

Production potential and economics of different sorghum (*Sorghum bicolor*)-based cropping systems at Akola

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ABSTRACT

A field experiment was conducted during the rainy seasons of 1987-90 on Vertisols to assess production potential and economics of different sorghum [*Sorghum bicolor* (L.) Moench]-based cropping systems at Akola, with 4 cropping systems, 3 fertilizer levels with 2 checks. Sorghum with recommended dose of fertilizer 80, 40 and 40 kg N, P and K/ha + farmyard manure @ 1,000 kg/ha recorded higher yield, whereas sorghum + pigeonpea [*Cajanus cajan* (L.) Millsp.] in 3 : 3 ratio gave more monetary return when applied with 80, 40 and 40 kg N, P and K/ha than all the other cropping systems.

Intercropping is a potential system of crop production in semi-arid tropics and it provides substantial yield compared to sole cropping. The advantages may be especially important because they are achieved not by means of costly inputs, but by simple expedient of growing crops together (Willey *et al.*, 1980). Intercropping of sorghum [*Sorghum bicolor* (L.) Moench] and pigeonpea [*Cajanus cajan* (L.) Millsp.] has been in practice for long in sorghum-growing areas of country. To generate information on yield potential of different sorghum-based cropping systems with different levels of fertilizer, this study was undertaken.

MATERIALS AND METHODS

The experiment was conducted during the rainy seasons of 1987-90 on Vertisols at Akola. The soil was low in total N (0.035%), very poor in available P (8.3 kg/ha) and medium in K (310 kg/ha).

Treatment comprised 4 cropping systems,

viz. C₁, sorghum intercropped with fodder cowpea [*Vigna unguiculata* (L.) Walp.] (paired row 30/90 for sorghum with 2 rows of cowpea); C₂, sorghum intercropped with pigeonpea (3 : 3 row proportion); C₃, sorghum with additional application of decomposed farmyard manure @ 1,000 kg/ha; and C₄, sole crop of sorghum, and 3 levels of N, P, K fertilizer, viz. F₁, 80, 40 and 40 kg/ha; F₂, 20, 20 and 20 kg/ha; and F₃, 20, 10 and 10 kg/ha respectively. In addition to the above 12 treatment combinations, 2 check treatments, viz. CH₁, sorghum with farmyard manure and CH₂, sole sorghum without application of farmyard manure or NPK were also included. 'CSB 9', 'C 11' (pigeonpea) and 'EC 54216' (fodder cowpea) were used. Experiment was laid out in randomized block design with 3 replications with a plot size of 9 m × 6.3 m (gross) and 7.5 m × 5.4 m (net). Sowing was done on 15 July 1987, 3 July 1988, 7 July 1989 and 26 June 1990.

Table 1. Grain and fodder yields (kg/ha) as influenced by different treatments (1987-88)

Treatment	Grain yield (kg/ha)					Fodder yield (kg/ha)				
	1987	1988	1989	1990	Mean	1987	1988	1989	1990	Mean
C ₁ F ₁	1,304	1,543	3,448	3,580	2,468	3,415	5,594	7,028	6,994	5,757
C ₁ F ₂	1,259	1,461	2,724	2,814	2,064	3,004	5,175	6,913	6,088	4,545
C ₁ F ₃	880	913	2,295	2,230	1,579	3,086	4,402	5,028	4,691	4,301
C ₁	1,148	1,306	2,822	2,874	2,037	3,168	5,057	6,323	5,924	5,118
C ₂ F ₁	1,094	1,281	3,085	3,116	2,346	3,497	4,715	5,653	5,596	4,865
C ₂ F ₂	650	955	2,616	2,599	1,705	2,633	4,074	4,806	3,866	3,844
C ₂ F ₃	609	871	2,213	2,057	1,437	1,646	3,580	4,032	3,048	3,076
C ₂	784	1,035	2,638	2,590	1,761	2,592	4,123	4,830	4,170	3,928
C ₃ F ₁	2,074	2,419	4,337	4,288	3,279	4,979	6,790	8,106	8,971	7,211
C ₃ F ₂	1,242	1,575	3,662	3,744	2,555	5,637	7,199	9,028	5,596	6,865
C ₃ F ₃	1,020	1,133	2,888	2,905	1,986	4,115	4,607	6,065	4,444	4,807
C ₃	1,445	1,709	3,629	3,645	2,607	4,910	6,198	7,733	6,337	6,294
C ₄ F ₁	1,596	2,340	4,048	3,892	2,969	3,539	4,155	5,505	6,007	4,801
C ₄ F ₂	1,325	1,720	3,530	3,522	2,524	2,469	3,199	4,357	4,691	3,679
C ₄ F ₃	1,111	1,034	2,822	2,740	1,926	2,967	4,088	3,876	3,538	3,867
C ₄	1,344	1,698	3,466	3,384	2,474	3,325	3,814	4,577	4,745	4,115
Check 1	1,128	1,103	1,678	1,349	1,314	4,054	3,990	3,300	2,716	3,515
Check 2	773	896	1,489	1,094	1,063	3,827	3,086	3,061	2,057	3,007
F ₁	1,516	1,896	3,728	3,719	2,714	3,857	5,313	6,573	6,892	5,658
F ₂	1,118	1,429	3,133	3,169	2,212	3,435	4,911	6,274	5,060	4,920
F ₃	903	987	2,555	2,483	1,732	3,203	4,169	4,750	3,930	4,013
<i>CD (P = 0.05)</i>										
N = 14	NS	065	277	239		1,043	142	449	664	
C	NS	111	165	138		560	064	308	407	
F	NS	096	144	118		483	054	261	347	
C × F	NS	195	NS	NS		970	116	225	703	

N = 14, No. of treatments 14

Details of treatments are given under Materials and methods

Table 2. Grain yield of pigeonpea, green-fodder yield of cowpea (kg/ha) and net monetary returns (Rs/ha) as influenced by different treatments (1987-90)

Treatment	Intercrop yield (kg/ha)				Mean	Net monetary returns (Rs/ha)				Mean
	1987	1988	1989	1990		1987	1988	1989	1990	
C ₁ F ₁	133*	217	243	382	243	2,445	4,264	6,162	8,281	5,288
C ₁ F ₂	192*	205	219	320	234	2,405	4,141	6,438	6,635	4,904
C ₁ F ₃	185*	221	193	296	223	2,077	2,750	4,814	4,913	3,638
C ₁						2,309	3,718	5,804	6,610	4,612
C ₂ F ₁	400 (750)	980 (1,050)	830 (1,260)	760 (1,144)	742 (1,055)	6,043	9,301	11,818	14,198	10,340
C ₂ F ₂	280 (680)	760 (880)	660 (980)	550 (880)	562 (878)	4,489	6,969	9,708	10,559	7,931
C ₂ F ₃	180 (530)	700 (870)	590 (830)	450 (748)	480 (744)	2,868	6,351	8,284	8,138	6,410
C ₂						4,467	7,540	9,936	10,965	8,227
C ₃ F ₁						4,857	7,080	9,681	11,042	8,165
C ₃ F ₂						4,455	5,836	9,457	8,326	7,018
C ₃ F ₃						3,225	3,554	6,637	6,341	4,939
C ₃						4,179	5,490	8,592	8,570	6,707
C ₄ F ₁						3,220	5,393	7,723	8,171	6,129
C ₄ F ₂						2,413	3,813	6,205	7,431	4,965
C ₄ F ₃						3,311	3,095	5,205	5,503	4,278
C ₄						2,985	4,100	6,480	7,023	5,147
Check 1						3,434	3,274	3,207	2,657	3,143
Check 2						2,827	2,350	2,823	1,829	2,457
F ₁						4,143	6,509	8,846	10,423	7,480
F ₂						3,440	5,189	7,977	8,238	6,211
F ₃						2,870	3,937	6,253	6,224	4,821
CD (P = 0.05)										
N = 14						1,997	286	864	693	
C						1,203	176	842	491	
F						1,042	153	727	427	
C x F						2,082	306	1,458	854	

N = 14, No. of treatments 14; * Green fodder of cowpea

Figures in parentheses are straw yield of pigeonpea

Prevailing prices (Rs/kg): sorghum grain 2.10, 1.40, 1.59, 1.80; sorghum fodder 0.60, 0.70, 0.60, 0.60; pigeonpea seed 5.24, 8.42, 6.20, 8.45; pigeonpea stalk 0.30, 0.30, 0.30 and 0.70 during 1987, 1988, 1989, 1990 respectively

RESULTS AND DISCUSSION

The maximum grain production was recorded by treatment C_3F_1 treatment (Table 1). It was significant during all the years except during 1987, followed by C_3F_2 except during 1987. Treatment C_3 proved best amongst the other cropping systems. It showed significant trend during 1988-90 seasons, but non-significant results during 1987. Application of recommended dose of NPK recorded significantly higher yields than rest of the doses. Interaction of cropping system $\times$ fertilizer level was found significant only during 1988 season.

Means of 4 years indicated that the maximum fodder yield was recorded under C_3F_1 . In respect of cropping system C_3 found significant than all the other cropping systems. Considerable reduction in fodder yield was recorded in C_2 . Full dose (80, 40 and 40 kg NPK/ha) was significant, giving higher fodder yields during all the years than the other levels of fertilizer.

N, P and K @ 80, 40 and 40 kg/ha proved the best in respect of green-fodder weight of cowpea and pigeonpea during all the years than other reduced rates of fertilizer.

Significantly higher monetary returns were observed (Table 2) under C_2 system than C_4 system (sole sorghum), the increase

being 22% over sole sorghum. Full dose of fertilizer also found significantly superior than lower levels of fertilizer. The increase in monetary return was 20.43 and 55.15% over half and one-fourth levels of fertilizer respectively. Cropping system C_2 with full dose of fertilizer was found significantly superior to the other cropping systems with other fertilizer combinations during all the years. These results are in accordance with Willey *et al.* (1980), Tarhalkar and Rao (1981) and Rao *et al.* (1981).

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