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Effect of row ratio on sorghum (*Sorghum bicolor*) + soybean (*Glycine max*) intercropping system in rainfed Vertisols

P. SUBBIAN AND R. SELVARAJU

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore 641 003

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ABSTRACT

A field experiment was conducted during north-east monsoon season of 1997–98 and 1998–99 at Coimbatore, to study the influence of different row ratios on yield and economics of sorghum [*Sorghum bicolor* (L.) Moench] + soybean [*Glycine max* (L.) Merr.] intercropping under rainfed vertisol conditions. Growing sorghum + soybean at 3:6 ratio was the best for getting higher grain yields, net returns and benefit : cost ratio.

Key words : Sorghum + soybean intercropping, Row ratio, Sorghum equivalent, Economics

The productivity of dryland crops is very low mainly because of low and erratic rainfall, poor soil fertility and improper choice of crops and cropping systems. Intercropping has long been recognized as a kind of biological insurance against risks under aberrant rainfall behaviour in dryland environment. Generally, short-duration legumes are selected as one of the component crops in cereal-based intercropping systems because of their ability to adopt well under such situations (Singh and Ahuja, 1990). Since sorghum occupies major area among the millets in the country and soybean, because of its gaining importance as a high value crop, the present investigation was carried out to develop an efficient sorghum+soybean intercropping system to optimize row ratios to suit dryland vertisols.

MATERIALS AND METHODS

A field experiment was conducted at Coimbatore during north-east monsoon (NEM) season of 1997–98 and 1998–99 to study the performance of sorghum + soybean intercropping system at different row ratios under rainfed conditions. The soil was black clay loam, low in available N (139 kg/ha), medium in available P (18 kg P_2O_5/ha) and high in available K (386 kg K_2O/ha). Sorghum genotype 'CSH 14' and soybean var. 'Co. 2' were used. The treatments consisted of 5 row ratios of sorghum + soybean, viz. 1:2, 2:1, 3:3, 2:4 and 3:6, with sole crops of sorghum and soybean. Different row ratios of sorghum and soybean were adopted based on the

importance of soybean, since in several dryland tracts soybean is replacing sorghum. The experiment was conducted in randomized block design with 3 replications. For intercropping system, the rows were spread at 30 cm apart uniformly. Sole sorghum was sown at 45 cm row spacing and sole soybean at 30 cm row spacing. A fertilizer dose of 80, 60 and 20 kg N, P and K/ha was adopted to all the treatments uniformly. Market price of sorghum and soybean was Rs 4/kg and Rs 12/kg respectively. During the cropping season, a total rainfall of 580 mm during 1997–98 and 620 mm during 1998–99 was received.

RESULTS AND DISCUSSION

Grain and fodder yield of crops

Among the different row ratios, the grain yield of sorghum during 1997–98 and 1998–99 was higher in 2:1 ratio of sorghum and soybean, followed by 3:6 and 1:2 ratio (Tables 1, 2). With regard to soybean, the seed yield was maximum at 3:6 row ratio, followed by 2:4 and 1:2 ratios during 1997–98,whereas the yield of soybean was maximum at 2:4 ratio, followed by 3:6 ratio during 1998–99. The sole sorghum and soybean recorded 2,129 and 1,258 and 1,096 and 873 kg/ha of grain yield during 1997–98 and 1998–99 respectively. The sorghum fodder yield was maximum under 2:1 ratio, being 20.06 tonnes/ha, while the sole sorghum recorded a fodder yield of 20.65 tonnes/ha.

The sorghum fodder yield was higher at 1:2 row ratio (7.83 tonnes/ha) while the sole sorghum gave a fodder yield of 9.94 tonnes/ha. Pooled analysis of the 2 years data (Table 3) also showed the same trend for grain and straw yields. Better use of space and time in addition with higher plant population due to double the row ratios when compared to sorghum resulted in higher grain yield of soybean. Sorghum gave better grain yields even at lower row ratios, propably owing to better growth with large ears by utilising the resources efficiently.

Sorghum-equivalent yield

Growing sorghum and soybean at 3:6 row ratio recorded higher sorghum-equivalent yield during 1997–98 and 1998–99 followed by 1:2 and 2:4 during 1997–98 and 2:4 and 1:2 row ratios during 1998–99. Among the row ratios, growing sorghum and soybean at 3:3 ratio gave the lowest sorghum equivalent in both the years. Sole sorghum gave less sorghum equivalent than sole soybean in both the years.

Economics

Intercropping of sorghum + soybean was found highly profitable when compared to sole cropping in Vertisols under rainfed condition. Sorghum + soybean at 3:6 ratio recorded at net return and benefit : cost ratio of Rs 16,078/ha and 3.90 during 1997–98 and Rs 10,361/ha and 3.96 during 1998–99 respectively. The sole sorghum has recorded a net return of Rs 8,204 and Rs 6,534/ha during 1997–98 and 1998–99, with a benefit : cost ratio of 1.98 and 2.87 respectively. The net return and benefit : cost ratio were the least with sole soybean during both years. Increased net returns owing to intercropping of sorghum with grain legumes over sole cropping of the

Table 1. Effect of row ratio on yield and economics of sorghum + soybean intercropping system (1997–98)

Row ratio		Sorghum plant height (cm)	Grain yield (kg/ha)		Land-equivalent ratio	Sorghum fodder (tonnes/ha)	Sorghum equivalent (kg/ha)	Test grain weight of sorghum (g)	Net return (Rs/ha)	Benefit : cost ratio
Sorghum	Soybean		Sorghum	Soybean						
1	2	155	1,482	713	1.35	15.83	3,620	23.9	12,287	2.98
2	1	149	2,022	361	1.28	20.06	3,105	22.3	11,192	2.71
3	3	158	1,259	559	1.10	15.74	2,935	23.1	11,652	2.83
2	4	160	1,225	738	1.25	13.46	3,438	23.1	10,152	2.46
3	6	162	1,774	836	1.60	16.88	4,282	22.5	16,078	3.90
Sole sorghum		179	2,129	-	1.00	20.65	2,129	23.8	7,412	1.80
Sole soybean		-	-	1,096	-	-	3,288	-	8,204	1.98
CD (P = 0.05)		11	272	399	-	3.16	318	1.2	2,170	0.19

Table 2. Effect of row ratio on yield and economics of sorghum + soybean intercropping system (1998–99)

Row ratio		Sorghum plant hight (cm)	Grain yield (kg/ha)		Land-equivalent ratio	Sorghum fodder yield (tonnes/ha)	Sorghum equivalent (kg/ha)	Test grain weight of sorghum (g)	Net return (Rs/ha)	Benefit : cost ratio
Sorghum	Soybean		Sorghum	Soybean						
1	2	174	894	559	1.35	7.83	2,571	28.3	9,412	3.69
2	1	169	1,139	388	1.35	7.65	2,303	25.7	9,227	3.71
3	3	162	841	480	1.22	6.07	2,281	26.7	7,863	3.25
2	4	159	776	664	1.38	6.10	2,768	26.6	9,321	3.66
3	6	168	971	632	1.49	6.86	2,867	27.2	10,361	3.96
Sole sorghum		186	1,258	-	1.00	9.94	1,258	25.1	5,105	2.41
Sole soybean		-	-	873	-	-	2,619	-	6,534	2.87
CD (P=0.05)		NS	199	95	-	0.81	360	1.6	472	0.28

Table 3. Effect of row ratio on yield and economics of sorghum + soybean intercropping system (pooled data of 2 years)

Row ratio		Grain yield (kg/ha)		Sorghum fodder yield (tonnes/ ha)	Sorghum equivalent (kg/ha)	Net return (Rs/ha)	Benefit : cost ratio
Sorghum	Soybean	Sorghum	Soybean				
1	2	1,188	636	15.83	3,096	10,850	3.34
2	1	1,581	375	20.06	2,704	10,210	3.22
3	3	1,050	520	15.74	2,608	9,758	3.04
2	4	1,001	701	13.46	3,103	9,737	3.06
3	6	1,373	734	16.88	3,575	13,220	3.93
Sole sorghum		1,694		20.65	1,694	6,259	2.11
Sole soybean			975		2,954	7,369	2.43
CD (P = 0.05)		227	85	3.16	295	530	0.25

same were also reported by Pal *et al.* (1993) and Patil *et al.* (1997).

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