

AN AGROMETEOROLOGICAL ASSESSMENT OF CROP PRODUCTION IN ALFISOLS — A CASE STUDY

Cropping patterns in a given climate depend upon the rainfall distribution and the soil type. A study of rainfall in relation to potential evapotranspiration computed from the data recorded at Begumpet, Hyderabad, revealed that the water availability period of Hyderabad region is 155 days when actual evapotranspiration is greater than half of potential evapotranspiration (Raman and Murthy 1971). Thus, there is a possibility of raising two crops — one short duration followed by a medium duration crop. Double cropping can increase crop production by 50-150% (Singh *et al.* 1980). Recent studies established that jowar-redgram intercropping is more stable than sole cropping (Rao and Willey 1980). The water balance studies revealed that the soil moisture storage is maximum in September (93 mm), decreasing on either side of this month (Subba Rao 1981). The assured weekly rainfall, in Hyderabad region, at 30% probability, exceeds weekly potential evapotranspiration from 26th week to 39th week (*i.e.*, from 25 June to 30 September), thus meeting the crop water requirements fully. Beyond this period, the assured weekly rainfall falls rapidly. At

TABLE 1
Seasons' rainfall (mm) during crop period in 1979 and 1980

Crop	Rainfall					
	Average* (from week No. 26)	1979	Defi- cit	Average (from week No. 24)	1980	Defi- cit
Greengram	322.9	236.8	86.1	329.1	288.0	101.0
Ragi	463.1	429.2	33.9	429.5	323.3	106.2
Bajra	463.1	429.2	33.9	416.6	323.3	93.3
Groundnut	480.2	429.2	51.0	487.8	346.8	141.0
Jowar	480.2	429.2	51.0	487.0	346.0	141.0
Castor	542.3	458.9	83.4	579.9	358.4	221.5
Redgram	542.3	458.9	83.4	585.1	360.0	225.1

*Average of last ten years

50% and 70% probability, the growing period is still restricted (Sarker *et al.* 1978). The long duration crops will thus be exposed to moisture stress at critical phases in the shallow Alfisols, thus suggesting that an intermediate crop would be most suitable. It is also reported that *rabi* crops may not be possible in Hyderabad region due to inadequacy of profile moisture of Alfisols, when the soil is covered with crops the monsoon season and the September and October rainfall is subnormal (Virmani 1975).

TABLE 2
Cropping systems on Alfisols—1979 and 1980. Date of planting 1979—28 June 1979, 1980—12 June 1980

Cropping treatment	Date of harvest		Duration of 1st crop		Date of planting of 2nd crop		Grain yield (q/ha)	
	1979	1980	1979	1980	1979	1980	1979	1980
T ₁	8 Oct	15 Sep	103	96	25 Sep	2 Sep	36.20	20.95
T ₂	8 Oct	15 Sep	103	96	25 Sep	2 Sep	40.60	20.56
T ₃	8 Oct	7 Sep	103	88	25 Sep	2 Sep	22.45	22.10
T ₄	8 Oct	7 Sep	103	88	25 Sep	2 Sep	19.12	21.48
T ₅	31 Aug	15 Aug	65	65	21 Aug	5 Aug	3.55	5.87
T ₆	31 Aug	15 Aug	65	65	1 Sep	17 Aug	2.95	6.38
T ₇	31 Aug	15 Aug	65	65	21 Aug	5 Aug	3.25	6.09
T ₈	31 Aug	15 Aug	65	65	1 Sep	17 Aug	2.65	6.47
T ₉	31 Aug	15 Aug	65	65	21 Aug	5 Aug	2.95	6.08
T ₁₀	31 Aug	15 Aug	65	65	1 Sep	17 Aug	3.47	6.18
T ₁₁	11 Oct	30 Sep	106	111	12 Oct	30 Sep	F	10.95
T ₁₂	11 Oct	30 Sep	106	111	25 Sep	13 Sep	F	10.95
T ₁₃	11 Oct	27 Sep	106	108	25 Sep	13 Sep	29.30	19.55
T ₁₄	29 Nov	3 Nov	155	145	..	..	13.20	11.97
T ₁₅	11 Oct	27 Sep	106	108	..	..	29.62 (24.30+ 5.32)	16.14 (10.44+ 5.70)
T ₁₆	8 Oct	7 Sep	103	88	..	..	15.60 (15.60+F)	12.48 (6.50 +5.98)
T ₁₇	29 Nov	14 Nov	155	156	..	..	9.20 (9.20+F)	11.36 (4.96 +6.40)
T ₁₈	29 Nov	14 Nov	155	156	..	..	10.93	10.70
F ² test	..	..	..	..	..	..	..	..
SEm\pm	..	..	..	..	..	..	..	..
CD 5%	..	..	..	..	..	..	..	..

F=failed

In view of the above, a field experiment was designed to study the feasibility of raising relay, sequential and intercrops by selecting suitable crops and crop combinations under rainfed cultivation to match the meteorological conditions most frequently realised in Hyderabad region.

Materials and methods—The experiment was conducted at Students' Farm, College of Agriculture, Rajendranagar (17° 19' N, 78° 23' E, 542.6 m asl), Hyderabad, Andhra Pradesh during *kharif* and post-monsoon seasons of 1979 and 1980. The soil is a shallow Alfisol having 150 N, 22 P₂O₅ and 250 K₂O

kg/ha with a pH of 8.1. The average values of field capacity, wilting coefficient and bulk density were 16.0%, 8.5% and 1.5 g/c.c. respectively. The trial was laid out in a randomized block design, with four replications. The various treatments were: T₁-Ragi (PR 202) followed by relay horsegram (local); T₂-Ragi followed by relay cowpea (C 152); T₃-Bajra (BJ 104) followed by relay horsegram; T₄-Bajra followed by relay cowpea; T₅-Greengram (PS 16) followed by relay castor (Aruna); T₆-Greengram followed by sequential castor; T₇-Greengram followed by relay bajra; T₈-Greengram followed by sequential bajra; T₉-Greengram followed by relay ragi; T₁₀-Greengram followed by sequential ragi; T₁₁-Groundnut (TMV 2) followed by sequential horsegram; T₁₂-Groundnut followed by relay horsegram; T₁₃-Jowar (CSH 6) followed by relay horsegram; T₁₄-Sole castor; T₁₅-Intercropping redgram (C. 11) with Jowar 1 : 2; T₁₆-Intercropping of groundnut with bajra 3 : 1; T₁₇-Intercropping of groundnut with redgram 3 : 1; T₁₈-Sole redgram.

All the crops and crop combinations were sown by dibbling in both the years. The various dates of sowing and harvest are presented in Table 2. A fertilizer dose of 30 N, 50 P₂O₅ and 30 K₂O kg/ha was applied as basal to all crops. Cereals and castor were supplemented with additional dose of 40 kg N/ha at appropriate time besides the basal application. The economic returns were calculated by existing prices of the produce in local market.

3. Results and discussion

Cropwise rainfall is presented in Table 1. During 1979, the rainfall amounts were close to the average but the distribution was not favourable initially. The rainfall deficit upto harvest of jowar was 51.0 mm while the deficit after harvest of jowar increased to 83.4 mm. Contrary to this, during 1980, the rainfall distribution was favourable initially but the deficits gradually increased with the advance of crop season (Table 1). The evaporative demand was slightly higher than the average during the first year in which the rainfall was higher than in the second year.

The grain yield of crops is presented in Table 2. During both the years the yields of bajra, redgram and castor were steady inspite of variation in seasons'

rainfall. Ragi yielded less during 1980 indicating that its yield can be expected to be low in years of deficient rain fall. Greengram yielded more during 1980. This appears to be due to good rainfall distribution immediately after sowing. Groundnut was a total failure during 1979 both as a sole and intercrop, due to long dry spells prevailed immediately after sowing and at the time of pegging. Jowar yielded more during 1979. This shows that this crop can withstand more to dry spells and recover with good subsequent rainfall.

Some of the post-monsoon crops, tried as relay and sequential, did not germinate and others failed after germination during both the years. This is to be expected since the rainfall during October was also far below the average. Hence the crops could not establish themselves. A climatological approach revealed that the maximum probability of raising a relay or sequential crops is only 25 per cent (Virmani 1975). Thus relay or sequential crops are likely to be exposed to moisture stress in three out of four years. The present field experiment, thus confirms the findings of earlier work by climatological approach.

Among the intercrops, jowar and redgram combination appears to be better and this combination may be preferred to sole jowar crop in areas of low rainfall.

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15 September 1982

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