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EFFECT OF INTERCROPPING AND WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF IRRIGATED SORGHUM

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ABSTRACT

Field experiments were conducted to evaluate suitable intercrops and weed management practices for sorghum based intercropping systems under irrigated condition at killikulam. The results revealed that higher growth and yield parameters, grain and stover yields were recorded in sole sorghum than sorghum intercropped with either blackgram or cowpea. Pre-emergence application of metolachlor 1.0 kg ha^{-1} + hand hoeing on 40 DAS increased the growth and yield attributes, grain and stover yields of sorghum. The interaction between intercropping and weed management practices also revealed that the growth and yield attributes and yields were highest in the intercropping sytem with sorghum + blackgram involving pre-emergence application of metolachlor at 1.0 kg ha^{-1} one hoeing on 40 DAS.

KEY WORDS: Sorghum, Blackgram, Cowpea, Intercropping, Weed management practices

Sorghum is the major cereal crop of the semi-arid tropics. It is grown during Kharif, Rabi and Summer seasons in Tamil Nadu. Comparing the production potential of sorghum in U.S.A., the productivity in India is low (989 kg ha^{-1}) (FAI, 1994). The lower productivity in sorghum is due to several constraints. Weed competition is considered to be one of the constraints in sorghum cultivation resulting reduction of yield to the tune of 30 to 88 per cent depending upon the degree of weed infestation (Shelke *et al.*, 1986). Sorghum is grown as sole and also as inter crop with pulses both under irrigated and rainfed conditions. Such intercropping may be considered as a potential biological tool to control weeds. But this system alone is not sufficient to ensure adequate weed control because of varied canopy coverage by different intercrops. Hence, an integrated approach was proposed to control weeds through manual and chemical weeding in addition to biological means of intercropping.

MATERIALS AND METHODS

Field studies were conducted in sorghum during Summer (Feb.-May' 95) and Rabi (Aug.-Dec.'95) at Agricultural College and Research Institute, Killikulam (Lat.8°.46' N, Long.77° 42'E and Elevation 40 M). The soil was sandy clay loam, low in available nitrogen, medium in P_2O_5 and high in K_2O. The experment was laid out in split plot design with three cropping systems viz., M_1 - Sole sorghum M_2 - Sorghum + blackgram and M_3 - Sorghum + Cowpea intercropping system in the main plots and six weed control treatments viz., S_1 - Butachlor 1.0 kg a.i. ha^{-1} + Hand weeding (HW) on 40 DAS. S_2 - Fluchloralin 1.0 kg a.i. ha^{-1} + HW on 40 DAS. S_3 - Pendimethalin 1.0 kg a.i. ha^{-1} + HW on 40 DAS. S_4 - Metolachlor 1.0 kg a.i. ha^{-1} + HW on 40 DAS. S_5 - HW twice on 20 and 40 DAS. S_6 - Unweeded control in subplots for first crop (during Summer season). One more additional weed control treatment i.e. S_7 - Isoproturon 0.6 kg a.i. ha^{-1} + HW on 40 DAS was included for second crop (during Rabi season). The herbicides were applied as pre-emergence to weed and crop. Sorghum variety Co.26, blackgram Co 5 and Cowpea Co 4 were used for this study. Sorghum was sown in paired rows (30 cm in the pairs and 60 cm between pairs). In between paired rows of sorghum, intercrops cowpea (Co 4) and blackgram (Co 5) were sown. The plant to plant spacing adopting were 15 cm for sorghum and 10 cm for blackgram and cowpea. The observations on, plant height and LAI were recorded on sorghum at 60 DAS and maturity respectively. The yield and yield parameters of sorghum and intercrops were recorded at maturity. Yield of intercrops were also recorded after harvesting at maturity.

RESULTS AND DISCUSSION

i) Effect of intercropping on sorghum

The results from the studies showed that the growth and yield of sorghum was affected due to

Table 1. Effect of intercropping and weed management practices on irrigated sorghum (Summer 1995, Killikulam, India)

Treatment	Plant height (cm)	LAI on (60 DAS)	Yield Parameters			Grain yield (kg ha^{-1})			Stover yield (t ha^{-1})
			No.of grains Panicle^{-1}	Paniele length (cm)	No.of rachis panicle^{-1}	Intercrop			
						Sorghum	Black gram	Cowpea	
Intercropping systems :									
Sole sorghum	171.9	7.18	1414	25.8	41.8	5062	-	-	16.03
Sorghum + blackgram	163.6	6.87	1349	24.1	39.4	4771	340	-	15.09
Sorghum + Cowpea	157.1	6.68	1256	23.1	37.8	4578	-	246	14.46
CD (P=0.05)	3.6	0.12	31	0.6	0.9	117	-	-	0.35
Weed control treatments :									
Butachlor 1.0 kg ha^{-1} + HW (40 DAS)	171.2	7.15	1395	25.6	40.1	5041	341	245	15.96
Fluchloralin 1.0 kg ha^{-1} + HW (40 DAS)	167.8	7.05	1366	25.1	39.3	4934	326	223	15.62
Pendimethalin 1.0 kg ha^{-1} + HW (40 DAS)	183.9	7.54	1499	27.5	43.1	5414	402	287	17.15
Metolachlor 1.0 kg ha^{-1} + HW (40 DAS)	193.4	7.82	1574	28.5	45.2	5698	417	291	18.00
HW twice (20 & 40 DAS)	174.7	7.26	1724	26.1	40.9	5143	352	258	16.28
Unweeded control	94.0	4.63	778	13.1	18.8	2572	201	169	8.15
CD (P=0.05)	3.9	0.12	32	0.6	1.0	127	26	19	0.37

the intercropping of blackgram and cowpea. The plant height at maturity of sorghum was reduced due to intercropping and the reduction ranged from 7.7 to 14.8 cm compared to that of sole sorghum. (Table 1 and 2). The leaf are index at 60 DAS was reduced at higher level in sorghum + cowpea than sorghum + blackgram intercropping system. The plant height and LAI reductions were higher under cowpea intercropping than with blackgram.

The sorghum grain yield loss due to intercropping with cowpea was higher (0.44 to 0.49 t ha^{-1}) than with blackgram. (0.26 to 0.29 t ha^{-1}) as compared to sole sorghum. This was due to the competition for nutrients and water between sorghum and intercrops. The full utilisation of intercepted radiation was the cause for improved growth parameters and yield of sole sorghum than the sorghum in intercropping system, according to Palaniappan and Sivaraman (1994). Among the intercropping systems, sorghum + blackgram at 2 : 1 ratio gave higher sorghum yield than sorghum + cowpea and this might be due to higher leaf area of the cowpea than that of blackgram.

ii) Effect of weed management practices on sorghum

The various weed control treatments improved the growth parameters viz., plant height, LAI and yield attributes (number of grains panicle^{-1}, number of rachis panicle and panicle^{-1} length) and increased its yielding ability. Application of metolachlor 1.0 kg a.i ha^{-1} + one hand hoeing on 40 DAS paved way for relatively higher growth and yield attributing characters than the other weed management practices followed. The unweeded check recorded the lowest growth and yield attributes. The yield of sorghum obtained from the different weed management practices revealed that the yield level improved by 1855 to 3126 ha^{-1} over unweeded control. The pre-emergence application of metolachlor 1.0 kg a.i ha^{-1} + one hand hoeing on 40 DAS recorded higher grain and stover yield of sorghum in both the seasons. The integrated weed management i.e., chemical um manual weeding technology caused 5.3 to 16.5 per cent yield increase over conventional weeding (hand weeding twice). This increased yield under the integrated weed management practice was due to efficient control of weeds. Since, sorghum based intercropping requires a weed free period upto 15 days of sowing (Kondep *et al.*, 1990). Pre-emergence application of metolachlor at 1.0 kg a.i. ha^{-1} effectively controlled the weeds during this period, which inturn favoured better crop growth, yield attributing characters and yield. The grain

Table 2. Effect of intercropping and weed management practices on irrigated sorghum (Rabi, 1995, Killikulam, India)

Treatment	Plant height (cm)	LAI (60 DAS)	Yield Parameters			Grain yield (kg ha^{-1})			Stover yield (t ha^{-1})
			No.of grains Panicle^{-1}	Panicle length (cm)	No.of rachis panicle^{-1}	Intercrop			
						Sorghum gram	Black gram	Cowpea	
Intercropping systems :									
Sole sorghum	159.7	6.80	1293	23.3	38.4	4672	-	-	14.62
Sorghum + blackgram	152.0	6.55	1235	22.7	36.1	4417	328	-	13.90
Sorghum + Cowpea	145.7	6.36	1181	21.7	34.8	4234	-	238	13.32
CD (P=0.05)	4.4	0.13	36	0.6	1.1	136	-	-	0.41
Weed control treatments :									
Butachlor 1.0 kg ha^{-1} + HW (40 DAS)	151.2	6.56	1239	22.3	36.8	4463	324	228	14.08
Fluchloralin 1.0 kg ha^{-1} + HW (40 DAS)	148.2	6.47	1214	21.9	36.1	4381	308	206	13.80
Pendimethalin 1.0 kg ha^{-1} + HW (40 DAS)	162.5	6.90	1332	24.1	39.4	4795	376	266	15.13
Metolachlor 1.0 kg ha^{-1} + HW (40 DAS)	190.0	7.73	1477	26.6	43.4	5308	398	291	16.76
Isoproturon 0.60 kg ha^{-1}+ HW (40 DAS)	171.0	7.16	1403	25.7	41.5	5042	385	278	15.92
HW twice (20 & 40 DAS)	154.3	6.65	1265	22.9	37.5	4554	333	239	14.37
Unweeded control	89.9	4.54	722	12.8	20.4	2526	181	151	7.57
CD (P=0.05)	3.4	0.10	28	0.5	1.1	102	21	14	0.31

yield in under unweeded control revealed the importance of weeding (2572 and 2526 kg ha^{-1} in Summer and Rabi season respectively).

Higher intercrop yields were also resulted when metolachlor 1.0 kg ha^{-1} applied as pre-emergence followed by one hand hoeing on 40 DAS. This treatment was on par with that of pendimethalin applied at 1.0 kg a.i. ha^{-1} and isoproturon at 0.60 kg a.i. ha^{-1} with one hand hoeing on 40 DAS during both the seasons. Mishra and Singh (1993) also reported that the pre-emergence application of pendimethalin controlled the weeds in the sorghum + blackgram system.

iii) Interaction effect

The positive effect on growth and yield of all the component crops by all the herbicides tested in this experiment established their suitability to sorghum based intercropping systems. Among them, metolachlor 1.0 kg a.i. ha^{-1} + one hoeing on 40 DAS was found suitable to sorghum as sole and as well as in intercropping system.

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