Indian J. Weed Sci. **42** (3 & 4) : 184-188 (2010)

Effect of Cultural Manipulation and Weed Management Practices on Weed Dynamics and Performance of Sweet Corn (*Zea mays* L.)

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ABSTRACT

A field experiment was conducted during the **rabi** 2004-05 and 2005-06 to study the effect of planting pattern and weed conrol practices on weed dynamics and productivity of sweet corn. Planting pattern of 60 x 20 cm with 83,333 plants/ha proved to be very effective in suppressing weeds, recording the lowest density of grasses, sedges and broad-leaved weeds at 30 and 45 days after sowing (DAS). At harvest also, it resulted in the lowest total weed density, weed dry weight with the highest weed control efficiency (WCE) and was at par with 75 x 16 cm. These two planting patterns were found to be significantly superior to 60 x 25 cm and 75 x 20 cm with 66,666 plants/ha. Though the highest cob length and green cob weight of sweet corn were realized with 60 x 25 cm, the green cob (13.9 and 13.2 t/ha) and green fodder yield (17.6 and 16.6 t/ha) were found to be the highest with 60 x 20 cm and resulted in higher net returns (Rs. 24, 987 and 23,024/ha). Pre-emergence application of atrazine @ 1 kg/ha followed by (fb) hand weeding at 30 DAS provided significant weed control during the citical crop-weed competition period in sweet corn upto 45 DAS. It also recorded the lowest total weed density and dry weight with the highest weed control efficiency at harvest, which resulted in the highest green cob yield (14.2 and 13.4 t/ha) and green fodder yield (18.0 and 17.1 t/ha) of sweet corn with enhanced net returns (Rs. 25,251 and 23,221/ha) and B : C ratio, though at par with two hand weedings at 15 and 30 DAS and pre-emergence application of atrazine @ 1 kg/ha fb post-emergence application of paraquat @ 0.5 kg/ha at 30 DAS. Uncontrolled weed growth throughout the crop growth period reduced the green cob yield to an extent to 40-42% during both the years of experiment.

Key words : Green cob yield, planting pattern, plant population, sweet corn, weed control practices

INTRODUCTION

Sweet corn, unlike seed corn is far less competitive in growth and offers ample scope for the development of weeds (Pierce, 1989). This factor coupled with higher nutrient requirement of the crop makes it susceptible to compete from heavy weed infestation. Weeds in sweet corn reduced the green cob yield by 56% compared to pre-emergence application of atrazine (Van Wychen *et al.,* 1999). Planting pattern is a cost effective technique that modifies the crop canopy structure and micro-climate, enhances crop competitiveness in weed suppression, improves the resource use efficiency and maximizes crop productivity. As sweet corn is a new plant type, there is an urgent need to fine-tune suitable agro-techniques for higher production and income to farmers. Therefore, these facts necessitate a study of cultural manipulation by different planting patterns in combination with weed control measures on weed dynamics as well as crop performance.

MATERIALS AND METHODS

Field experiment was conducted during two consecutive **rabi** seasons of 2004-05 and 2005-06 at S. V. Agricultural College Farm, Tirupati. The experiment was laid out in split plot design with three replications. The treatments comprised four planting patterns in main plots and four weed control practices in sub-plots (Table 1).

The soil was sandy loam in texture, low in organic carbon (0.25%) and available N (203.5 kg/ha), medium in available P_2O_5 (31.7 kg/ha) and K_2O (198.5 kg/ha). The seeds of variety Madhuri, a super sweet and succulent corn was dibbled at a depth of 4-5 cm in four planting patterns, as per the treatments. All the recommended package of practices except planting pattern and weed control were adopted during both the years of experimentation. Calibrated quantity of herbicides was applied as aqueous spray (600 l/ha) with knap sack sprayer. Pre-emergence application of atrazine @ 1 kg/

ha was done within 24 h after sowing of sweet corn. Post-emergence application of paraquat @ 0.5 kg/ha at 30 DAS was done as directed spraing in between the rows with the help of specially designed hood to maintain width of spray drift, without any effect on crop. Green cobs along with husk were harvested at milky stage. Data on weeds were recorded with a quadrat (0.5 x 0.5 m) at two places per plot. Weeds were counted and removed for recording their dry weights. These data were subjected to square root transformation ($\sqrt{X + 0.5}$) for statistical analysis.

RESULTS AND DISCUSSION

Effect on Weeds

During both the years of study, 23 weed species including six grasses, two sedges and 15 broad-leaved weeds were identified in the experimental field. Among these, *Panicum repens* (21.4%), *Digitaria sanguinalis* (18.5%),*Celosia argenta* (16.4%), *Acanthospermum hispidum* (15.5%) and *Cleome viscosa* (14.0%) were found to be the dominant weeds. The lowest density of grasses, sedges and broad-leaved weeds at 30 and 45 DAS was noticed with the planting pattern of 60 x 20 cm, however, it was at par with 75 x 16 cm (Table 1). The narrow row spacing of 60 cm along with higher plant population of 83,333 plants/ha, might have provided lesser space for weed emergence and modified the crp canopy structure, which in turn reduced the light transmittance to ground to stimulate weed growth upto 45 DAS as reported by Teasdale 1995). At harvest, the lowest total weed density and weed dry weight were obtained with 60 x 20 cm which were comparable with 75 x 16 cm (Table 1). Maximum WCE was recorded with 75 x 15 cm which was comparable to 60 x 20 cm spraying (Table 2). Higher plant population per unit area with these two planting patterns might have created better micro-environment to shift the balance in favour of crop, resulting in reduced weed dry weight. The higher density and biomass accumulation of weeds with lower weed control efficiency were registered with 75 x 20 and 60 x 25 cm of planting patterns. This might be due to sparse plant stand of 66,666 plants/ha, that allowed luxuriant weed growth, presumably due to the increased availability of growth resources to weeds. These results are in conformity with the findings of Choudhary (1981) and Tollenar *et al.* (1994).

With regard to weed control practices, the density of sedges at 30 DAS was found to be the lowest with hand weeding twice at 15 and 30 DAS, which was significantly lesser than with other two treatments that involved pre-emergence application of atrazine 1 kg/ha fb post-emergence application of paraquat 0.5 kg/ha at 30 DAS (Table 1). In this situation, first hand weeding imposed at 15 DAS might have significantly reduced the sedges than with the pre-emergence application of atrazine, which proved to be the least effective against them, especially *Cyperus iria,* as reported by Pandey *et al.* (1999). At 45 DAS, all the three weed control practices proved to be equally effective in controlling the second flush of weeds. This might be due to the hand weeding and post-emergence application of paraquat imposed at 30 DAS in the respective treatments to control weeds during the critical period of crop-weed competition in sweet corn upto 45 DAS. The highest weed control efficiency resulted with the integrated with management practice of pre-emergence application of atrazine 1 kg/ha fb hand weeding at 30 DAS, which was at par with other two weed conrol practices (Table 2). This was due to the effective control of weeds throughout the crop growth period. These results are in conformity with the findings of Reddy *et al.* (2004).

Effect on Crop

The higher stature of yield attributes i. e. cob length and green cob weight (with husk) was noticed with 60 x 25 cm and was at par with 75 x 20 cm which accommodated 66,666 plants/ha (Table 2). It was due to effective utilization of all the available growth resources by each individual plant without competition among the plant community, during any stage of crop growth. The inter-plant competition existed for the growth resources under higher plant population of 83,333 plants/ha with 60 x 20 cm and 75 x 16 cm that resulted in the reduced stature of cobs. But the highest green cob yield and green fodder yields were realized with these planting patterns. It was due to the cumulative effect of more number of plants accomodated per unit area. Duncan (1958) reported that the individual plant yield decreased with increasing plant population, whereas the yield per unit area would increase upto optimum plant population. The lowest green cob yield with 75 x 20 and 60 x 25 cm might be due to the inadequate plant stand and shortage of sink for fully utilizing the production potential of assimilates. Therefore, higher stature of cobs with these two planting patterns failed to over perform

Table 1. Effect of planting pattern and weed control practices on weed dencity (No./m^2) at 30 and 45 DAS and weed control efficiency of sweet corn

Treatments	At 30 DAS						At 45 DAS						Weed control efficiency (%)	
	Grasses		Sedges		BLW		Grasses		Sedges		BLW			
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Planting pattern (cm)														
60 x 20	3.38 (11.9)	3.53 (14.2)	7.27 (61.1)	7.49 (64.3)	3.39 (12.9)	3.17 (13.4)	3.04 (10.4)	4.02 (18.3)	6.10 (50.3)	6.65 (57.1)	2.82 (11.9)	3.53 (15.7)	54.9	59.0
75 x 16	3.06 (9.1)	2.87 (9.1)	6.69 (52.9)	6.97 (53.9)	3.07 (10.5)	2.65 (10.3)	2.79 (8.9)	3.28 (13.3)	5.41 (41.5)	5.92 (44.3)	2.40 (9.2)	2.98 (11.6)	62.9	63.5
60 x 25	4.07 (17.5)	4.92 (25.6)	8.40 (79.1)	8.72 (84.6)	4.36 (19.5)	4.29 (18.7)	4.18 (18.6)	5.15 (29.1)	7.62 (71.5)	8.21 (80.9)	3.68 (17.6)	4.42 (22.6)	45.8	54.5
75 x 20	3.88 (15.7)	4.61 (23.2)	8.08 (73.4)	8.41 (77.2)	4.15 (17.9)	3.89 (18.3)	3.74 (15.1)	4.86 (25.9)	7.15 (64.2)	7.72 (71.5)	3.31 (15.6)	4.16 (22.2)	47.2	44.9
LSD (P=0.05)	0.47	0.68	0.61	0.55	0.63	0.68	0.64	0.78	0.64	0.79	0.44	0.58	-	-
Weed control practices														
Weedy check	5.33 (28.3)	6.36 (40.9)	11.89 (142.1)	12.22 (150.0)	6.15 (37.9)	6.76 (46.3)	5.54 (31.6)	7.09 (50.8)	12.88 (166.6)	13.27 (177.5)	6.50 (42.4)	6.90 (48.1)	-	-
Two hand weedings at 15 and 30 DAS	2.89 (7.1)	2.79 (7.5)	3.88 (15.7)	4.12 (17.6)	3.08 (9.5)	2.80 (6.3)	2.76 (7.2)	3.38 (11.4)	4.34 (19.1)	5.05 (26.4)	2.02 (3.9)	2.75 (8.1)	77.7	77.5
Pre-emergence application of attrazine @1 kg/ha fb HW at 30 DAS	3.25 (10.4)	3.24 (11.5)	7.39 (55.2)	7.53 (56.9)	2.80 (7.1)	2.71 (4.1)	2.30 (5.0)	3.45 (12.3)	4.28 (18.8)	4.83 (23.3)	1.85 (3.2)	2.34 (5.5)	80.6	81.9
Pre-emergence application of atrazine @ 1 kg/ha fb post-emergence application of paraquat @ 0.5 kg/ha at 30 DAS	2.93 (8.5)	3.32 (12.2)	7.28 (55.1)	7.42 (55.4)	2.90 (6.5)	2.15 (4.1)	2.95 (8.5)	3.49 (12.1)	4.76 (22.9)	5.28 (28.6)	2.19 (4.7)	2.52 (6.4)	75.8	73.5
LSD (P=0.05)	0.37	0.61	0.72	0.61	0.93	0.82	0.85	0.46	0.11	0.51	0.35	0.62	-	-

Original data given in parentheses are subjected to square root transformation before statistical analysis.
HW–Hand weeding, DAS–Days after sowing, BLW–Broad-leaved weeds.

Table 2. Effect of planting pattern and weed control practices on the yield attributes, yield and economics of sweet corn

Treatments	Cob length (cm)		Green cob weight (g)		Green cob yield (with husk) (t/ha)		Green fodder yield (t/ha)		Net returns (Rs./ha)		Benefit : cost ratio	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Planting pattern (cm)												
75 x 16	18.5	17.6	189.7	182.6	13.18	12.60	16.62	15.78	23174	21532	3.25	3.09
60 x 20	19.0	18.3	198.6	192.0	13.97	13.19	17.61	16.69	24987	23024	3.43	3.23
75 x 20	20.6	20.2	212.5	207.3	10.93	10.38	13.87	13.02	17359	15827	2.65	2.50
60 x 25	21.2	20.7	220.2	218.7	11.78	10.93	15.02	14.12	19500	17235	2.86	2.64
LSD (P=0.05)	1.2	0.8	12.4	13.8	0.92	0.68	1.53	1.61	2310	2714	0.24	0.16
Weed control practices												
Weedy check	17.6	17.2	164.0	161.8	8.24	7.88	11.06	10.30	11262	10359	2.19	2.08
Two hand weedings at 15 and 30 DAS	20.1	19.4	213.6	208.7	13.52	12.74	16.22	15.56	23562	21372	3.19	2.99
Pre-emergence application of atrazine @ 1 kg/ha fb HW at 30 DAS	21.1	20.2	223.4	218.9	14.22	13.41	18.05	17.15	25251	23221	3.40	3.19
Pre-emergence application of atrazine @1 kg/ha fb post-emergence application of paraquat @ 0.5 kg/ha at 30 DAS	20.5	19.9	219.8	214.1	13.88	13.07	17.57	16.59	24310	22664	3.42	3.20
LSD (P=0.05)	1.2	1.0	19.7	17.7	0.93	1.00	1.87	1.73	2238	2507	0.23	0.24

HW–Hand weeding, DAS–Days after sowing.

the other two planting patterns as 60 x 25 and 75 x 20 cm, with respect to economic yield. The best planting pattern of 60 x 20 cm recorded 27.8 and 27.3% higher green cob yield over 75 x 20 cm, during 2004 and 2005, respectively. The outcome of present study corroborates with the findings of Raja (2001 and Sahoo and Mahapatra (2004). Maximum productivity of green cobs and fodder with 60 x 20 cm had ultimately resulted in the highest net returns of Rs. 24,987 and 23,024/ha and benefit : cost ratio during both the years of study.

Among the different weed control practices, pre-emergence application of atrazie 1 kg/ha fb HW at 30 DAS recorded the highest cob length, green cob weight which resulted in the highest green cob (14.2 and 13.4 t/ha), green fodder yield (18.0 and 17.1 t/ha) and net returns (Rs. 25,251 and 23,221/ha), which were statistically at par with pre-emergence application of atrazine 1 kg/ha fb post-emergence application of paraquat 0.5 kg/ha and hand weeding twice at 1 and 30 DAS. This might be due to the effective control of weeds as evidenced from the lowest weed density and dry weights, which provided congenial environment during the critical stages of crop-weed competition and resulted in better expression of growth and yield potential of sweet corn. Weeds allowed to grow during the crop season in weedy check deprived the crop for all the available growth resources and resulted in poor performance of sweet corn crop and reduced the green cob yield to an extent of 40-43% during both the years of experimentation. Similar results were also reported by Pandey *et al.* (2002).

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