

STUDIES ON THE EFFECT OF PLANTING PATTERNS AND WEEDING INTERVALS IN SORGHUM BASED INTERCROPPING SYSTEM ON WEED INFESTATION AND YIELD

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ABSTRACT

The influence of management practices like intercropping, planting patterns and weeding intervals on weed infestation and grain yield of sorghum were studied. Sole sorghum was a poor competitor with weeds but the competitive ability of cowpea intercropping with sorghum reduced the weed growth considerably. Weed free situation upto 15 days may be sufficient for obtaining optimum grain yield and net monetary returns from sorghum - cowpea intercropping system, whereas weed free upto 30 days was essential for sorghum intercropped with green gram or groundnut. The planting patterns had no impact on weed infestation and total grain yield.

KEY WORDS : Intercropping, Planting pattern, Weeding interval
Grain yield, Sorghum.

Sorghum crop suffers due to its initial slow growth and establishment and also because of growing under less favourable condition of rainy season where often highly efficient weeds establish prior to crop, resulting in poor yields. The percentage of yield reduction due to weeds in sorghum ranges from 6 to 40 (Gopalakrishna, 1977). This loss can be minimised by adopting suitable weed management practices.

The non conventional weed control methods or agronomical manipulation suitable for the small farmers could be successfully employed. Among several methods suggested, intercropping is one which prevents usurption of space by weeds and reduce weed growth by competition. Intercropping can be a method of weed management, if a suitable intercrop with proper agronomic traits is grown. With these

points in view, the present experiment was undertaken.

MATERIALS AND METHODS

Field trials were conducted in rainy seasons of 1979 and 1980 on sandy loam soil having neutral pH, low N and P₂O₅ and high K₂O content at the Agriculture College Farm, Hyderabad. The experiment was laid out in split plot design and replicated thrice. In first year, the main plot treatments comprised of five weeding intervals (no weeding, weed free upto 15, 30, 45 days and harvest) and subplot treatments were cropping systems (sole sorghum, sorghum + groundnut, sorghum + greengram and sorghum + cowpea). During second year, two planting patterns (normal and paired) with similar cropping patterns as main plot treatments and three weeding intervals (No weeding, weed free upto 15 and 30 days) as subplot treatments

were tried. The varieties of sorghum, greengram, groundnut and cowpea tried were CSH 5, PS 16, TMV 2 and C 152 respectively. Sorghum in normal planting was spaced 45 x 15 cm apart and 30-60-30 x 15 cm in paired planting. In all the treatments except in sole sorghum, cent per cent population of sorghum and 66% population of intercrop were maintained. The total rainfall received during crop growth period was 633 and 345 mm as compared to the normal value of 811mm. The recommended fertilizer dose of 80 : 40 : 40 N, P₂O₅ and K₂O kg ha⁻¹ was applied. Half of the dose of nitrogen with entire dose of P and K was applied as basal and the remaining nitrogen was given 30 days after sowing.

RESULTS AND DISCUSSION

In the present study, eighteen weed species were identified. Among them, *Lagasca mollis*, *Digitaria sanguinalis*, *Echinochloa colonum*, *Cyperus rotundus*, *Cynodon dactylon* and *Celosia argentea* were prominent. They accounted for 23.4, 22.5, 21.6, 11.5, 8.2 and 2.1 per cent respectively among the weed species. Weed number and weed dry matter production m⁻² were significantly influenced by cropping systems and weeding intervals in both years (Table 1). Growing of intercrops of greengram or groundnut or cowpea reduced the mean weed population by 17.8, 23.4 and 51.5 per cent respectively as compared to sole crop of sorghum at 90th day. Among the intercrops, cowpea was more efficient in controlling weeds as compared to other legumes due to its quick growth and well developed canopy structure. Similar weed dry matter was also influenced by these treatments. Cowpea intercrop with sorghum recorded lowest dry matter of weeds in both years followed by

greengram intercrop. These results were in accordance with Bantilan *et al* (1974). Similarly weed number and weed dry matter were significantly reduced with increase in weed free duration in both years. Further it was observed that the emergence of weeds was less after 30 days of weed free period and by that time crop growth was also aggressive due to which the drymatter of weed was reduced drastically in intercropping system and particularly with sorghum + cowpea.

The other characters such as leaf area index (LAI) and drymatter production of sorghum were maximum in sole sorghum and minimum in sorghum + cowpea intercropping system (Table 1). This might be due to competition of cowpea with sorghum. Similar competition of cowpea with sorghum was also reported by Enyi (1973). Further, increase in weed free duration caused significant increase in LAI and drymatter production of sorghum. This can be attributed to increased availability of nutrients, moisture and light to the crop plants due to removal of weeds.

Significantly highest drymatter of weeds was recorded in sole sorghum without weeding. Sorghum + cowpea with weed free upto 30 days recorded significantly lowest weed drymatter. This might be due to increase in total plant population per unit area and quick coverage of ground as compared to sole sorghum, resulting in higher competition against weeds. Similar effect due to intercropping of greengram was also reported by Moody (1978). Planting patterns had no effect on weed number and drymatter of weeds.

Total grain yield was significantly influenced due to intercropping systems, weeding intervals and their interaction. Planting patterns had no

Table 1. Weed number, drymatter of weeds, growth and yield of sorgham as influenced by different treatments.

Treatments	Weed number/ at 90th day		Drymatter of weeds (q/ha)		Shoot drymatter of sorghum (q/ha)		LAI of sorgham at 60th day		Test weight (g)		Sorghum grain Equivalent (g/ha)		
	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1977-80	1980-81	1979-80	1980-81	
Planting Patterns:													
(Normal Planting)	—	71 (8.41)	—	40.37	—	146.81	—	4.34	—	—	22.00	—	30.03
(Paired Planting)	—	76 (8.74)	—	44.31	—	148.47	—	4.34	—	—	21.56	—	29.93
S. Em ± CD at 5%	—	0.14	—	—	—	0.41 1.22	—	0.04	—	—	0.19	—	0.30
Planting systems													
1 (Sole sorghum)	108 (9.76)	106 (10.28)	21.03	53.79	197.29	149.25	5.46	4.51	22.82	22.17	43.93	31.00	31.00
(Sorghum + Groundnut)	91 (8.57)	73 (8.55)	17.73	45.36	194.75	148.26	5.14	4.42	22.88	22.08	46.77	30.43	30.43
(Sorghum + Green gram)	93 (9.01)	83 (9.09)	16.88	43.02	194.94	149.33	5.11	4.43	22.91	21.98	50.83	30.28	30.28
(Sorghum + Cowpea)	64 (7.13)	40 (6.35)	11.23	27.20	172.34	143.72	4.29	4.00	22.51	21.86	57.59	28.12	28.12
S. Em ± CD at 5%	0.15 0.44	0.20 0.60	0.40 1.16	1.73 5.21	1.50 4.33	0.57 1.73	0.06 0.19	0.05 0.16	0.44 NS	0.26 —	0.52 1.52	0.42 1.26	0.42 1.26
Weeding Intervals													
0 No weeding till harvest	211 (14.48)	126 (11.23)	38.16	78.14	114.63	84.67	3.34	3.19	20.14	19.93	24.87	15.54	15.54
1 Weed free upto 15 days	76 (8.60)	65 (8.05)	17.96	33.00	171.87	165.24	4.67	4.71	22.36	22.50	47.80	34.06	34.06
2 Weed free upto 30 days	39 (6.10)	41 6.43	7.17	15.85	217.60	193.00	5.47	5.12	23.26	23.63	57.82	40.34	40.34
Weed free upto 45 days	29 (5.29)	—	3.59	—	221.76	—	5.69	—	24.07	—	59.09	—	—
Weed free upto harvest	—	—	—	—	221.79	—	5.83	—	24.09	—	59.34	—	—
S.Em ± C.D. at 5%	0.18 0.64	0.14 0.40	0.50 1.77	1.38 3.97	2.08 6.80	0.59 1.70	—	0.05 0.13	0.50 1.67	0.24 0.68	0.76 2.49	0.39 1.14	0.39 1.14

Notes: The figures in parenthesis are square root transformed values.

Table 2. Weed drymatter production as influenced by interaction of planting patterns, cropping systems and weeding intervals at 90th day.

Treatment	No weeding (W1)		Weed free upto 30 days (W2)		Weed free upto 45 days (W3)		Weed free upto 45 days (W4)		Mean	
	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81
Normal planting of sorghum.	73.49	32.08	-	15.54	-	-	-	-	-	40.37
Paired sorghum.	82.83	33.94	-	16.16	-	-	-	-	-	44.31
Sole sorghum	42.87	92.17	25.44	46.88	10.61	22.32	5.21	-	21.03	53.79
Sorghum + Groundnut	41.49	76.13	19.39	41.81	7.16	18.13	2.83	-	17.73	45.36
Sorghum + Mungbean	38.63	79.69	16.76	33.67	7.89	15.70	4.25	-	16.88	43.02
Sorghum + Cowpea	29.63	64.65	10.23	9.68	3.03	7.27	2.03	-	11.23	27.20
Mean	38.16	78.14	17.96	33.00	7.17	15.85	3.59	-	-	-
					1979-80		1980-81			
					S.E.m	CD at 5%	S.E.m	CD at 5%		
					0.80	2.31	2.76	7.94		
					0.85	2.66	2.84	8.18		

(a) Difference between 2 sub plots at the same level of main plot.

(b) Difference between 2 main plots at the same level of sub plot.

Table 3. Total grain yield (q/ha) as influenced by interaction of planting patterns, cropping systems and weeding intervals.

Treatments	No weeding		Weed free upto 30 days		Weed free upto 45 days		Weed free upto harvest		Mean	
	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81
Normal planting	17.30	39.23	-	46.84	-	-	-	-	-	34.46
Paired sorghum.	17.43	38.58	-	47.69	-	-	-	-	-	34.56
Sole sorghum	19.87	16.85	38.47	32.72	50.50	43.45	54.33	-	59.50	31.01
Sorghum + Groundnut	20.70	15.21	44.16	37.08	54.74	48.81	57.17	-	57.07	33.70
Sorghum + Mungbean	23.07	16.98	48.68	39.39	61.31	47.84	60.05	-	61.05	34.74
Sorghum + Cowpea	35.83	20.43	59.87	46.42	64.73	48.96	64.79	-	62.72	38.06
Mean	24.87	17.36	47.08	38.91	57.82	47.26	59.09	-	59.34	-
					1979-80		1980-81			
					S.E.m	CD at 5%	S.E.m	CD at 5%		
					1.18	3.40	0.81	2.33		
					1.27	3.85	0.79	2.26		

(a) Difference between 2 sub plots at the same level of main plot.

(b) Difference between 2 main plots at the same level of sub plot.

Table 1. Net monetary returns (Rs ha⁻¹) as influenced by different treatments.

Treatments	No weeding		Weed free upto 30 days		Weed free upto 45 days		Weed free upto harvest		Mean
	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	1979-80	1980-81	
<i>Planting Patterns</i>									
Normal planting	-	3022	-	7517	-	-	-	-	5688
Paired sorghum.	-	3034	-	7691	-	-	-	-	5703
<i>Cropping systems</i>									
Sole sorghum	2195	3105	3885	7205	5186	-	5335	-	4297
Sorghum + Groundnut	2192	2427	4254	7600	5229	-	5141	-	4385
Sorghum + Mungbean	2515	3069	4777	7809	5528	-	5570	-	4817
Sorghum + Cowpea	3434	3513	5551	7864	5852	-	5622	-	5274
Mean	2584	3028	4617	7619	5449	-	5417	-	-

S.E.m CD at 5% 1979-80 1980-81

Cropping systems × weeding intervals
 (a) Difference between 2 sub plots at the same level of main plot.
 (b) Difference between 2 main plots at the same level of sub plot.

Planting patterns × weeding intervals
 (a) Difference between 2 sub plots at the same level of main plot.
 (b) Difference between 2 sub plots at the same level of main plot.

	1979-80	1980-81	S.E.m	CD at 5%	1979-80	1980-81	S.E.m	CD at 5%
(a)	95	273	138	396	97	NS	95	NS
(b)	98	293	135	388	95	NS	95	NS

impact on crop yields. Significantly highest total grain yield of 57.59 and 38.60 q ha⁻¹ was recorded in sorghum + cowpea in 1979-80 and 1980-81 respectively, while sole sorghum recorded the lowest. The increase in total grain yield was in the order of 6.5 and 8.7 with groundnut and 15.8 and 12.0 with green grass and 31.1 and 24.5 percent with cowpea intercropping with sorghum in both years respectively over sole crop of sorghum. These results showed that sorghum + cowpea system suppressed the weeds better than other cropping systems as it recorded low intensity and reduced accumulation of weeds. Among the weeding intervals, significant increase in grain yield was noticed in the treatments where weed free condition was maintained upto 30 days. The average yield increase from no weeding to weed free upto 30 days was 2.32 and 2.72 times during both the years respectively. This might be because of weed free environment kept during crop growth period which influenced the yield of intercrop as well as main crop of sorghum. Sorghum + cowpea intercropping was significantly superior over sole sorghum at all weeding intervals. Weed free till 15 days of cowpea intercropping recorded as much grain as that of weed free till harvest under sole crop of sorghum. These results showed that though the weed free condition was

better for the crop growth, extending after 30 days in sorghum intercropping system may adversely affect the crop yields. Cowpea was effective in suppressing weeds due to its early establishment and covering of maximum area in the field indicating more competitive ability against weeds.

Therefore maximum net monetary returns of Rs.5,274 and Rs. 6,329 ha⁻¹ in both years respectively were obtained from sorghum + cowpea intercropping system followed by sorghum + greengram intercrop (Table 4). Though sorghum + groundnut intercrop recorded significantly higher total grain yield as compared to sole sorghum, it was on par in relation to net monetary returns. This was due to the high cost of groundnut. Sorghum + cowpea intercrop system with 15 days weed free environment also recorded higher monetary returns as compared to sole crop of sorghum with weed free till harvest.

Thus these results conclusively proved that weed free situations till 45 and 30 days were essential if sole sorghum or sorghum in association with greengram or groundnut is taken up. However sorghum intercropped with one row of cowpea and provided 15 days weed free period may be sufficient for obtaining optimum grain yields and highest monetary returns.

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