

Integrated Weed Management in Bt Cotton

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ABSTRACT

A field experiment was conducted during rainy seasons of 2010 and 2011 at Junagadh (Gujarat, India) to study efficacy of some pre- and post-emergence herbicides for weed control in Bt cotton (NHH-44). The results revealed that treatments viz., three hand weeding (HW) & interculturing (IC) at 30, 60 & 90 DAS, pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS, oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS, pendimethalin @ 0.9 kg/ha as pre-emergence + imazethapyr @ 75 g/ha as post-emergence at 45 DAS, pendimethalin @ 0.9 kg/ha as pre-emergence + oxadiargyl @ 90 g/ha as post-emergence at 45 DAS were found effective in enhancing growth, yield attributes and yield of cotton and reducing dry weight of weeds.

Keywords: *Pendimethalin, Oxadiargyl, Imazethapyr, Quizalofop, Glyphosate*

1. INTRODUCTION

Among the various factors responsible for deplorably low yield of irrigated cotton, severe weed infestation is important particularly in India. Initial slow growth, wide row spacing, high dose of chemical fertilizers combined with prostrate nature of its growth permit early and severe crop-weed competition resulting in loss of yield to the tune of 45 to 85% (Das, 2008). At present, manual weeding has become costly due to scarcity of labourers and hence it has become extremely difficult to keep the crop weed free. Effective and economical weed control in irrigated cotton is possible through integrating pre- and post-emergence herbicides along with hand weeding and interculturing. Effectiveness of newly developed post-emergence herbicides viz., quizalofop, oxadiargyl, imazethapyr and glyphosate needs to be tested for irrigated cotton and hence, an experiment is undertaken to evaluate the efficacy of some pre- and post-emergence herbicides for irrigated Bt cotton.

2. MATERIALS AND METHODS

A field experiment was conducted at Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat, India) during rainy seasons of 2010 and 2011. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction (pH 7.9 and EC 0.33 dS/m) as well as low in available nitrogen (228 kg/ha), available phosphorus (23.5 kg/ha) and medium in available potash

(236 kg/ha). The experiment comprising of 10 treatments viz., T₁- Pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS, T₂- Oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS, T₃- Pendimethalin @ 0.9 kg/ha as pre-emergence + Pendimethalin @ 0.9 kg/ha as herbigation at 45 DAS, T₄- Pendimethalin @ 0.9 kg/ha as pre-emergence + Quizalofop @ 40 g/ha as post-emergence at 45 DAS, T₅- Pendimethalin @ 0.9 kg/ha as pre-emergence + Imazethapyr @ 75 g/ha as post-emergence at 45 DAS, T₆- Pendimethalin @ 0.9 kg/ha as pre-emergence + Oxadiargyl @ 90 g/ha as post-emergence at 45 DAS, T₇- Pendimethalin @ 0.9 kg/ha as pre-emergence + Glyphosate @ 0.96 kg/ha as post-emergence directed spray at 75 DAS, T₈- 3 HW & IC at 30, 60 and 90 DAS, T₉- Weed free, and T₁₀- Unweeded check, were laid out in randomized block design with three replications. The Bt cotton hybrid 'NHH-44' was sown at 120 cm x 45 cm spacing. FYM 15 t/ha was incorporated in soil at the time of preparatory tillage. The crop was fertilized with 160-0-120 kg N-P₂O₅-K₂O/ha, of which 120 kg K₂O/ha as muriate of potash and 40 kg N/ha as ammonium sulphate were applied as basal, while 40 kg N/ha as urea was top-dressed each at 30, 60 and 90 DAS. The pre-emergence herbicides were applied to soil on next day after sowing. The spray volume for pre- and post-emergence herbicides was 500 L/ha. The weed flora of cotton field were *Digera arvensis*, *Eluopus villosus*, *Cyperus rotundus*, *Cynodon dactylon*, *Echinochloa crusgalli*, *Chenopodium album*, *Convolvulus arvensis*, *Trianthema monogyna*, *Amaranthus spinosus*, *Asphodelus tenuifolius* etc.

3. RESULTS AND DISCUSSION

Growth and yield attributes

Data presented in Table 1 showed that various weed management treatments significantly influenced the growth and yield attributes of cotton viz., plant height, number of bolls per plant, boll weight and seed cotton weight per plant during both the years as well as in pooled results. In individual years, significantly the highest values of these parameters were recorded under the weed free check (T₉); however it remained at par with 3 HW & IC at 30, 60 & 90 DAS (T₈), pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₁) oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₂), pendimethalin @ 0.9 kg/ha as pre-emergence + imazethapyr @ 75 g/ha as post-emergence at 45 DAS (T₅), pendimethalin @ 0.9 kg/ha as pre-emergence + oxadiargyl @ 90 g/ha as post-emergence at 45 DAS (T₆). On pooled basis, the treatments viz., weed free check (T₉), 3 HW & IC at 30, 60 & 90 DAS (T₈), pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₁), and oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₂) were found superior in respect of growth and yield attributes of cotton. Periodical removal of weeds (T₈) or herbicide application supplemented with weeding (T₁ and T₂) suppressed weeds, which in turn provided better weed free environment to crop during critical period for growth and development. Singh and Kokate (2010) also reported similar results.

Cotton yield

A perusal of data furnished in Table 2 revealed that different weed management treatments tried in this experiment did cause their significant influence on seed cotton yield, stalk yield and lint yield during both the years as well as in pooled results. During both the years, significantly the highest seed cotton yield (2056 and 1968 kg/ha), stalk yield (3013 and 2944 kg/ha) and lint yield (665 and 646 kg/ha) were registered under the weed free check (T₉), which remained statistically at par with treatments viz., 3 HW & IC at 30, 60 & 90 DAS (T₈), pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₁) oxadiargyl @ 90 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₂), pendimethalin @ 0.9 kg/ha as pre-emergence + imazethapyr @ 75 g/ha as post-emergence at 45 DAS (T₅), pendimethalin @ 0.9 kg/ha as pre-emergence + oxadiargyl @ 90 g/ha as post-emergence at 45 DAS (T₆). On pooled basis, the treatments viz., weed free check (T₉), 3 HW & IC at 30, 60 & 90 DAS (T₈), pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₁) and oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₂) were found superior in respect of cotton yield. Improved growth and yield attributes owing to efficient weed control under these treatments ultimately reflected in increased yield of cotton. Similar results were also reported by Yadav *et al.* (2006).

Weed parameters

The weed free (T₉) recorded significantly the lowest dry weight of weeds (82 and 69 kg/ha during 2010 and 2011, respectively) with the highest WCE of 97.4% (Table 2). The next best treatments were 3 HW & IC at 30, 60 & 90 DAS (T₈), pendimethalin @ 0.9 kg/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₁) and oxadiargyl @ 90 g/ha as pre-emergence + HW & IC at 30 & 60 DAS (T₂) in respect of dry weight of weeds which recorded higher WCE of 89.9, 87.0 and 83.3% and lower WI of 3.4, 6.0 and 7.8%, respectively. The treatments viz., pendimethalin @ 0.9 kg/ha as pre-emergence + imazethapyr @ 75 g/ha as post-emergence at 45 DAS (T₅) and pendimethalin @ 0.9 kg/ha as pre-emergence + oxadiargyl @ 90 g/ha as post-emergence at 45 DAS (T₆) have also proved their superiority over unweeded check by recording WCE of 79.7 and 76.7% and WI of 9.9 and 12.1%, respectively. The superiority of pendimethalin (Singh and Kokate, 2010) and oxadiargyl (Dimitrova *et al.*, 2001) was reported earlier.

4. CONCLUSION

Effective control of weeds along with higher yield of cotton could be achieved by three HW & IC at 30, 60 & 90 DAS or pre-emergent application of pendimethalin @ 0.9 kg/ha + HW & IC at 30 & 60 DAS or pre-emergent application of oxadiargyl @ 90 g/ha + HW & IC at 30 & 60 DAS or pre-emergent application of pendimethalin @ 0.9 kg/ha + post-emergent application of imazethapyr @ 75 g/ha at 45 DAS or pre-emergent application of pendimethalin @ 0.9 kg/ha + post-emergent application of oxadiargyl @ 90 g/ha at 45 DAS

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Table 1. Effect of weed management treatments on growth and yield attributes of cotton

Treatment	Plant height (cm)			Number of bolls/plant			Single boll weight (g)			Seed cotton weight/plant (g)		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
T ₁	114.7	109.8	112.2	33.7	30.3	32.0	5.11	4.77	4.94	105.7	99.9	102.8
T ₂	113.1	101.8	107.5	32.8	29.8	31.3	5.02	4.67	4.85	104.1	97.7	100.9
T ₃	89.2	91.0	90.1	23.7	23.6	23.7	3.83	3.44	3.64	77.1	72.8	74.9
T ₄	103.3	97.0	100.2	28.4	25.7	27.0	3.88	4.25	4.07	85.8	84.9	85.4
T ₅	111.7	98.6	105.2	32.7	29.7	31.2	4.91	4.62	4.76	101.6	97.2	99.4
T ₆	106.3	97.4	101.9	32.0	29.2	30.6	4.81	4.59	4.70	100.6	93.2	96.9
T ₇	105.8	93.6	99.7	26.3	26.7	26.5	4.43	3.48	3.95	80.7	75.0	77.8
T ₈	118.3	115.0	116.7	35.3	31.6	33.5	5.21	4.95	5.08	108.5	102.6	105.6
T ₉	123.3	115.3	119.3	35.7	32.1	33.9	5.27	5.00	5.14	113.3	107.4	110.4
T ₁₀	84.8	84.7	84.8	19.4	16.7	18.1	3.74	3.41	3.57	64.0	60.7	62.4
LSD (P=0.05)	18.8	19.2	13.0	3.9	3.8	2.6	0.49	0.43	0.32	20.8	16.8	12.9

Table 2. Effect of weed management treatments on cotton yield and weed dry weight

Treatment	Seed cotton yield (kg/ha)			Stalk yield (kg/ha)			Lint yield (kg/ha)			Weed dry weight (kg/ha)			WCE (%)	WI (%)
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled		
T ₁	1948	1838	1893	2882	2855	2868	635	598	617	360	400	380	87.0	6.0
T ₂	1918	1794	1856	2835	2814	2825	630	581	605	391	586	489	83.3	7.8
T ₃	1412	1307	1359	2101	2075	2088	466	422	444	1791	1830	1811	37.9	32.5
T ₄	1579	1511	1545	2645	2600	2622	509	492	500	904	900	902	69.1	23.2
T ₅	1866	1761	1813	2771	2787	2779	621	578	599	566	620	593	79.7	9.9
T ₆	1834	1702	1768	2705	2734	2719	603	561	582	621	739	680	76.7	12.1
T ₇	1454	1342	1398	2289	2207	2248	477	433	455	950	1033	992	66.0	30.5
T ₈	1992	1894	1943	2907	2899	2903	649	639	644	264	325	295	89.9	3.4
T ₉	2056	1968	2012	3013	2944	2978	665	646	656	82	69	75	97.4	0.0
T ₁₀	1171	1084	1128	1968	1870	1919	379	355	367	2748	3083	2916	0.00	44.0
LSD (P=0.05)	240	271	175	514	400	315	83	86	58	140	210	122		