments using TNAU power weeder and oleo type weeder. Mechanical weeders were used in 20 and 40 DAS.

Results and Discussion

Weed density and weed dry matter

Among the different weed management methods, Pendimethalin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 40 DAS recorded lower weed density and total dry weight followed by Fluchloralin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS (Table 1). Quizalofop ethyl is a phenoxy herbicides, selective in nature applied as post emergence application. The application of pendimethalin or fluchloralin @ 1.0 kg a.i. ha^{-1} followed by one hand weeding at 45 DAS

Table 2. Effect of weed management practices on growth characters in Bt cotton. PE – Pre - emergence POE - Post emergence.

Treatments	Plant height (cm)	Leaf area index	Dry matter production (kg ha^{-1})
T_1- PE Pendimethalin 0.75 kg ha^{-1} + HW at 30 DAS	118.13	2.95	5210
T_2- PE Fluchloralin 0.75 kg ha^{-1} + HW at 30 DAS	116.93	2.84	5195
T_3- PE Pendimethalin 1.0 kg ha^{-1} + HW at 30 DAS	115.40	2.90	5191
T_4- PE Fluchloralin 1.0 kg ha^{-1} + HW at 30 DAS	114.13	2.79	5185
T_5- PE Pendimethalin 0.75 kg ha^{-1} +POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS	124.63	3.27	5309
T_6- PE Fluchloralin 0.75 ha^{-1} + POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS	118.27	3.12	5230
T_7- PE Pendimethalin 0.75 kg ha^{-1} + POE Imazethapyr 60 g ha^{-1} at 30 DAS	89.80	1.48	3290
T_8- PE Fluchloralin 0.75 kg ha^{-1} + Imazethapyr 60 g ha^{-1} at 30 DAS	91.00	1.38	3271
T_9- power weeder weeding at 20 and 40 DAS	112.53	2.80	4962
T_{10}- Oleotype weeder weeding at 20 and 40 DAS	109.60	2.96	4975
T_{11}- HW at 20 and 40 DAS	111.33	2.72	4999
T_{12}- Unweeded control	98.33	1.37	3654
SEd	3.08	0.10	294
CD (p=0.05)	6.39	0.310	611

produced significantly higher seed cotton yield (1700 kg ha^{-1}) [4].

Weed control efficiency

The Weed control efficiency was higher in Pendimethalin 0.75 kg ha^{-1} + Quizalofop-ethy l 40 g ha^{-1} at 30 DAS followed by Fluchloralin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS (Table 1). The spraying of Quizalofop-ethyl at 75 to 100 g ha^{-1} at 15 to 20 DAS of planting and one hand weeeding at 35 DAS after emergence of weeds were effective to combat weed problem with weed control efficiency of 95 to 100% [5].

Growth and yield attributes

Among the different weed management methods, Pendimethalin 0.75 kg ha^{-1} + Quizalofop- ethyl 40 g ha^{-1} at 30 DAS registered higher plant height (124.6

Table 3. Effect of weed management practices on yield characters and yield in Bt cotton. PE – Pre – emergence, POE- Post emergence.

Treatments	Sympodial branches plant^{-1}	No. of bolls plant^{-1}	Boll weight (g)	Seed cotton yield (Kg/ha)
T_1 - PE Pendimethalin 0.75 kg ha^{-1} + HW at 30 DAS	16	25.20	5.2	2269
T_2 - PE Fluchloralin 0.75 kg ha^{-1} + HW at 30 DAS	16	24.10	5.0	2156
T_3 - PE Pendimethalin 1.0 kg ha^{-1} + HW at 30 DAS	16	24.85	5.2	2250
T_4 - PE Fluchloralin 1.0 kg ha^{-1} + HW at 30 DAS	15	23.60	5.0	2122
T_5 - PE Pluendimethalin 0.75 kg ha^{-1} + POE Quizalofop-ethyl 40 g ha^{-1} at 30 DAS	18	32.10	5.2	2538
T_6 - PE Fluchloralin 0.75 kg ha^{-1} + POE Quizalofop-ethyl 40- g ha^{-1} at 30 DAS	17	28.03	5.1	2268
T_7 - PE Pendimethalin 0.75 kg ha^{-1}+ POE Imazethapyr 60 g ha^{-1} at 30 DAS	13	18.20	4.9	1852
T_8 - PE Fluchloralin 0.75 kg ha^{-1} + Imazethapyr 60 g ha^{-1} at 30 DAS	13	19.00	4.9	1803
T_9 - power weeder weeding at 20 and 40 DAS	15	20.30	5.2	2054
T_{10} - Oleotype weeder weeding at 20 and 40 DAS	15	21.10	5.1	2085
T_{11} - HW at 20 and 40 DAS	16	21.50	5.0	2089
T_{12} - Unweeded control	12	17.30	4.8	1773
SEd	0.96	1.41	0.13	128.06
CD (p=0.05)	1.99	2.94	NS	265.59

Table 4. Effect of weed management practices on Nutrient uptake by weeds and cotton (kg ha^{-1}). PE – Pre – emergence, POE – Post emergence.

Treatments	Nutrient uptake by weeds (Kg ha^{-1})			Nutrient uptake by cotton (Kg ha^{-1})		
	N	P	K	N	P	K
T_1 - PE Pendimethalin 0.75 kg ha^{-1} + HW at 30 DAS	4.46	1.51	1.97	95.60	24.59	79.23
T_2 - PE Fluchloralin 0.75 kg ha^{-1} + HW at 30 DAS	4.63	1.62	2.10	94.96	23.95	77.53
T_3 - PE Pendimethalin 1.0 kg ha^{-1} + HW at 30 DAS	4.67	1.47	2.19	94.15	23.97	77.90
T_4 - PE Fluchloralin 1.0 kg ha^{-1} + HW at 30 DAS	4.87	1.55	2.35	94.80	23.11	77.01
T_5 - PE Pendimethalin 0.75 kg ha^{-1} + POE Quizalofop-ethyl- 40 g ha^{-1} at 30 DAS	2.73	0.20	0.79	104.55	27.67	89.56
T_6 - PE Fluchloralin 0.75 kg ha^{-1} + POE Quizalofop-ethyl- 40 g ha^{-1} at 30 DAS	3.00	0.62	1.00	95.76	24.60	80.54
T_7 - PE Pendimethalin 0.75 kg ha^{-1} + POE Imazethapyr 60 h ha^{-1} at 30 DAS	17.32	3.20	7.52	74.26	13.50	44.89
T_8 - PE Fluchloralin 0.75 kg ha^{-1} + Imazethapyr 60 g ha^{-1} at 30 DAS	17.35	3.22	7.68	74.36	13.50	45.06
T_9 - power weeder weeding at 20 and 40 DAS	6.92	1.92	5.31	83.49	19.50	74.08
T_{10}- Oleotype weeder weeding at 20 and 40 DAS	6.85	1.96	5.42	86.59	19.80	74.60
T_{11}-HW at 20 and 40 DAS	6.72	1.85	5.24	85.40	21.01	76.50
T_{12}-Unweeded control	18.35	6.03	41.08	71.76	14.50	45.07
SEd	0.75	0.22	0.50	4.23	1.32	4.32
CD (p = 0.05)	1.56	0.45	1.02	8.79	2.74	8.97

cm), leaf area index (3.27) and dry matter production (5309 kg ha^{-1}) and it is on par with Fluchloralin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS (T_6) (Table 2).

Application of Pendimethalin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS recorded higher number of sympodial branches plant^{-1} (18) and more number of bolls plant^{-1} (32.10), which ultimately increased the seed cotton (Table 3). This may be due to higher plant height and dry matter production. There is no significant difference in boll weight between different weed management practices. The post emergence application of Quizalofop-ethyl 50 g ha^{-1} at 21 DAS not only controlled grassy weeds but also resulted in higher fiber yield [6].

Nutrient uptake by weeds and cotton

The nutrient (NPK) removal by weeds was greatly reduced by application of Pendimethalin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS (T_5) as a result of lower weed dry weight (Table 4) followed by Fluchloralin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS. The nutrient (NPK) uptake by cotton was higher with application of Pendimethalin 0.75 kg ha^{-1} + Quizalofop-ethyl 40 g ha^{-1} at 30 DAS (T_5) (Table 4). This might be due to fairly weed free condition at crop growth and lower weed competition for nutrients.

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