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Productivity, economic viability and energy output of rainy-season crop and *desi* cotton (*Gossypium arboreum*) under rainfed conditions

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ABSTRACT

An experiment was conducted during 1988–93 to study productivity, economic viability and energy output of different rainy-season crops in comparison with *desi* cotton (*Gossypium arboreum* L.). Intercropping of 'CSH 9' sorghum [*Sorghum bicolor* (L.) Moench] + 'No. 148' pigeonpea [*Cajanus cajan* (L.) Millsp.] sole 'JL 24' groundnut (*Arachis hypogaea* L.) and that of 'ICTP 8203' pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. stuntz.] + 'No. 148' pigeonpea were found highly remunerative and energy-producing crops, in order of sequence, and could be the alternatives for replacing 'Y_1' *G. arboreum* under scarcity condition of Dhule Region.

In the scarcity area of Dhule Region, up to recent past, 'Y 1' *desi* cotton (*Gossypium arboreum* L.) was the ruling crop under rainfed condition and maximum area was concentrated around Tapi banks. From the last decade, the variation in the precipitation pattern of this area did not restrict to the quantum alone but the distribution. Prevailing of dry spells both in number and duration also showed great variability, resulting in decline in the productivity of this *desi* cotton day-by-day. The same results were also observed in climatic-parameter study in relation to crop yields in scarcity zone. Efforts were made to assess different crops, for their productivity, economic viability for a long time, so as to find out proper recommendations.

MATERIALS AND METHODS

A rainfed experiment was conducted during the rainy seasons (*kharif*) of 1988–89 to 1992–93. 'Y 1' and 'SRT 1 cotton, 'JL 24' groundnut (*Arachis hypogaea* L.), 'Morden' sunflower (*Helianthus annuus* L.), 'Tapi' sesame (*Sesamum indicum* L.), 'MACS 13' soybean [*Glycine max* (L.) Merr.], 'ICPL 87' pigeonpea [*Cajanus cajan* (L.) Millsp.], 'ICTP 8203' pearlmillet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz.], 'CSH 9' sorghum [*Sorghum biocolor* (L.) Moench] + 'No. 148' pigeonpea and 'ICTP 8203' pearl millet + 'No. 148' pigeonpea both in 2 : 1 row proportion (Table 1) were tried in randomized block design with 3 replications. The soil of the experimental field was medium in depth, slightly alkaline in reaction, (pH 7.90), with electrical conductivity EC 0.27 mmhos/cm, organic matter 0.58%. The soil was medium in available nitrogen (207 kg/ha), low in phosphorus (15.5 kg P_2O_5/ha) and high in potassium (560 kg K_2O/ha). The soil-moisture constant at 1/3 bar and 15 bar were 39.5 and 15.52% re-

spectively. The gross plot size was 9.00 m x 7.20 m and net plot size was 7.20 m x 6.30 m. The sowing and other common in each season followed as per the recommendations.

The data on rainfall received during the crop-growth stages and its distribution in number of rainy days, in various years are presented in Table 2.

The data pertaining to the mean productivity, total and net monetary returns, harvest indices and energy output of various crops pooled over seasons from 1988–89 to 1992–93 are presented in Table 3. The energy values of inputs and outputs were calculated (Gopalan *et al.*, 1981).

RESULTS AND DISCUSSION

Season

The values of precipitation and distribu-

Table 1. Details of treatments followed for various crops

Crop	Variety	Spacing (cm x cm)	Fertilizer dose (kg/ha)		
			N	P	K
Cotton	'Y 1'	45 x 22.5	50	25	25
Cotton	'SRT 1'	60 x 30	50	25	25
Groundnut	'JL 24'	30 x 10	25	50	00
Sunflower	'Morden'	60 x 22.5	60	30	30
Sesamum	'Tapi'	30 x 15	50	00	00
Soybean	'MACS 13'	30 x 10	25	50	00
Pigeonpea	'ICPL 87'	60 x 22.5	25	50	00
Pearlmillet	'ICTP 8203'	45 x 15	60	30	30
Sorghum + pigeonpea	'CSH 9' + 'No. 148'	S 30 x 15+ P 90 x 30*	80	40	40
Pearlmillet + Pigeonpea	'ICTP 8203' + No. 148	PM 30 x 15+ P 90 x 30	60	30	30

S, Sorghum; P, pigeonpea; PM, pearlmillet
* Paired-row planting

Table 2. The distribution of rainfall (mm) and number of rainy days during crop growth periods

Year	Days from sowing				Total rainfall (mm)
	1–30	31–60	61–90	91 onwards	
1988–89	196.4 (7)	144.3 (7)	268.0 (10)		608.7 (24)
1989–90	161.2 (17)	126.0 (12)	78.4 (6)	1.6 (1)	367.2 (36)
1990–91	70.0 (5)	158.9 (8)	259.0 (10)	50.3 (4)	538.2 (27)
1991–92	265.4 (11)	62.0 (4)	4.5 (1)	21.0 (2)	352.9 (18)
1992–93	133.0 (5)	236.0 (11)	55.2 (2)	150.0 (4)	574.2 (22)

Figures in parentheses indicate number of rainy days
Average rainfall of this station is 586.5 mm spread over in 41 rainy days.

Table 3. Productivity, monetary return,s harvest index and energy out put of various crops pooled over seasons from 1988–89 to 1992–93

Treatment		Main produce (q/ha)	By-produce (q/ha)	Total biomass production (q/ha)	Harvest index (%)	Energy output (G. Cal/ha)	Cost of cultiva-tion (Rs/ha)	Total returns (Rs/a)	Net returns (Rs/ha)
Cotton ('Y 1')		4.44	34.90	39.34	11.00	2.15	3,168	3,861	693
Cotton ('SRT 1')		6.74	37.17	43.91	15.00	3.20	3,424	6,785	3,361
Groundnut ('JL 24')		10.43	25.49	35.92	29.00	6.02	4,361	11,190	6,829
Sunflower ('Morden')		6.32	23.03	29.35	21.50	4.02	2,539	5,424	2,885
Sesamum ('Tapi')		4.27	16.55	20.82	20.50	2.48	2,722	5,591	2,869
Soybean ('MACS 13')		10.45	27.19	37.64	27.80	4.61	3,305	6,527	3,222
Pigeonpea ('ICPL 87')		10.63	31.22	41.85	25.40	3.70	3,834	8,096	4,262
Pearlmillet ('ICTP 8203')		26.13	47.93	74.06	35.30	9.64	2,904	8,510	5,606
Sorghum + Pigeonpe	S	34.05	87.33	121.38	28.00 +	13.28	4,592	14,460	9,868
('CSH 9' + 'No 148')	P	2.10	7.98	10.08	20.80				
Pearlmillet + pigeonpea	PM	24.68	43.91	68.59	36.00 +	9.39	3,240	9,851	6,611
('ICTP 8203' + No 148')	P	3.74	9.18	12.92	28.90				
CD (P = 0.05)						2.96		3,462	

tion thereof prevailed, in various growth stages indicated that except in 1991–92, the quantum of the rainfall received was about normal and was fairly distributed in all important growth periods of various crops, and could be characterized as normal (Table 2). During 1991–92 though the quantity of rainfall was not much reduced, the distribution was very peculiar. During the first 30 days crops enjoyed good moisture conditions with the spill over 62 mm in 4 rainy days in subsequent growth stages. The rainfall was then shortly withdrawn in later stages, creating moisture stress in the formation and development stages of sink in various crops. However, the effects of this harsh year have been masked while pooling the data over seasons. (Pandey *et al.*, 1988).

Productivity

The data on productivity pooled over seasons together with the harvest indices showed that the ruling crop of rainfed 'Y 1' cotton was showed the lowest productivity of main produce and the harvest index. Groundnut showed its merit in the productivity and sunflower was the next in order among oilseed crops. Among the pulses tried, were almost equal in their productivity and harvest indices and could fairly be compared with groundnut, demanding a high cost on seed and timely seeding. The above 2 requirements of groundnut were the limiting factors with the farmers. The grain crops like pearlmillet, which is also a ruling practice, had proved its sustainability over period, both in terms of productivity and harvest index.

The intercropping treatments proved superior in productivity and harvest indices and also showed added advantage in the production of the pulse from the system. These results are similar to those reported by Umrani (1981) and Salunkhe *et al.* (1990).

Economic viability

The adoptability of suggested crop shift, in drought-prone area, is necessarily governed by its economic viability and practical feasibility, as the farmers are reluctant for acceptance of such changes due to their poor fiscal status. The economic viability of these crops, pooled over 5 seasons, in terms of total and net monetary return indicated that the ruling 'Y 1' cotton was the least-paying proposition, while the 'CSH 9' sorghum + 'No 148' pigeonpea intercropping, sole 'JL 24' groundnut and intercropping of 'ICT 8203' pearlmillet + 'No 148' pigeonpea are the paying propositions in the order of sequence.

Energy output

The intercropping treatments were much superior, not only in economical viability but also in respect of energy output. This high values of energy output may be attributed to their large biomass production, being cereal crops as one of the components. These results are similar to those reported by Gloype (1983), Winteringham (1983) and Jadhav (1990).

Thus, it could be inferred that, the practice of cultivating rainfed *G. arboreum* proved to less remunerative and less productive, while growing of alternative crops like 'JL 24' groundnut, 'MACS 13' soybean, 'ICPL 87' pigeonpea and intercropping of 'No 148' pigeonpea either in 'CSH 9' sorghum or 'ICTP 8203' pearlmillet in 2 : 1 proportion will be more remunerative, energy producing and also productive crop propositions in this area.

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