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Agroclimatic Study for Dry Farming of Banaskantha

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ABSTRACT

The different climatic parameters of Banaskantha with particular reference to agriculture were studied for 11 years (1972-82). No regular trend was observed in the agricultural drought but the crop growing period was 12 weeks duration extending from 28th to 39th standard weeks. The soil moisture storage ranged from 40 mm to 105 mm during *kharif* and 15 mm to 40 mm in *rabi* season. Only the short duration *kharif* crops e.g. pulses, pearlmillet and sorghum may be grown successfully in this area along with drought resistant castor—a long duration crop. The farmer may find it difficult to grow *rabi* crops without proper irrigation facilities.

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INTRODUCTION

To a great extent the normal growth of the crop is hampered due to inadequate and erratic distribution of rainfall in the North Gujarat. The utilization of total rainfall of the area by a particular crop depends upon the atmospheric demand and soil characteristics. Therefore, there is a need to carry out agroclimatic studies considering the soil characteristics of the area. Virmani *et al.* (1982); Biswas and Basarhar (1982) carried out the probability studies of weekly rainfall of different stations of Gujarat State. Biswas (1982) had classified the Gujarat State in different agroclimatic zones using moisture availability index. But his studies did not incorporate the soil characteristics of the stations. Therefore, an attempt has been made to study the occurrence of different climatic phenomenon, namely intea ity of agricultural drought, moisture adequacy index and soil moisture status considering the soil characteristics of the area which would be helpful in crop planning.

MATERIAL AND METHODS

The 11-year (1972-82) rainfall data for Deesa and Sardar Krushinagar were collected and utilized for agroclimatic studies of Banaskantha district in North Gujarat. However, the data on mean monthly temperature were used for estimating potential evapotranspiration (PE). The above-mentioned parameters were used to calculate actual evapotranspiration (AE); soil moisture storage, water surplus (W_S) and water deficit (W_D) according to the water budgetting technique developed by Thornthwaite and Mather (1955).

The agricultural drought intensity was calculated according to the methods used by Krishnan, 1971 as shown below:

Aridity index, % (W_D/P_E x 100) (25th to 41st std. week)	*Agricultural drought intensity*
<50	nil
50-60	slight
60-70	moderate
70-80	severe
>80	disastrous

The moisture adequacy index (AE/PE) was calculated for 52 weeks of every year. The water availability periods with excellent, good, poor and very poor conditions were defined according to the differential magnitude of actual and potential evapotranspiration given as under: excellent water availability period (E)

$$\text{when } AE \geqslant \tfrac{3}{4}PE;$$

good water availability period (G)

$$\text{when } \tfrac{3}{4}PE > AE \geqslant \frac{PE}{2};$$

poor water availability period (P)

$$\text{when } \frac{PE}{2} > AE \geqslant \frac{PE}{4};$$

and very poor water availability period (VP)

$$\text{when } AE < \frac{PE}{4},$$

RESULTS AND DISCUSSION

Climatic conditions and agricultural droughts:

The climate of the area is semi-arid with average moisture index value of –64.6%. However, there have been large variations in the moisture index, i.e. –27.4% during 1977 and –94.9% during 1974 (Table 1). Due to the above-mentioned parameter the, occurrence of arid climate was for five years and the same was the case with semi-arid climate. Only during 1977 due to the maximum amount of rain, the climate was dry-sub-humid type.

The annual precipitation during 1981 was 524.9 mm (16.8% less than the average value); even then agricultural drought was not observed in this

TABLE 1

Occurrence of climatic conditions and agricultural droughts.

Year	*Rainfall (mm)*	*Moisture index (%)*	*Climate type*	*Aridity index (kharif season) (%)*	*Agricultural Drought intensity*
1972	439.4	–79.0	Arid	53	Slight
1973	935.7	–52.3	Semi-arid	35	Nil
1974	113.6	–94.9	Arid	93	Disastrous
1975	1115.1	–41.4	Semi-arid	23	Nil
1976	915.8	–54.5	Semi-arid	36	Nil
1977	1482.3	–27.4	Dry-subhumid	19	Nil
1978	666.1	–66.5	Semi-arid	34	Nil
1979	516.4	–81.5	Arid	67	Moderate
1980	505.3	–77.4	Arid	54	Slight
1981	524.9	–71.6	Arid	42	Nil
1982	677.1	–64.5	Semi-arid	55	Slight
Average	717.4	–64.6	—		—

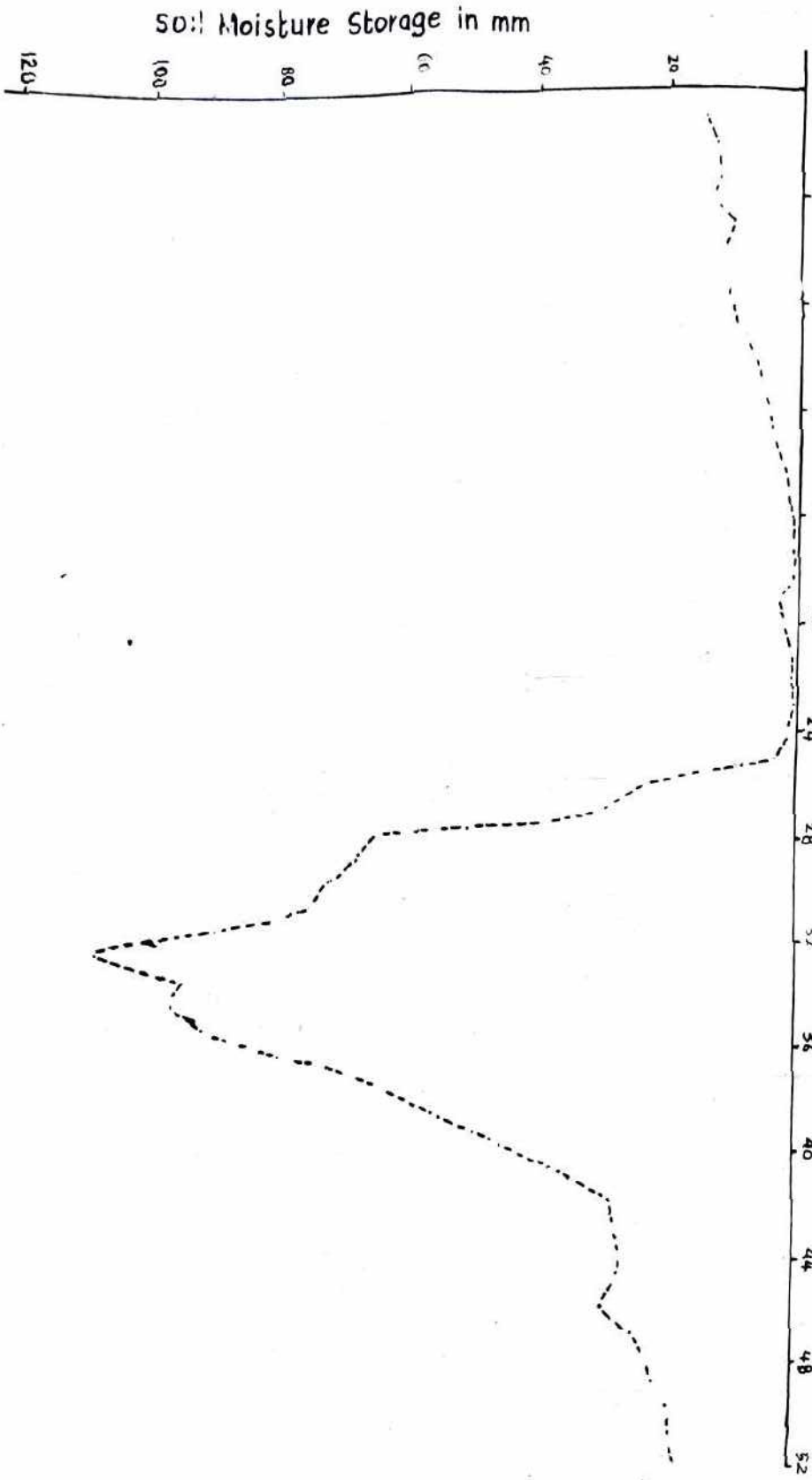


Fig-1 : Average Soil Moisture Storage (1972-82)

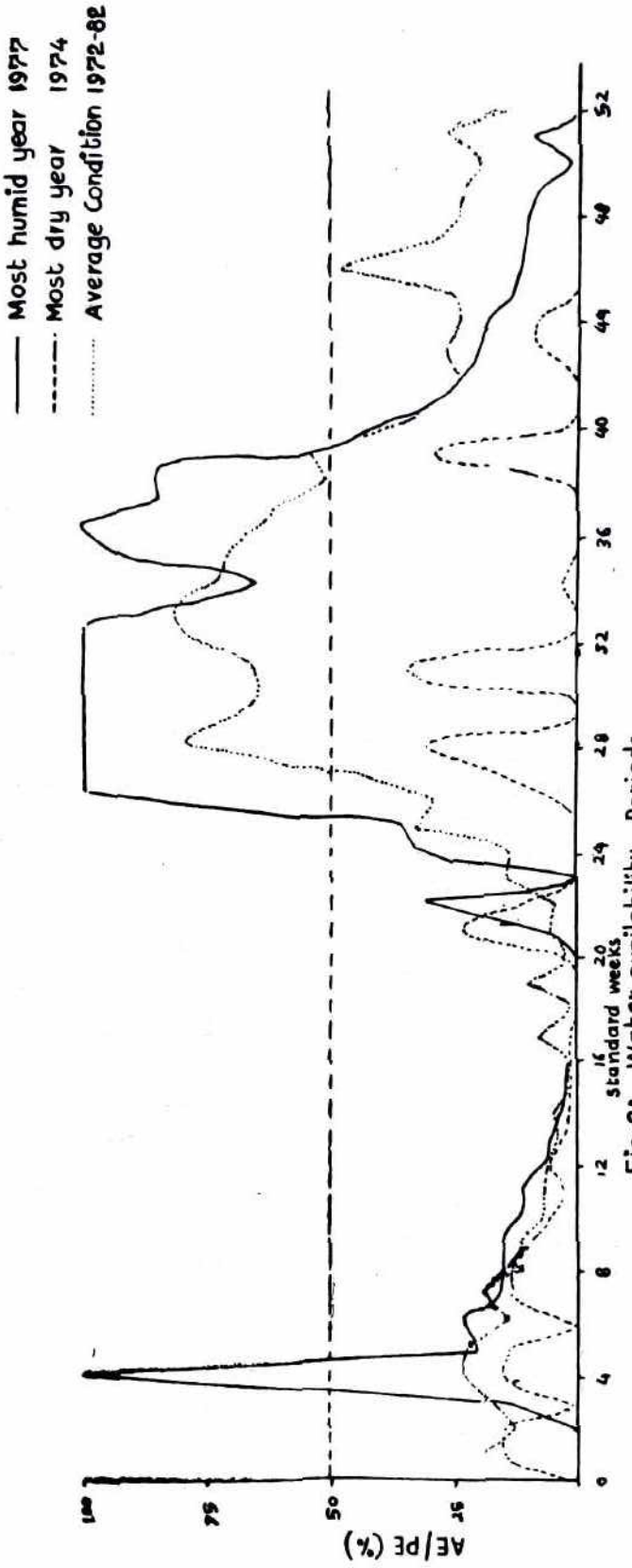

Most humid year 1977
Most dry year 1974
Average Condition 1972-82
AE/PE (%)
100
75
50
25
0
4
8
12
16
20
24
28
32
36
40
44
48
52
Standard weeks
Water availability Periods

Fig-2:

year. However, slight drought was observed in 1982 even after receiving 29% more rain than 1981 (Table 1). Further more, during 1979 and 1980 there has been very meagre difference with 1981 (nil drought) but the intensity of drought was slight (1980) to moderate (1979).

Generally, the drought conditions are always related with the rainfall during a particular year, but occasionally the drought conditions may be controlled by some other factors i.e. distribution of rainfall, potential evapotranspiration etc. Therefore, the distribution of rainfall would command more role rather than the total precipitation in a year.

Soil Moisture Condition:

Generally, with the onset of monsoon the rainfall exceeds the water demand and due to the loamy sand soil of the area, infiltration rate is high, therefore, the soil moisture storage increases. Maximum value of soil moisture was found in the 33rd week (Fig. 1) which happens to be the second week of August. After this due to the higher atmospheric water demand moisture was extracted from the soil which caused a considerable decrease in the stored soil moisture. However, at the end of the *kharif* season the soil moisture was 50 mm which could be utilized by long duration *kharif* crops viz. castor, cotton etc. During the hot months of the year the soil moisture was found to be very near to zero and the soil moisture content increased after the onset of monsoon (Fig. 1).

Water Availability Periods:

Severe to moderate moisture stress conditions were observed throughout the year in 1974 which was thus unfavourable for cultivation whereas during 1977, 14 weeks (i.e. 26th to 39th weeks) were found free from stress and were suitable for good crop growth. Similar condition was observed in the 4th week too. The average data for 11 years show that in the *kharif* season 12-week period (28th to 39th) was found to be the most suitable for growing crops under dry land conditions (Fig. 2).

In the winter season due to slight to moderate water stress the conditions were found to be not much suitable for growing *rabi* crops under dry farming. However, the drought resistant *kharif* crop like castor may be grown successfully which are harvested upto February. The rest of the periods (10th to 24th week) were not at all suitable for germination and growth of the crop without proper irrigation facilities.

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