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Weed Management in Spring Sugarcane Based Intercropping Systems

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ABSTRACT

Weed density and weed dry matter reduced significantly due to different weed control measures. Cane yield increased significantly with all the measures over weedy check and was highest under weed-free conditions though it was at par with manual hoeing 20, 40, 60 DAP and at harvest of intercrops. Cowpea was most effective in smothering weeds followed by greengram and blackgram. Cowpea, blackgram and greengram reduced cane yield by 5.2, 10.4 and 8.4%, respectively. Sugarcane+cowpea gave highest mean cane equivalent yield of 108.4 t ha^{-1} with net return of Rs. 68684 and B : C ratio of 2.24 as against 77 t ha^{-1}, Rs. 43264 and 1.44 with sole sugarcane. CEY and net return also followed the same trend. Atrazine greatly hampered the emergence of the intercrops.

INTRODUCTION

Sugarcane is the major cash crop in *tarai* belt of Uttaranchal and western parts of U. P. Accounting to delayed germination, slow growth and wider row spacing weeds cause 30 to 70% reduction in cane yields (Singh *et al.*, 1980). Intercropping not only gives additional yield and economizes sugarcane cultivation, but also suppresses weed growth. Intercropping can go a long way in economizing sugarcane cultivation with additional yields and their smothering effect on weeds, though it invites careful selection of weed management options. Therefore, the present investigation was carried out to devise appropriate weed management practices for various spring sugarcane based intercropping systems.

MATERIALS AND METHODS

A field experiment was conducted during 2000-01 and 2001-02 on silty clay loam soils, rich in organic carbon, medium in available P and K with pH 7.2 at Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar, U. S. Nagar (U.A.). Twenty treatments comprising combinations of four cropping systems (Sugarcane sole, and intercropped with cowpea, greengram and blackgram) and five weed management options (weedy, weed-free, manual hoeing at 20, 40, 60 DAP and after harvest of intercrop, pre-emergence application of pendimethalin at 1 kg a. i. ha^{-1}/atrazine at 1.5 kg a. i. ha^{-1}) were replicated thrice in factorial RBD. Sugarcane cv. Co Pant 90223 was planted in first week of March and raised with recommended package of practices and intercropped with cowpea, blackgram and greengram, two rows each as per treatment. Intercrops were sown on 10 March 2000 and 7 March 2001 during 2000-01 and 2001-02, respectively. In atrazine treated plots, the sowing of intercrops was done a month later. Cowpea was raised for green pods. Sugarcane crop was harvested on 10 February 2001 and 8 January 2002. Sugarcane was fertilized with 120 : 60 : 40 kg of N : P_2O_5 : K_2O/ha, whereas intercrops were given with 16 : 48 : 30 kg of N : P_2O_5 : K_2O on row basis. Blackgram and greengram were harvested on 10 July 2001 and 5 July 2002, whereas cowpea on 25 May 2001 and 20 May 2002 during 2000-01 and 2001-02, respectively.

RESULTS AND DISCUSSION

Cropping Systems

Intercrops had smothering effect on weeds as indicated by weed population and weed dry mater recorded at different growth stages (Table 1).. Cowpea proved most effective in controlling weeds followed by greengram and blackgram. Population of *Cynodon dactylon, Cyperus rotundus, Sorghum halepense* and other weeds reduced by 81.3, 63.1, 25.0 and 71.4% with cowpea as intercrop. Weed dry matter followed the similar trend with respective reduction of 67.5, 10.0, 13.0 and 62.5%. In pigeonpea+soybean intercropping systems, similar results were observed by Vyas *et al.* (2003).

Intercrops led to significant reduction in cane yield (Table 2). The reduction in yield was 5.2, 10.4 and 8.4% with cowpea, blackgram and greengram, respectively. The reduction was attributed to cumulative effect of lower number of millable canes and individual cane weight. Juice sucrose content did not vary due to cropping systems.

Cane equivalent yield was recorded to be highest in sugarcane+cowpea (108.4 t ha^{-1}) followed by sugarcane+greengram (77.8 t ha^{-1}), sugarcane+blackgram (77.4 t ha^{-1}) and sole sugarcane (77.0 t ha^{-1}). Ravichandran *et al.* (1996) have also recorded higher cane equivalents and net return with intercropping of blackgram. Among the intercrops, the highest yield of green pods was obtained with cowpea leading to highest cane equivalent yield (108.4 t ha^{-1}) and net returns (Rs. 68684) with B : C ratio of 2.24, all being significantly higher than other cropping systems including sole sugarcane.

Weed Management

The experimental field was infested with 15 weed species, of which seven belong to grassy weeds, seven to non-grassy weeds and one to sedge. *Cynodon dactylon, Cyperus rotundus, Sorghum halepense, Cleome viscosa, Digitaria sanguinalis, Panicum repense, Cirsium arvense* and *Amaranthus viridis* were identified in the experimental field. *C. rotundus* (54.0%), *C. dactylon* (21.3%) and *S. halepense* (16.4%) were the dominating weed species. All the weed control measures led to significant reduction in weed population. Hoeing at 20, 40, 60 days stages proved most effective in suppressing weed population and weed dry matter, irrespective of the species. Pre-

Table 1. Effect of cropping systems and weed management options on population and dry matter (g m^{-2}) of different species at 60 days after planting stage (Mean of two crop seasons)

Treatment	Weed population (No. m^{-2})				Total weed dry matter (g m^{-2})			
	C. rotundus	*C. dactylon*	*S. halepense*	Other weeds	*C. rotundus*	*C. dactylon*	*S. halepense*	Other weeds
Cropping systems								
Sugarcane sole	8.31 (32)	4.28 (19)	2.18 (8)	1.91 (7)	2.21 (8.0)	1.10 (3.0)	0.78 (3.0)	0.81 (2.4)
Sugarcane+Cowpea	1.58 (6)	1.85 (7)	1.61 (6)	0.52 (2)	0.61 (2.6)	0.75 (2.7)	0.62 (2.6)	0.48 (0.9)
Sugarcane+Blackgram	7.09 (28)	3.42 (12)	0.86 (3)	1.41 (5)	1.56 (6.4)	1.10 (4.0)	0.23 (1.0)	0.67 (2.0)
Sugarcane+Greengram	3.60 (14)	2.80 (8)	1.91 (7)	1.34 (4)	1.40 (5.2)	1.01 (3.7)	0.78 (3.0)	0.44 (1.0)
LSD (P=0.05)	0.68	0.60	0.30	0.12	0.28	0.20	0.06	0.10
Weed management								
Control	13.41 (66)	5.52 (26)	5.01 (20)	2.65 (10)	2.00 (8.5)	1.32 (7.0)	1.00 (4.2)	1.42 (3.1)
Hoeing at 20, 40, 60 and after harvest of intercrops	2.37 (5)	0.71 (2)	0.72 (2)	0.76 (2)	1.00 (4.2)	0.86 (2.6)	0.70 (1.3)	0.73 (1.0)
Pendimethalin at 1.5 kg a. i. ha^{-1}	5.69 (21)	3.28 (12)	1.32 (5)	1.32 (6)	2.20 (8.0)	0.86 (2.6)	0.72 (3.5)	0.89 (2.2)
Atrazine at 1.5 kg a. i. ha^{-1}	3.14 (8)	4.21 (17)	0.81 (3)	1.14 (5)	1.60 (7.0)	1.21 (4.5)	0.61 (3.0)	0.80 (1.3)
Weed-free	0.70 (0)	0.50 (0)	0.50 (0)	0.50 (0)	0.70 (0)	0.70 (0)	0.35 (0)	0.24 (0)
LSD (P=0.05)	0.76	0.63	0.34	0.14	0.24	0.32	0.13	0.16

Figures in parentheses indicate actual values, which were transformed to $\sqrt{X+0.5}$ for analysis.

Table 2. Effect of cropping systems and weed management options on crop performance and monetary returns (Mean of two crop seasons)

Treatment	NMC ('000 ha^{-1})	Cane yield (t ha^{-1})	Sucrose (%)	Cane equivalent yield (t ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	Benefit : cost ratio
Cropping systems							
Sugarcane sole	101	77.0	15.6	77.0	73150	43264	1.44
Sugarcane+Cowpea	96	73.0	15.9	108.4 (112.8)	102999	68684	2.24
Sugarcane+Blackgram	92	69.0	16.0	77.4 (3.12)	73549	42567	1.31
Sugarcane+Greengram	95	70.5	16.4	77.8 (2.84)	73872	42211	1.33
LSD (0.05)	NS	5.5	NS	8.6	891	3910	0.99
Weed management							
Control	85.8	59.5	15.5	70.5	66998	37663	1.28
Hoeing at 20, 40, 60 and after harvest of intercrops	101.3	79.0	16.2	94.0	89157	56342	1.71
Pendimethalin at 1.5 kg a. i. ha^{-1}	95.0	71.7	16.1	85.0	80845	49688	1.59
Atrazine at 1.5 kg a. i. ha^{-1}	89.5	67.6	15.7	79.32	75358	46260	1.51
Weed-free	108.5	84.2	16.4	97.0	92102	55954	1.80
LSD (P=0.05)	8.7	6.2	0.6	9.6	996	4372	0.11

Values in parentheses are intercrops yield (q ha^{-1}). NS–Not Significant.

emergence application of pendimethalin at 1.5 kg ha^{-1} proved more effective than atrazine in controlling *C. dactylon,* whereas reverse was noted for *C. rotundus. S. halepense* and other weeds equally suppressed pendimethalin and atrazine, however, the later had an adverse effect on intercrops. None of the treatments could reach to the level of weed-free conditions.

Cane yield was significantly influenced by weed control measures (Table 2). All the weed control measures increased cane yield remarkably over weedy check. Among the measures, hoeing at 20, 40, 60 and at harvest of intercrops proved better though it could not equalize to weed-free conditions. Almost similar trend was observed in respect of number of millable canes. Juice sucrose varied owing to weed management practices. Higher sucrose content (16.4%) was observed in weed-free crop as against atrazine (15.7%) and untreated crop (15.5%). Cane equivalent yield was recorded to be highest of 97.0 t ha^{-1} in crop grown under weed-free conditions though it was at par with that given hoeings at 20, 40, 60 days after sowing and at harvest of intercrops (94.0 t ha^{-1}) and significantly superior to others. A similar trend was followed by gross return. The net return and benefit : cost ratio were the highest with hoeing at 20, 40, 60 days stages and at harvest of intercrops.

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