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Performance of Soybean Varieties in Sorghum Based Cropping Systems in Relation to Yield*

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A field experiment was conducted at Coimbatore in South West monsoon 1978 to identify the shade tolerant soybean varieties under the sorghum based cropping systems. Performance of sorghum (Co. 21) was found better in paired row system. Maximum sorghum grain yield of 4304 kg per ha was recorded when grown with soybean. Application of 80 kg N per ha resulted in higher sorghum grain yield of 4356 kg per ha over 60 kg N per ha. Of the five soybean varieties tested viz. UGM_{20}, M_2, M_8, Cul. 27/8 and Punjab-1 as intercrop, the last one was highly tolerant to different shade levels and performed well both in uniform row system and paired row system and was followed by UGM_{28}. Intercrop yield of 335 and 202 kg per ha was recorded by Punjab-1 and UGM_{20} respectively. Lab-lab Co 9 recorded a highest green pod yield of 1241 kg per ha at 80 kg N in uniform row system. Maximum net return of Rs. 2939/- and Rs. 2841/- per ha were realised when sorghum was grown with lab-lab and soybean Punjab-1.

Increasing pressure on land leads to the intensive cropping system to make use of the available land, light and other resources. Short stature plants are usually shaded in inter-and mixed cropping systems and thereby the competition for light is intensified. Hence identification of shade-tolerant varieties is most useful for increasing crop production in intercropping system. The importance of soybean is being felt to meet the demands of protein and calories. There is a possibility to set up the soybean production as a mixed crop with millets. Lab-lab is a common pulse crop grown mixed with sorghum but information available is meagre. In general, the pulse crops when grown with cereals reduces the need for nitrogen of the main crop because of the symbiotic phenomenon. Hence two levels of nitrogen were included to study the response in the mixtures. The present study was designed to identify the shade tolerant soybean varieties in sorghum based cropping system based on growth and yield and to find out the possibility of reducing nitrogen dose in the mixtures.

MATERIAL AND METHODS

The study was taken at Central farm, Agricultural College and Research Institute, Coimbatore. The soil type was sandy clay/loam with a pH of 8.2 and the EC 0.4 millimhos per cm. The experiment was conducted in a split plot design with three replications. In the main plots the treatment combinatinos of sorghum + lab-lab and sorghum + soybean under different cropping systems and in sub-

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plots two nitrogen levels were imposed. Three cropping systems viz.. Sorghum in uniform row system with lab-lab var Co. 9 (C_1); Soybean varieties (C_2); and paired row system with soybean varieties (C_3) were adopted. The sorghum var. Co. 21 (S) was taken as base crop for the study. Five soybean varieties namely UGM_{20} (V_1), M_2 (V_2), M_3 (V_3), Cul. 27/8 (V_4) and Punjab-1 (V_5) were tested. Two levels of nitrogen 60 and 80 kg N per ha (N_1 and N_2) were included. The N was applied as urea to the treatments concerned in two split doses; one at the time of sowing and second on 35th day after sowing. A common dose of 60 kg P_2O_5 and 45 kg K_2O per ha was applied basally in all treatments in the form of superphosphate and muriate of potash. The seeds were sown in lines with a spacing of 60x9 cm in uniform row system and (30+60) x 12 cm spacing in paired row system in the levelled beds. Irrigation was given on the day of sowing, life irrigation on the fourth day and subsequent irrigations were given as and when felt necessary. The crops were harvested at maturity. The yield data recorded are discussed below.

RESULTS AND DISCUSSION

1. *Sorghum grain yield*: Grain yield was significantly influenced by the cropping systems and the nitrogen levels. The interaction between varieties and cropping systems were also significant (Table 1). Paired row system was found to be superior in grain yield than uniform row system. This may be due to additive effect of similar response observed under yield attributes such as earhead length, weight of ear head and 1000 grain weight. Among the N levels tested, the high N level recorded significantly higher grain yield than the low level. This is in agreement with theobservations of Krishnamoorthy *et al.* (1973) who recorded enhancement in grain yield with increasing levels of nitrogen in sorghum. Under any one cropping system grain yield was on par when grown with different soybean varieties. While comparing the systems of cropping under any one level of soybean varieties sorghum grain yield was uniformly higher in paired row system. There was slight reduction in sorghum grain yield when grown along with lab-lab.

2. *Sorghum straw yield*: Straw yield was significantly influenced by the intercrops, the cropping systems and the nitrogen levels (Table II). Maximum straw yield was recorded when grown along with UGM_{20}. Sorghum planted in paired row system (C_3) recorded higher straw yield as compared to the uniform row planting (C_2). This may be attributed to increased competition between plants under C_2 than in C_3 system. Sorghum var Co. 21 being a Semi-tall variety the competition between plants in the rows would have caused a reduced straw yield in C_2 system. The N_2 level recorded higher straw yield than N_1 level.

3. *Seed yield of intercrops*: The seed yield was significantly influenced by varieties, cropping systems and the nitrogen levels. The interaction between

nitrogen levels and varieties was also significant (Table III). Punjab-1 recorded an average of 292 kg per ha and found better than other varieties. It was followed by UGM $_{20}$ and Cul 27/8. The varieties M_2 and M_3 recorded an average yield of 112 and 91 kg per ha respectively and were on par. The increased yield in Punjab-1 may be due to earliness of 10 days in flowering and maturity. This earliness would have helped to overcome the effect of shading in the critical stages. Soybean varieties registering increased yield of 30 percent was noted in C_2 system over C_3 system. An enhanced yield of 35 per cent was realised at N_2 level in soybean varieties over the N_1 level. This effect may be due to the total responsiveness to the increased N_2 because of lack of nodulation in the field studied due to salinity and under such condition nitrogen could not be reduced. Interaction between N levels and soybean varieties revealed that all the five varieties tested have recorded higher yields at N_2 level than N_1. While comparing the varieties at any one N level, the yield was in the order of Punjab-1, UGM $_{20}$, Cul 27/8, M_3 and M_2. Similar trend of response in the characters such as leaf area and number of branches per plant were observed due to the effect of soybean varieties, cropping systems and N levels. This corresponding influence would have increased the photosynthetic efficiency and yield attributes to a greater degree. As a result there was increasd seed yield per plant also. In lab-lab there was no influence in green pod yield by N levels applied.

4. *Stover yield of intercrop* : The stover yield was influenced by varieties, cropping systems and the nitrogen levels (Table IV). Among the varieties tested, Punjab-1 recorded maximum yield of 709 kg per ha whereas the lowest was recorded by M_2. The uniform row planting was found to be superior in recording maximum stover yield than the paired row system. The N_2 level increased the stover yield than N_1 level. The interaction between varieties and cropping systems was significant. In general under all the soybean varieties, uniform row planting was better. Under any one cropping system no clear indication was seen. Stover yield was also not significant due to N levels tested in the case of lab-lab.

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Table I Sorghum Grain Yield (kg/ha)

N levels Varieties	Cropping Systems	C_2			C_3			Mean	N levels varieties	N_1	N_2
		N_1	N_2	Mean	N_1	N_2	Mean				
V_1		4221	4312	4267	4277	4379	4328	4297	V_1	4249	4345
V_2		4242	4322	4282	4286	4371	4329	4305	V_2	4264	4346
V_3		4230	4704	4267	4280	4421	4351	4309	V_3	4255	4362
V_4		4209	4316	4262	4309	4397	4353	4307	V_4	4259	4356
V_5		4150	4321	4235	4311	4430	4371	4303	V_5	4230	4375
Mean		4210	4315	4262	4292	4399	4346	4304	Mean	4251	4353
									L	4164	4231

Source	*Harvest stage*	
	SE d	CD
Sorghum lab-lab-Vs Rest	11.52	24.20
Varieties	10.98	N. S.
Cropping systems	6.94	14.60
V x C	15.53	32.64
N	7.69	16.06
N at sorghum lab-lab	24.34	N. S.
N at Rest	7.69	N. S.
Sorghum lab-lab-Vs Rent at any one N level	24.32	N. S.
N at V	17.21	N. S.
V at N	16.39	N. S.
N at cropping system	10.88	N. S.
Cropping system at N	10.35	N. S.

Table II Straw Yield of Sorghum (kg/ha)

N levels / Varieties	Cropping Systems C_2 N_1	C_2 N_2	C_2 Mean	C_3 N_1	C_3 N_2	C_3 Mean	Mean
V_1	16552	18108	17329	16784	18596	17690	17510
V_2	16514	18123	17318	16983	18124	17553	17436
V_3	16549	17679	17114	16557	18067	17312	17213
V_4	16817	17790	17303	16798	18004	17401	17352
V_5	16627	18098	17362	16781	18120	17450	17406
Mean	16611	17959	17285	16780	18182	17481	17383

N levels / Varieties	N_1	N_2	Mean
V_1	16668	18352	17510
V_2	16748	18124	17436
V_3	16553	17873	17213
V_4	16807	17897	17352
V_5	16703	18109	17406
Mean	16574	17986	17280
L	16574	17986	17280

Source	*Harvesting stage* SE d	C. D.
Sorghum, lab-lab Vs Rest	142.23	N. S.
Varieties	135.61	282.90
Cropping systems	85.77	178.92
V x C	191.79	N. S.
N	97.59	202.41
N at sorghum lab-lab	323 68	N. S
N at Rest	102.35	N. S
Sorghum lab-lab Vs Rest at any one N level	221.45	N. S
N at V	228.88	N. S
V at N	211.15	N. S
N at cropping systems	144.75	N. S
Cropping systems at N	133.54	N. S

Table III Seed Yield of Inter Crops (kg/ha)

N levels Varieties	Cropping Systems C_2			C_3			Mean	N levels varieties	N_1	N_2	Mean
	N_1	N_2	Mean	N_1	N_2	Mean					
V_1	171	219	205	151	185	168	186	V_1	161	202	186
V_2	94	117	105	62	94	78	91	V_2	78	105	91
V_3	102	170	136	74	103	89	112	V_3	88	136	112
V_4	126	193	160	118	146	132	146	V_4	122	170	146
V_5	297	366	331	199	305	252	292	V_5	141	190	165
Mean	162	213	187	121	166	144	165	Mean	141	190	165
								L	1027	1241	1134

Source	*Harvesting stage*	
	SE d	CD
Varieties	11.39	23.95
Cropping systems	7.20	15.14
V x C	16.11	N. S,
N	4.09	8.53
N at V	9.14	19.08
V at N	13.10	27.49
N at cropping systems	5.78	N. S,
Cropping systems at N	8.28	N. S,
lab-lab Vs N levels	64.82	N. S,

Table IV Stover Yield of Inter Crops (kg/ha)

N levels / Varieties	Cropping Systems C_2 N_1	C_2 N_2	C_2 Mean	C_3 N_1	C_3 N_2	C_3 Mean	Mean	N levels / Varieties	N_1	N_2	Mean
V_1	759	840	799	558	649	603	701	V_1	659	745	701
V_2	547	643	595	472	529	500	548	V_2	510	586	548
V_3	554	656	605	457	559	508	557	V_3	506	608	557
V_4	647	727	687	571	716	643	665	V_4	609	722	665
V_5	727	771	749	632	706	669	709	V_5	680	739	709
Mean	647	727	687	538	632	585	636	Mean	593	680	636
								L	964	1064	1014

Source	*Harvesting stage* SE d	C. D.
Varieties	37.50	78.81
Cropping systems	23.72	49.84
V x C	53.04	111.45
N	6.58	13.74
N at V	14.72	N. S
V at N	38.92	N. S
N at cropping system	9.31	N. S
Cropping system at N	24.61	N. S
Lab-lab at levels	6.11	28.33