

STUDY ON THE POPULATION REQUIREMENT FOR SORGHUM BASED COWPEA INTERCROPPING SYSTEM UNDER RAINFED CONDITION

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Field experiments were conducted for three years from 1982-83 to 1984-85 during *Rabi* season to study the optimum population requirement for dryland under Sorghum based Cowpea intercropping system at Agricultural Research Station, Kovilpatti. The results revealed that raising 100 per cent population of base crop sorghum with 50 per cent population of cowpea as intercrop arranged in paired row at 2 : 1 ratio (30 X 15 + 60 cm) was found to record maximum sorghum grain yield, total grain yield, LER, net return and sorghum equivalent. It was also observed that maintaining 100 per cent population of cowpea as intercrop did not have adverse effect on the yield of 100 per cent population of sorghum, while maintaining of 100 per cent population of sorghum affected the grain yield of cowpea when its population stood to 100 per cent. The result further indicated that under additive series, the total population under intercropping system should not exceed 150 per cent.

Moisture is the limiting factor in dryland, which mostly depends on rainfall. There is variation from year to year at Kovilpatti tract in respect of quantity and distribution of rainfall resulting in wide fluctuations in the available soil moisture. A change in available soil moisture may affect differently to different crop population levels under rainfed and thus on grain yield. Hence, a study was necessary to find out optimum population level under intercropping system. Intercropping has been found successful, where the annual mean rainfall is more than 750 mm. It was reported that cowpea was found to be the best suitable intercrop for the base crop of Sorghum for Kovilpatti tract. (Selvaraj, 1978, Balasubramanian 1984) but the optimum plant population for this intercropping system has not been worked out so far for the black soil tract of

Kovilpatti taluk; where a maximum of 450 mm rainfall is received during the crop period (15th October to 15th February). Hence, the present study was taken at the Agricultural Research Station, Kovilpatti to find out the optimum crop population to be maintained for intercropping system under rainfed condition with maximum possible grain yield per unit area in the sorghum based intercropping system.

MATERIALS AND METHODS

Field experiments were conducted at Agricultural Research Station, Kovilpatti during *rabi* season from 1982-83 to 1984-85 under rainfed condition. The soil type was black clay with a field capacity of 32 per cent and a wilting point value of 15 per cent. CSH 6 Sorghum was the test base crop for

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Table : 1 Rain fall data

Meteoro- logical standard week No.	Period	1982-83		1983-84		1984-85	
		Rain- fall (mm)	Rainy days	Rain- fall (mm)	Rainy days	Rain- fall (mm)	Rainy days
42	October 15-21	3.0	1	108.3	3	—	—
43	22-28	92.6	5	78.5	2	73.5	3
44	29-Nov. 4	71.9	5	80.2	4	21.5	1
45	5-11	15.2	2	79.7	2	23.8	2
46	12-18	24.3	4	—	—	35.6	3
47	19-25	5.9	1	3.0	1	—	—
48	26-Dec. 2	3.8	1	6.9	1	20.6	1
49	3-9	51.8	2	5.9	2	0.5	—
50	10-16	4.0	1	11.0	2	—	—
51	17-23	0.3	—	16.9	1	—	—
52	24-31	—	—	26.5	2	—	—
	Jan. 1-7	—	—	16.0	1	135.6	3
2	8-14	—	—	3.3	1	—	—
3	15-21	—	—	34.2	3	44.5	1
4	22-28	—	—	—	—	—	—
5	29-Feb. 4	—	—	—	—	2.0	—
6	5-11	—	—	43.9	3	—	—
7	12-18	—	—	38.7	3	—	—
	Total	272.8	22	523.0	31	357.6	14

1982-83 and 1983-1984, while Co. 23 was the test base crop for 1984-85 Co. 3 Cowpea was the test intercrop for the three years of study. The treatments studied were: T 1: Sorghum (Sole crop) 100 per cent population (1,48,000 plants/ha; 45x15 cm.)

T 2: Cowpea (Sole crop) 100 per cent population 1,48,000 plants/ha-45x15 cm)

T 3: Sorghum 100 per cent population Cowpea 100 per cent population (45 x 15 cm.)

T 4: Sorghum 50 per cent population + Cowpea 50 per cent population 1:1 (45 x 15)

T 5: Sorghum 100 per cent population + Cowpea 50 per cent population (2:1) Paired row 30x15cm + 60 cm.

T 6: Sorghum 50 per cent population Cowpea 100 per cent population (1:2) paired row - 30 x 15 cm + 60 cm.

The experiments were conducted in randomised block design with four replications. A manurial schedule of 40 kg. N and 20 kg P_2O_5 per hectare was applied uniformly as entire basal to all treatments except treatment T 2 where 20 kg N and 40 kg P_2O_5 per hectare was applied. The experiments were sown on 16.10.1982, 18.10.1983 and 26.10.1984 respectively for the years 1982-83, 1983-84 and 1984-85. A plot size of 7.20 x 3.60 m² was adopted for this study. Sorghum and Cowpea grain yield were recorded and from this, total grain yield, LER and sorghum equivalent were computed. Net return also was computed from the total return and total cost. The rainfall received during the cropping seasons is furnished in Table-1. Sorghum and cowpea grain yield, total grain yield, LER are furnished in Table-2 and Sorghum equivalent and net return data are furnished in Table-3. Sorghum equivalent was calculated as per the method suggested by De *et al.*, (1978).

RESULTS AND DISCUSSION :

From the mean of three years study on the grain yield of sorghum (Table 2), it is observed that the treatment T 5 (Sorghum 100 per cent + Cowpea 50 per cent) had recorded maximum sorghum grain yield of 1787 kg/ha and it was on par with T 1 (100 per cent sole sorghum) and T 3 (Sorghum 100 per cent + Cowpea 100 per cent) and these treatments were significantly superior to T 6. (Sorghum 50 per cent + Cowpea 100 per cent and T 4 (Sorghum 50 per cent + Cowpea 50 per cent). The increase in sorghum grain yield was due to 100 per cent population

under these treatments. It is also observed that Cowpea grain yield was affected when its population is increased to 100 per cent at 100 per cent population level of base crop of sorghum. Significant maximum grain yield of Cowpea grain yield was recorded by the treatment T 2 (sole cowpea) and this treatment is significantly superior to all treatments except T 6. The maximum Cowpea grain yield in T 2 was mainly due to pure solid stand and the reason for maximum yield in T 6 was due to lesser population of sorghum which exerted lesser competition to 100 per cent cowpea. It is also observed that, wherever cowpea was grown with 100 per cent population of base crop sorghum, the grain yield of cowpea was found affected and this might be due to shade effect of sorghum on cowpea and hence produced less number of cowpea pods than those in solid stand.

In respect of total grain yield also the treatment T 5 had recorded significantly higher total grain yield of 20,07 kg/ha and significantly superior to T 4 and T 2. The higher total grain yield for the treatment T 5 might be due to optimum population of 150 per cent, which might have enjoyed the soil moisture more efficiently with optimum plant canopy to arrest the unnecessary evaporation from the soil as well as efficient utilization of available soil moisture.

In respect of LER also, the treatment T 5 had maximum value of 1.31

Table : 2 Yield levels of sole and mixed crops and mean LER

Tr. No.	Details of Treatment	Sorghum grain yield (kg/ha)			Cowpea grain yield (kg/ha)			Total grain yield (kg/ha)			Mean L _e		
		1982-83	1983-84	1984-85	Mean	1982-83	1983-84	1984-85	Mean	1982-83		1983-84	1984-85
T1	Sorghum (Sole crop)	2570	1559	1171	1767	—	—	—	2570	1559	1171	1767	—
T2	Cowpea (Sole crop)	—	—	—	—	998	528	614	715	998	528	614	713
T3	Sorghum 100% + Cowpea 100%	2436	1433	1121	1663	258	104	276	213	2694	1537	1397	1876
T4	Sorghum 50% + Cowpea 50%	1743	974	742	1153	423	101	198	214	2166	1075	940	1394
T5	Sorghum 100% + Cowpea 50%	2620	1505	1235	1787	332	136	192	220	2952	1641	1427	2007
T6	Sorghum 50% + Cowpea 100%	1627	1066	815	1169	959	274	276	504	2586	1339	1093	1673
	SE/SED	148.14	89.22	102.40	116.89	64.55	35.35	32.95	128.32	—	—	—	181.64
	CD (P=0.5%)	449.73	275.53	315.56	269.55	198.51	109.42	101.53	295.91	—	—	—	404.71

Table : 3 Sorghum equivalent and Net return (Rs/ha)

Tr. No.	Detail of Treatments	Mean sorghum equivalent kg/ha				Mean Net Return (Rs. ha)			
		1982-83	1983-84	1984-85	Mean	1982-83	1983-84	1984-85	Mean
T1	Sorghum (Sole crop)	2570	1559	1171	1767	1525	1482	728	1245
T2	Cowpea (Sole crop)	2352	1540	1983	1958	1704	679	1125	1159
T3	Sorghum 100% + Cowpea 100%	3110	1734	2015	2286	1552	948	1028	1176
T4	Sorghum 50% + Cowpea 100%	2623	1268	1382	1758	1635	612	568	939
T5	Sorghum 100% + Cowpea 50%	3311	1902	1717	2310	2148	1526	1191	1622
T6	Sorghum 50% + Cowpea 100%	4034	1854	1712	2537	2794	1072	641	1502
	SE / SED	190.9	141.9	207.6	283.6	—	—	—	—
	CD (p = 0.05)	575.4	NS	443.3	631.8	—	—	—	—
	Grain price of sorghum (Rs./kg)	1.80	1.30	1.30					
	Grain price of cowpea (Rs./kg)	3.75	3.80	4.20					

which indicated the maximum benefit from this combination and this was due to higher yield of sorghum grain on par with sole sorghum.

From the perusal of data on Sorghum equivalent (Table 3) it was seen that eventhough the treatment T 6 recorded the maximum, it was on par with T 5 and treatment T 5 also resulted in higher mean net return per hectare (Table 3). This treatment had pair row arrangement of sorghum with one row of cowpea between two pairs of sorghum. It was reported that paired row planting of sorghum gave similar yield as that of normal row arrangement of sorghum and in addition it provides inter space wide enough to accommodate intercrops most efficiently (Singh 1981).

From the above results, based on sorghum grain yield intercrop yield, total grain yield, LER, sorghum equiva-

lent and net return, the treatment T 5 (Sorghum 100 per cent population + 50 per cent cowpea population) was found promising under rainfed conditions of Kovilpatti of Tamil Nadu.

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