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Pre and Post-sowing Control of Weeds, their Influence on Nutrient Uptake in Summer Irrigated Cotton (*Gossypium hirsutum* L.)

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Abstract: In cotton, post sowing weed management is widely adopted by the farmers, which resulted in substantial yield loss following undue delay in weeding. As timely weed control after establishment of the crop is not feasible due to non availability of labourers during peak cultivation period of same season. Therefore, adoption of pre -sowing weed management practice is absolutely essential in order to control the weeds prior to sowing which could reduce the weed intensity during the crop growth period. Besides, post- sowing weed management is needed to be practiced so as to achieve complete weed control. In this context an experiment was conducted and the results of the experiment revealed that significant reduction in density of weeds was observed in SSB (Stale seedbed) by paraquat application @ 0.40 kg ha^{-1} due to its rapid contact action with non selective nature under pre-sowing method. In post-sowing method, manual weeding at 20 DAS fb glyphosate 1.50 kg ha^{-1} reduced the density of weeds due to effective translocation of glyphosate to underground reproductive propagules and prevention of its further regeneration. A greater reduction in weed density in SSB by paraquat application enhanced nutrient uptake of cotton following lower weed density associated with less weed competition. The post-sowing weed management practice of manual weeding (20 DAS) fb glyphosate 1.5 kg ha^{-1} exhibited higher nutrient uptake. The effective suppression of weeds at critical stages in the above said treatment was reflected in increasing the nutrient availability for better uptake of nutrients.

Key words: pre-sowing, post-sowing, stale seedbed, weed density, nutrient uptake

INTRODUCTION

In the recent decades, scope for naturally available material is vast than the synthetic ones. For instance demand for cotton based fabrics are given much emphasis in global markets level especially in developed countries like USA and U.K. On the other hand supply of cotton raw material to the textile industry seems to be inadequate due to various reasons. It could not be possible to increase the production of cotton with the available cotton growing areas. On the other hand extension of area in cotton is questionable as most of the agricultural lands are being converted into other purposes like urbanization, industrialization etc. Hence, only alternative to tide over the above situations is to increase cotton yield from the existing cotton areas. Though there is lot of factors which led to cause decline in productivity of cotton, the foremost important factor which reduces the yield of cotton is weed. This competes with cotton for space, light, nutrients and moisture too.

Cotton is being cultivated almost all over the world. However, India ranks first in area covering 9.25 million ha representing 23 percent of world's cotton area and contributes 11.5 percent of world's total production (16.88 million bales). Amongst Indian states, Tamil Nadu exhibited marginally higher productivity (324 kg lint ha^{-1}) of cotton than the national average of 300 kg ha^{-1}. However, it is far lower than the world's average of 500 kg ha^{-1} following several factors. Though there is lot of factors which led to cause decline in production of cotton, the foremost important factor which reduces yield of cotton tremendously is weed which competes with cotton for space, nutrient, light and moisture. Initial slow growth with wider spacing favours the weeds to grow luxuriously in cotton especially upto to 60 DAS. As long as weed control is being done with post sowing weed management practices almost in all the crops. However, yield loss was observed in these methods following undue delay in weeding. As timely weed control after establishment of the crop is not feasible

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due to non availability of labourers during peak cultivation period. Under this situation, adoption of pre-sowing weed management practice is absolutely essential in order to control the weeds prior to sowing which may certainly reduce the weeds intensity during the crop growth period. In addition, post-sowing weed management is needed to be practiced so as to achieve complete weed control. Traditionally post-sowing practices like pre-emergence herbicides application and manual weeding are widely adopted by all the farmers. But these take care of only early emerging weeds. While, post emergence herbicides like glyphosate will be a best alternative for controlling of late emerging weeds with its residual effect. Keeping the above facts in view the following experiment was conducted at Agricultural College and Research Institute, Madurai, Tamil Nadu, India during 2003 and 2004.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College and Research Institute, Madurai, Tamil Nadu, India during 2003 and 2004 to study the pre and post sowing control of weeds, their influence on nutrient uptake in summer irrigated cotton (*Gossypium hirsutum* L.). The soil of the experimental field was well drained sandy clay loam with organic contend of 0.5 per cent, low, medium and high in NP_20_5 and K_2O respectively. The experiment consists of three pre-sowing weed management practices as main plot treatments and seven post-sowing weed management practices assigned to sub-plot treatments and were replicated thrice.

Under pre-sowing weed management practices, layout was taken immediately after field preparation. First irrigation was given in stale seedbed treatment plots to induce the weed seeds to germinate. At 14 days after first irrigation, slight hoeing was given in SSB by slight hoeing plots and paraquat sprayed at 0.40 kg ha^{-1} in SSB by paraquat plots to destroy the emerged weeds. While, under normal sowing plots, all the practices were carried out as per general recommendations just prior to sowing. In post-sowing weed management practice, pre-emergence herbicide fluchloralin was applied on 30 DAS in the respective plots with help of deflector type of nozzle. In the case of post-emergence application, glyphosate was applied on 30 DAS in the respective post-emergence application plots and was applied on 40 DAS in the respective plots given with MW on 20 DAS. The glyphosate was applied with help deflector type of nozzle fitted with hood to prevent spray drift over cotton crop. Manual weeding was given on 30 DAS in the respective pre-emergence applied treatments and was given on 20 DAS in the respective post-emergence treatment plots. While, it was imposed on 20 DAS and 40 DAS in farmer's practice of MW twice. Biometric observations on weed density was recorded on 60 DAS by placing quadrat (0.25 m^2) in four fixed points randomly in each plot of three replications and expressed in nos m^{-2} . Analysis on N, P_2O_5 and K_2O was done from the DMP of five randomly selected plants on 60 DAS and expressed in kg ha^{-1}.Similarly observation on plant height was recorded on 60 DAS. All the above data were statistically analyzed and discussed in the results which are as follows.

RESULTS AND DISCUSSION

Weed Density: Significant reduction in grasses, sedges, broad leaved weeds and total weed density was observed (11.01, 1.33, 12.96 and 25.30 No. m^{-2} during 2003 and 9.88, 1.04, 13.08 and 24.00 No. m^{-2} during 2004 respectively) in SSB (stale seed bed) by paraquat application @ 0.40 kg ha^{-1} under pre-sowing weed management practices (Table 1). However, it was found equally effective in checking the density of sedges as that of SSB by slight hoeing during 2004 (Table 1). The paraquat application due to its contact action killed all the existing weeds after application. Similar results obtained by (1) that non selective herbicide paraquat could have a complete control of existing weed spectrum. 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 (5) that the initial weed free condition provided a good start of the crop and enabled the crop to smother the later emerging weed flushes.

With regard to post sowing weed management, manual weeding at 20 DAS fb glyphosate 1.5 kg ha^{-1} reduced the grasses, broad leaved weeds and total weed density to the tune of 4.49, 9.37 and 14.75 No.m^{-2} during 2003 and (Table 1) 3.91, 8.15 and 12.68 No. m^{-2} during 2004 respectively. This could be due to effective translocation of glyphosate to underground reproductive propagates and prevention of its further regulation. This finding is in accordance with the results obtained by (3). Even though similar result was obtained in the case of sedge weed density in cotton, all the post sowing weed management practices were more (or) less having similar effect on the control of sedge weed except unweeded control. This might be due to minimum number of sedge weed occurrence and also the translocated effect of glyphosate applied on 30 (or) 40 DAS in all post sowing weed management practices except fluchloralin fb manual weeding and farmer's practice of manual weeding twice.

Table1: Effect of pre and post sowing weed management practices on density of grasses, sedges, BLW and total weeds (No. m^{-2}) at 60 DAS

Treatments	2003				2004			
Pre-sowing weed management practices	Grasses	Sedges	BLW	Total weeds	Grasses	Sedges	BLW	Total weeds
S_1-Normal sowing	13.84 (1.164)	1.57 (0.541)	21.40 (1.343)	36.81 (1.588)	13.58 (1.133)	1.20 (0.494)	20.37 (1.309)	35.15 (1.569)
S_2-SSB by slight hoeing	12.51 (1.137)	1.51 (0.533)	18.76 (1.280)	32.78 (1.503)	12.05 (1.081)	1.10 (0.482)	17.66 (1.249)	30.81 (1.516)
S_3-SSB by paraquat	11.01 (1.060)	1.33 (0.448)	12.96 (1.153)	25.30 (1.436)	9.88 (0.995)	1.04 (0.472)	13.08 (1.528)	24.00 (1.414)
SEd	0.019	0.006	0.043	0.011	0.028	0.004	0.040	0.010
CD (P=0.05)	0.054	0.018	0.120	0.030	0.078	0.012	0.113	0.030
Post-sowing weed management practices								
W_1-Fluchloralin 1.0 kg/ha-MW	16.36 (1.262)	1.29 (0.517)	23.18 (1.390)	40.85 (1.632)	14.31 (1.211)	0.97 (0.473)	20.74 (1.345)	36.02 (1.580)
W_2-Fluchloralin 1.0 kg/ha-glyphosate 1.5 kg/ha	11.24 (1.119)	1.15 (0.497)	15.84 (1.239)	28.23 (1.480)	10.33 (1.087)	0.85 (0.454)	14.59 (1.209)	25.77 (1.443)
W_3- Fluchloralin 1.0 kg/ha-glyphosate 1.0 kg/ha	13.85 (1.196)	1.17 (0.501)	19.96 (1.326)	34.98 (1.567)	12.36 (1.154)	0.88 (0.459)	18.19 (1.290)	31.43 (1.524)
W_4- MW-glyphosate 1.5 kg/ha	4.49 (0.806)	0.89 (0.460)	9.37 (1.046)	14.75 (1.244)	3.91 (0.767)	0.62 (0.418)	8.15 (0.997)	12.68 (1.166)
W_5- MW-glyphosate 1.0 kg/ha	7.37 (0.963)	0.99 (0.475)	11.09 (1.113)	19.45 (1.331)	6.55 (0.920)	0.68 (0.428)	10.24 (1.085)	17.47 (1.289)
W_6-MW (20 and 40 DAS)	9.42 (1.055)	1.05 (0.484)	14.47 (1.209)	24.94 (1.436)	8.11 (1.004)	0.78 (0.445)	12.73 (1.161)	21.62 (1.373)
W_7-Unweeded	24.70 (1.425)	3.78 (0.762)	30.03 (1.500)	58.51 (1.781)	20.46 (1.346)	3.01 (0.700)	32.29 (1.534)	55.76 (1.761)
SEd	0.037	0.024	0.035	0.012	0.045	0.023	0.040	0.013
CD (P=0.05)	0.075	0.050	0.073	0.026	0.093	0.046	0.081	0.027

Figures in parentheses are log(x+2) transformed values
Interaction not significant

Table 2: Effect of pre and post sowing weed management practices on N, P and K uptake by plants (kg ha^{-1}) and plant height (in cm) in cotton at 60 DAS.

Treatments	2003				2004			
Pre-sowing weed management practices	N	P	K	Plant Height	N	P	K	Plant Height
S_1-Normal sowing	49.92	4.78	22.75	35.14	62.11	5.55	27.56	36.20
S_2-SSB by slight hoeing	66.12	6.53	30.70	37.91	72.69	7.02	32.12	39.59
S_3-SSB by paraquat	78.07	7.42	34.71	39.75	85.61	8.16	38.09	41.39
SEd	5.77	0.547	2.485	0.946	4.81	0.533	2.156	1.075
CD (P=0.05)	16.01	1.520	6.902	2.629	13.34	1.481	5.987	2.987
Post-sowing weed management practices								
W_1-Fluchloralin 1.0 kg/ha-MW	24.55	4.05	16.33	33.22	47.09	4.40	21.03	34.85
W_2-Fluchloralin 1.0 kg/ha-glyphosate 1.5 kg/ha	64.59	6.29	30.87	36.63	79.86	7.12	34.79	38.52
W_3- Fluchloralin 1.0 kg/ha-glyphosate 1.0 kg/ha	44.31	4.35	21.07	35.22	63.28	5.09	26.32	36.16
W_4- MW-glyphosate 1.5 kg/ha	110.32	9.97	50.67	45.35	109.20	10.86	49.29	48.41
W_5- MW-glyphosate 1.0 kg/ha	99.96	9.12	41.85	41.97	104.10	9.79	42.39	42.18
W_6-MW (20 and 40 DAS)	81.78	7.64	36.35	40.55	89.89	8.55	40.37	41.57
W_7-Unweeded	17.42	2.32	8.56	30.26	20.86	2.54	13.27	31.75
SEd	8.37	0.675	3.583	1.282	7.62	0.721	3.022	1.336
CD (P=0.05)	16.98	1.369	7.269	2.600	15.46	1.463	6.131	12.710

Interaction not significant

Nutrient Uptake by Plants: A greater reduction in weed density in SSB by paraquat application enhanced the plant nutrient uptake of cotton which registered the N, P_2O_5 and K_2O uptake of 78.07, 7.42 and 34.71 kg ha^{-1} during 2003 and 85.61, 8.16 and 38.09 kg ha^{-1} during 2004 respectively (Table 2). The lower weed density obtained in the above promising pre-sowing weed management practice might be due to lesser amount of weed competition occurred throughout the crop period facilitated more nutrient uptake by cotton as reported by (2). The performance of SSB by slight being occupied second place in nutrient uptake by cotton. The post sowing weed management practice of manual weeding (20 DAS) fb glyphasate 1.5 kg ha^{-1} exhibited higher N, P_2O_5 and K_2O uptake of 110.32, 9.97 and 50.67 kg ha^{-1} during 2003 and 109.20, 10.86 and 49.29 kg ha^{-1} during 2004 respectively (Table 2). While manual weeding (20 DAS) and glyphosate 1.0 kg ha^{-1} was the next best practice to increase the uptake of N, P_2O_5 and K_2O. The effective suppression of weeds obtained at critical stages in the above post sowing weed management practices was reflected in increasing the nutrient availability for better uptake of nutrients by cotton crop.

Plant Height: Reduced weed density and higher plant nutrient uptake favoured the crop to grow taller (39.75 and 41.39 cm during 2003 and 2004 respectively) in SSB by paraquat application under pre-sowing weed management practice (Table 2). Similarly the post sowing weed management practice of manual weeding (20 DAS) fb glyphosate 1.5 kg ha^{-1} influences the plant height to the tune of 45.35 and 48.41 cm during 2003 and 2004 respectively. This was contributed by lesser weed density and better nutrient uptake recorded in this treatment.

Conclusion: According to the above results that pre sowing weed management practice of SSB by paraquat application @ 0.40 kg ha^{-1} and post sowing weed management of manual weeding on 20 DAS fb glyphosate @ 1.5 kg ha^{-1} are the most suited treatment in checking the weed density, increasing nutrient uptake of plants and enhancing plant height in summer irrigated cotton.

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