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Effect of pre and post sowing weed management on weeds, growth and yield of summer irrigated cotton

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ABSTRACT

Field investigation was carried out at Agricultural College and research Institute, Madurai during 2003 and 2004 to study the weed control, growth and yield of summer irrigated cotton. The results revealed that density of grasses, sedges and BLW was found reduced under pre sowing weed management practice of SSB by paraquat application at 0.40 kg ha^{-1}fb SSB by slight hoeing during 2003 and 2004. Among the post sowing weed management practices, MW on 20 DAS fb glyphosate at 1.5 kg ha^{-1} brought down the density of grasses, BLW and sedges to the significant level during 2003 and 2004. In response to the above said effect, these treatments had lesser number of total weed density at 90 DAS during both years. The growth attributes like plant height, monopodial branches plant^{-1} and plant DMP were influenced by the pre sowing practice of SSB with paraquat 0.40 kg ha^{-1} followed by SSB by slight hoeing owing to satisfactory control of weed density in these treatments. Under post sowing weed management practices, MW on 20 DAS fb glyphosate 1.5 kg ha^{-1} increased the plant height and plant DMP over other treatments. As evident from the above effects, the pre sowing practice of SSB by paraquat application at 0.40 kg ha^{-1} and post sowing practice of MW on 20 DAS fb glyphosate 1.5 kg ha^{-1} recorded higher seed cotton yield during both the years.

Key words : Pre-Sowing weed management, Post sowing weed management, Stale seed bed, Weed density, Growth attributes, Seed cotton yield.

INTRODUCTION

In textile industry cotton plays vital role in supplying raw materials to the tune of 85 per cent of total requirement in India. It has immense potentiality to share foreign exchange of 38 per cent of total export of Indian economy besides providing employment to 60 million people in India (Kairon and Venugopalan, 2000). In the recent past, its production and productivity in Tamil Nadu (324 kg ha^{-1}), it is far lower than the world average of 500 kg ha^{-1} (Natarajan, 2004). The causes for decline in productivity of cotton might be due to various factors, which accounts for poor fertility status of the soil due to heavy weed infestation besides crop weed competition in summer irrigated cotton in particular. Because of availability of wide row spacing, slow growth nature of cotton and plenty of sunlight during summer season provides ample scope for weed growth in cotton. Yield loss due to weed competition in cotton is estimated to vary from 40 to 85 per cent (Sreenivas, 2000). The post sowing weed management reduces the weed competition in the later vegetative phase of the crop and hence control on early emerged weeds is become questionable. Further, timely weed control after establishment of crop is not feasible due to high cost and non availability of labourers during peak period. Under such situation, adoption of pre sowing weed management practice is essence in addition to post sowing weed management practice in order to reduce weed competition in the initial and later stages of cotton crop. Keeping the above facts in view, the study was undertaken for effective control of weeds in summer irrigated cotton.

MATERIALS AND METHODS

A field experiment was conducted at Agricultural College and Research Institute, Madurai, Tamil Nadu during 2003 and 2004 to study the combined effect of pre and post sowing weed management practices on weeds and their influence on yield and economics of summer irrigated cotton. The soil of the experimental field was well drained clay loam with organic carbon content of 0.45 per cent and low, medium and high N, $P_2 0_5$ and $K_2 0$, respectively. The experiment consists of three Pre-sowing weed management practices *viz.*, S_1-Normal sowing, S_2 – Stale seed bed (SSB) by slight hoeing on 14th day of SSB and S_3 - SSB by paraquat spray @ 0.40 Kg ha^{-1} on 14th day of SSB assigned to main plot and seven post sowing weed management practices *viz.*, W_1 - Pre-emergence application of fluchloralin at 1.0 kg ha^{-1} fb MW on 30 DAS, W_2 - Pre-emergence application of fluchloralin at 1.0 kg ha^{-1} fb post-emergence spray of glyphosate at 1.5 kg ha^{-1} on 30 DAS, W_3 - Pre-emergence application of fluchloralin at 1.0 kg ha^{-1} fb post-emergence spray of glyphosate at 1.0 kg ha^{-1} on 30 DAS, W_4 - MW on 20 DAS fb post-emergence spray of glyphosate at 1.5 kg ha^{-1} on 40 DAS, W_5 - MW on 20 DAS fb post-emergence spray of glyphosate at 1.0 kg ha^{-1} on 40 DAS,

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W_6 - MW twice on 20 and 40 DAS (farmer's practice) and W_7 - Unweeded control allotted to subplots. Observations on grasses, sedges, BLW total weed density were recorded on 90 DAS. Regarding growth attributes, observations on plant height, No. of monopodial branches plant^{-1} and DMP kg ha^{-1} were recorded on 90 DAS. Also seed cotton yield was recorded. The above data were statistically analyzed in split plot design and discussed in the results.

RESULTS AND DISCUSSION

Effect on weeds:

The density of grasses and sedges was found to be lesser in pre sowing weed management practice of SSB by paraquat application (S_3) (12.48 and 1.49 m^{-2} during 2003 and 1.15 and 1.24 m^{-2} during 2004). However, the above promising treatment was comparable with SSB by slight hoeing (S_2) in registering density of BLW and grasses during 2003 and 2004, respectively (Table1). Lesser density of weeds under SSB by paraquat application might be attributed to its contact effects and non selective killing of weeds. Andrew Lanie *et al*.(1994) reported 48 to 74 per cent control of barnyard grass with paraquat application (420 g ha^{-1}) in soybean (*Glycine max* L.) planted in stale seed bed. Similarly, Chinnusamy and Kandasamy (2002) also reported that constant reduction in *Cleome viscosa* Linn. Could be observed in SSB by paraquat application was due to its rapid contact effect on weeds and killed the weeds as compared to SSB by slight hoeing. In the case of total weed density, pre sowing weed management practice of SSB by paraquat application (S_3) was found to be a better practice to reduce total weed density followed by slight hoeing. This might be due to reduced weed number of BLW, grasses and sedge weeds recorded in the above promising pre sowing weed management practices. The paraquat application due to its contact action killed all the existing weeds after application. Similarly, in the case of SSB by slight hoeing, initial weed flush was destroyed and the crop was raised in weed free seed beds. This was in agreement with Renu *et al*. (2000) that the initial weed

Table1 : Effect of pre and post sowing weed management practices on density of grasses, sedges, BLW and total weeds (No. m^{-2}) at 90 DAS

Treatments	2003				2004			
Pre-sowing weed management practices	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
S_1-Normal sowing	18.60	1.63	29.34	49.57	16.66	1.50	25.42	43.59
	(1.298)	(0.561)	(1.482)	(1.712)	(1.271)	(0.534)	(1.430)	(1.658)
S_2-SSB by slight hoeing	15.38	1.64	23.47	40.49	13.31	1.36	21.64	36.31
	(1.127)	(0.543)	(1.406)	(1.628)	(1.185)	(0.517)	(1.367)	(1.583)
S_3-SSB by paraquat	12.48	1.49	18.51	32.97	11.15	1.24	17.42	29.81
	(1.140)	(0.531)	(1.302)	(1.544)	(1.119)	(0.502)	(1.275)	(1.476)
S.E.±	0.019	0.002	0.048	0.010	0.031	0.001	0.033	0.010
C.D. (P=0.05)	0.053	0.007	0.134	0.029	0.086	0.002	0.091	0.028
Post-sowing weed management practices								
W_1-Fluchloralin 1.0 kg/ha-MW	20.94	1.41	26.63	48.98	18.96	1.21	24.27	44.44
	(1.357)	(0.532)	(1.450)	(1.707)	(1.317)	(0.507)	(1.413)	(1.666)
W_2-Fluchloralin 1.0 kg/ha-glyphosate 1.5 kg/ha	15.18	1.27	23.66	40.11	13.31	1.08	20.26	34.65
	(1.230)	(0.515)	(1.400)	(1.624)	(1.180)	(0.488)	(1.341)	(1.564)
W_3- Fluchloralin 1.0 kg/ha-glyphosate 1.0 kg/ha	16.45	1.35	25.93	43.73	15.25	1.14	23.71	40.10
	(1.263)	(0.525)	(1.437)	(1.660)	(1.235)	(0.497)	(1.403)	(1.624)
W_4- MW-glyphosate 1.5 kg/ha	8.96	1.06	16.00	26.02	7.48	0.90	14.74	23.12
	(1.033)	(0.485)	(1.253)	(1.447)	(0.971)	(0.463)	(1.222)	(1.400)
W_5- MW-glyphosate 1.0 kg/ha	9.69	1.14	19.11	29.94	9.03	0.96	17.35	27.34
	(1.063)	(0.497)	(1.320)	(1.504)	(1.038)	(0.472)	(1.281)	(1.467)
W_6-MW (20 and 40 DAS)	13.62	1.18	21.78	36.58	12.33	1.01	19.92	33.26
	(1.182)	(0.502)	(1.367)	(1.586)	(1.148)	(0.479)	(1.332)	(1.547)
W_7-Unweeded	23.60	4.11	40.21	67.92	27.24	3.24	30.25	60.73
	(1.403)	(0.786)	(1.572)	(1.844)	(1.466)	(0.719)	(1.507)	(1.797)
S.E.±	0.019	0.002	0.030	0.008	0.038	0.002	0.021	0.009
C.D. (P=0.05)	0.040	0.005	0.061	0.017	0.078	0.004	0.044	0.018

Figures in parentheses are log(x+2) transformed values

free condition provided a good start of the crop and enable to smother the later emerging weed flush. The total weed density was increased in the conventional method of normal sowing practice because of non imposement of any pre sowing weed management practice (Table 1). This situation was favourable for the available weed seeds to germinate without hindrance in normal sowing.

With regard to post sowing weed management practices, manual weeding at 20 DAS fb glyphosate either 1.0 (or) 1.50 kg ha^{-1} reduced the grass weed density during both the years. The efficiency of the above promising weed management practices in controlling grassy weeds was noticed to a great extent. This is in conformity with the findings of Nalayini *et al.*(2001) who stated that glyphosate being a translocate herbicide controlled the weeds like *Cynodon dactylon* (L.) Pers. This could be due to effective translocation of glyphosate to underground reproductive propagules and prevention of further regeneration. The results of the experiment on sedge weed control revealed that post sowing weed management practice of MW on 20DAS fb glyphosate 1.5 kg ha^{-1} performed better in checking sedge weed density in both the years (Table1). This might be due to minimum number of sedge weed occurrence and also the translocated effect of glyphosate applied in this treatment. The post sowing weed management of MW on 20 DAS fb glyphosate 1.5 kg ha^{-1} sowed its superiority in bringing down the broad leaved weed density to 16.00 and 14.75 m^{-2} during 2003 and 2004, respectively (Table1). This finding is in accordance with the results obtained by Chinnusamy and Kandasamy (2002). The unweeded control (W_7) recorded higher density of broad leaved weeds (40.21 m^{-2} during 2003 and 30.25 m^{-2} during 2004).

The total density of weed was significantly reduced to the tune of 26.02 m^{-2} during 2003 and 23.12 m^{-2} during 2004 under MW (20 DAS) fb glyphosate 1.5 kg ha^{-1} (W_5). This might be due to complete removal of early emerging weeds by manual weeding given on 20DAS and subsequent application of non selective post emergence translocated herbicide glyphosate at 1.5 kg ha^{-1} on 40 DAS which helped to knock down the regenerated and later emerging weeds at later stage resulted in good control of weeds. The next best treatment was manual weeding (20DAS) fb glyphosate 1.0 kg ha^{-1} (W_5) and manual weeding twice (20 and 40 DAS). While, unweeded control (W_7) recorded higher total weed density of 67.92 m^{-2} during 2003 and 60.73 m^{-2} during 2004 over rest of the post sowing weed management practices (Table1).

Effect on crop:

In pre sowing weed management practices, SSB by paraquat application (S_3) produced taller plants (62.47cm during 2003 and 64.19 cm during 2004) followed by SSB by slight hoeing (S_2) during both years (Table2). As SSB by paraquat application is proven to be effective in reducing crop weed competition to a greater extent by way of permitting the available weed seeds to germinate and destroy them by direct spray of paraquat. It provided a weed free environment which helped cotton to grow taller. The normal sowing (S_1) recorded only shorter plants (53.37cm in 2003 and 54.23 cm in 2004).

Profound influence due to post sowing weed management practices was noticed in the plant height of cotton. Among the treatments, manual weeding (20DAS) fb glyphosate 1.5 kg ha^{-1} (W_4) significantly increased the plant height (72.29 and 73.48 cm during 2003 and 2004, respectively). The farmer's practice of manual weeding twice (20 and 40 DAS) was the next best treatment in producing taller plants (Table 2). There was remarkable increase in monopodial branches $plant^{-1}$ under pre sowing weed management practice of SSB by paraquat application (S_3) (1.467 $plant^{-1}$ during 2003 and 1.545 $plant^{-1}$ during 2004). However, this treatment (S_3) was comparable with SSB by slight hoeing (S_2) in second year, which produced 1.451 $plant^{-1}$ (Table 2). Among the post sowing weed management practices, the treatment with manual weeding (20 DAS) fb glyphoste 1.5 kg ha^{-1} (W_4) registered increased number of monopodial branches (1.689 during 2003 and 1.757 $plant^{-1}$ during 2004) followed by manual weeding (20 DAS) fb glyphosate 1.0 kg ha^{-1} (W_5) treatment (1.60 $plant^{-1}$ during 2003) and these treatment were comparable with each other (Table 2).

The pre sowing weed management practice of SSB by paraquat application (S_3) registered higher DMP of 1431 and 1432 kg ha^{-1} during 2003 and 2004, respectively. Which was followed by SSB by slight hoeing (S_2) treatment during 2003 (Table 2). Better weed management with sufficient light, moisture and nutrients availability for increased crop DMP was obtained in the above promising treatment. This is in agreement with the findings of Srinivas *et al.* (1989). Among the post sowing weed management practices, manual weeding (20 DAS) fb glyphosate 1.5 kg ha^{-1} (W_4) recorded higher DMP in cotton (1916 during 2003 and 1959 kg ha^{-1} during 2004).

Significant influence in seed cotton yield was observed in pre and post sowing weed management practices in both years. Among the pre sowing weed management practices, SSB by paraquat application (S_3) registered significantly higher seed cotton yield of 1290 and 1521 kg ha^{-1} during 2003 and 2004, respectively (Table 2). The increased seed cotton yield in SSB by paraquat application was due to weed suppressing nature created

Table 2 : Effect of pre and post sowing weed management practices on growth attributes and seed cotton yield

Treatments	Plant Height(cm) at 90 DAS		No. of Monopodial branches plant^{-1}		Plant DMP (kg ha^{-1}) at 90 DAS		Seed cotton yield (kg ha^{-1})	
Pre-sowing weed management practices	2003	2004	2003	2004	2003	2004	2003	2004
S_1-Normal sowing	53.37	54.23	1.343	1.359	1079	1069	1084	1157
S_2-SSB by slight hoeing	53.43	58.51	1.419	1.451	1208	1201	1151	1276
S_3-SSB by paraquat	62.47	64.19	1.467	1.545	1431	1432	1290	1521
S.E.±	1.133	2.040	0.015	0.038	58	75	29	41
C.D. (P=0.05)	3.147	5.664	0.042	0.105	161	208	79	114
Post-sowing weed management practices								
W_1-Fluchloralin 1.0 kg/ha-MW	48.02	50.30	1.178	1.196	906	806	865	896
W_2-Fluchloralin 1.0 kg/ha-glyphosate 1.5 kg/ha	58.03	59.87	1.445	1.466	1131	1166	1180	1228
W_3- Fluchloralin 1.0 kg/ha-glyphosate 1.0 kg/ha	52.70	54.63	1.333	1.436	1040	1073	1033	1125
W_4- MW-glyphosate 1.5 kg/ha	72.29	73.48	1.689	1.757	1916	1959	1713	1911
W_5- MW-glyphosate 1.0 kg/ha	66.57	68.00	1.600	1.672	1720	1747	1598	1736
W_6-MW (20 and 40 DAS)	61.11	61.68	1.533	1.567	1339	1347	1520	1625
W_7-Unweeded	43.26	44.87	1.089	1.071	625	540	611	664
S.E.±	1.471	2.368	0.031	0.059	86	118	40	59
C.D. (P=0.05)	2.984	4.803	0.063	0.119	175	239	80	119

by the parquet application by way of its contact action on the weeds foliage and destroyed the existing weed flora before sowing cotton seeds. This is in line with the findings of Lanie *et al*. (1994) who reported that SSB prepared before sowing of soybean with glyphosate (840 g a.i. ha^{-1}) was effective as that of paraquat (1.12 kg ha^{-1}) application as pre sowing weed management practice.

Post sowing weed management practices had appreciable influence on seed cotton yield during both years. Among the post sowing weed management practices, manual weeding (20 DAS) fb glyphosate 1.5 kg ha^{-1} (W_4) registered higher seed cotton yield of 1713 kg ha^{-1} during 2003 and 1911 kg ha^{-1} and 13.2 per cent over farmers practice of manual weeding twice were achieved due to cumulative effect of MW imposed on 20 DAS and subsequent application of glyphosate on 40 DAS which had very good impact on the control of weeds throughout crop weed competition period in cotton. Ronald *et al*. (1996) reported that glyphosate was very effective post sowing weed management practice to control annual grasses and BLW. The treatment manual weeding (20 DAS) fb glyphosate 1.0 kg ha^{-1} (W_5) recorded 1598 kg ha^{-1} during 2003 and 1736 kg ha^{-1} during 2004. The farmer's practice of MW twice (20 and 40 DAS) (W_6) yielded 1520 kg ha^{-1} during 2003 and 1625 kg ha^{-1} during 2004.

Based on the results of the experiment, it could be concluded that raising cotton under pre sowing weed management practice of SSB by paraquat application at 0.40 kg ha^{-1} with post sowing weed management practice of manual weeding on 20 DAS fb glyphosate 1.5 kg ha^{-1} will be the best suited option for effective control of weeds and to get higher seed cotton yield in summer irrigated cotton.

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