*Mausam*, (1984), **35**, 4, 475-478

551.584 : 551.577.38 (547)

# Meso-scale study of crop drought climatology over Maharashtra

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(*Received 21 April 1980*)

**सार** — वेंकटरमन (1979) की विधि एवं वेंकटरमन एवं खांबेटे (1980) द्वारा अपनाए गए मानदण्डों के अनुसार महाराष्ट्र के वर्षाधीन खेती वाले क्षेत्र में फसलों के पुराने, भीषण, सामान्य, इक्का दुक्का एवं अल्प सूखे वाले क्षेत्रों का सीमांकन किया गया है। सूखे के विस्तार को ज्ञात करने के लिए मानदंड बनाए गए हैं। फिर विशिष्ट वर्षों में सूखे के क्षेत्रीय विस्तार को रेखांकित किया गया है।

ABSTRACT. Demarcation of areas prone to chronic, severe, moderate, occasional and little crop droughts in the dry farming tract of Maharashtra as evaluated per the methodology of Venkataraman (1979) and the criteria of Venkataraman and Khambete (1980) are presented. Criteria for determining areal spread of droughts are set out. The areal spreads of droughts in typical years are highlighted.

## 1. Introduction

A climatological assessment of the likely frequencies of occurrence of various classes of crop droughts in different areas are of value, in according priorities for provision of surface-irrigation facilities and in planning long term measures of drought mitigation under an integrated programme of drought prone area development. Evaluation of the extent of havoc caused by crop droughts is the most difficult (Yevijevech *et al.* 1978). This is due to the fact that in crop drought manifestation, besides rainfall distribution, soil and crop factors come into play. Even on a district level the above features vary widely. Therefore, assessment of areal spread of droughts based on rainfall budgeting can only be comparative regarding place to place variations in a year. Comparative assessments of spatial variations in drought intensity in a year can, however, provide an operational basis for organising drought relief measures in various areas on a rational basis.

## 2. Material and method

Venkataraman (1979) has outlined a rainfall budgeting method for assessing, monthly ratios of transpiratory consumption to the potential need of a reasonably parameterised kharif crop. A computerised procedure for calculation of such ratios of transpiratory satiation and computation of a crop drought index (CDI), from intraseasonal march of such monthly ratios, have been given by Venkataraman and Khambete (1980). Classification of drought severity in terms of CDI values and criteria for assessing degree of proneness to drought of a place from considerations of frequency of occurrence of various classes of drought severity have also been given by Venkataraman and Khambete (1980).

To study the incidence of crop droughts on a taluk-wise and yearwise basis in the dry farming tract of Maharashtra, lying between the isohytes of 40 and 100 cm of mean annual rainfall, rainfall totals for the months from June to October for available taluka level stations for the period 1901 to 1970 were taken. A computerised procedure based on the methodologies referred to above was adopted to assess the severity class of crop drought for each taluka year. Working out of frequencies of occurrence of various crop-drought severity classes were also computerised. From such frequencies the degree of drought proneness was assessed, as per the criteria of Venkataraman and Khambete (1980) in terms of five categories, *viz.*, chronic, severe, moderate, occasional and negligible.

For a more rational description of spatial variation of drought intensity in a dry farming district, it was decided to adopt criteria similar to that used for describing areal distribution of rainfall. These were as follows :

| *Criterion* | *Degree of areal spreed* |
|---|---|
| Almost all stations suffering from severe and moderately severe drought | Widespread, Gereral |
| 2/3 or more of the stations suffering from severe and moderately severe drought | Fairly widespread, nearly gereral |
| 1/3-2/3 of the stations having more intense droughts than light type | Local |
| 1/3 or less of the stations having light or negligible droughts | Scattered |

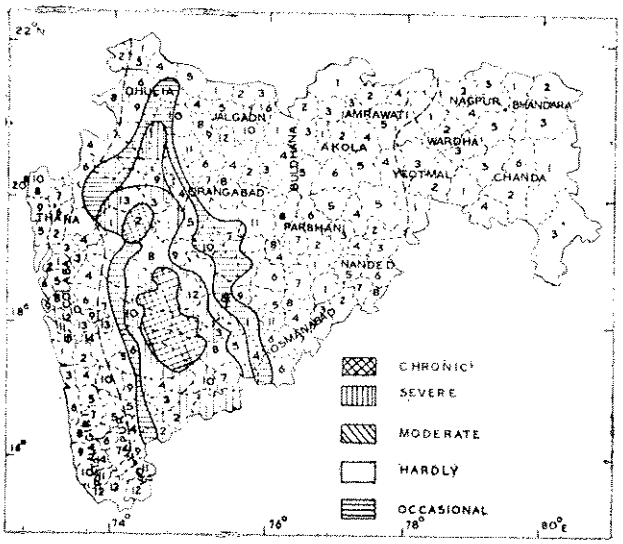


Fig. 1. Drought proneness in the dry farming tract of Maharashtra

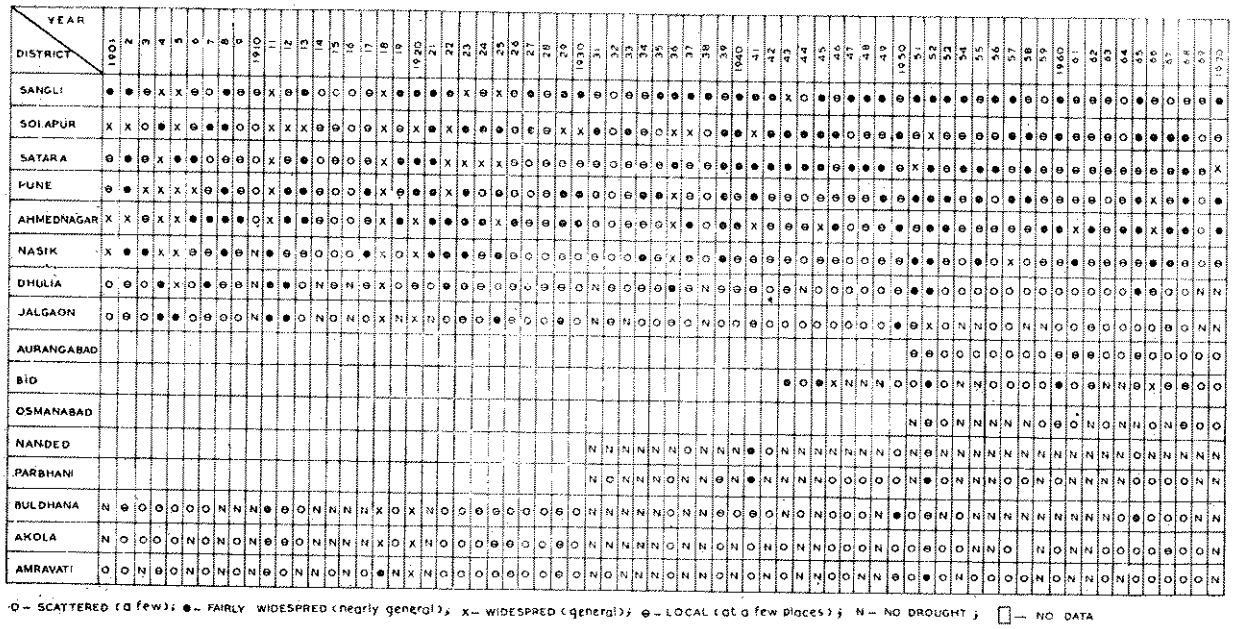


Fig. 2. Areal spread of drought in dry farming districts of Maharashtra

A sub-routine was added to the programme to obtain output of categories of areal spread on a year-wise basis.

### 3. Results and discussion

The degree of proneness to drought of the dry farming taluks as evaluated by the above methodology is shown in Fig. 1. The areal spread of droughts in the 16 dry farming districts for the years 1901 to 1970 is shown schematically in Fig. 2.

From Fig. 1 the areal composition of five classes of drought proneness is seen to be as follows :

The chronically drought prone area includes Phaltan and Dahiwadi taluks of Satara district, Malshiras taluka of Solapur district, Sangmner and Shrigonda taluks of Ahmednagar district and Indapur, Baramati, Daund taluks of Pune district. Provision of surface irrigation facilities in this area should receive top priority for alleviation of human sufferings due to drought and pasture development should be intensified.

The severely drought prone area lies adjacent to the chronic area and includes Jath, Miraj, Tasgaon and Khanapur taluks of Sangli district, a part of Khandala and Khatav taluks of Satara district, part of Karmala, Madha, Mangalwedha, Pandharpur and Sangola taluks of Solapur district, Sirur and Purandhar taluks of Pune district, Kopargaon, Shrirampur, Rahuri, Parner, Akole, Karjat and Jamkhed taluks of Ahmednagar district, and part of Bagland and Niphad, Yeola, Malegaon and Sinnar taluks of Nasik district. In this area surface irrigation facilities should be extended along with pasture and orchard development.

The moderately drought prone area lies as a small strip to the east of the severely drought prone area. Here provision of supplementary irrigation through ground-water tapping and harvest and reuse of run off from rainfall should be intensified.

The occasionally drought prone area consists of Khed and Haveli taluks of Pune district, part of Niphad, Nandgaon and Chandur taluks of Nasik district, Shevgaon and Pathardi taluks of Ahmednagar district, Ashti, Bir and Patoda taluks of Bir district and Barshi, Mohol and Solapur taluks of Solapur district. In this area evolvement of a package of crop, rainfall and soil-moisture management practices should be intensified to (*i*) increase crop out-turns by lengthening of the crop season through mixed cropping in normal years and double cropping in favourable years and (*ii*) to ensure adequate returns even in difficult years.

The remaining areas of the dry farming tract is hardly prone to droughts and hence is suited for adoption of high input technology. Here the aim should be to realise double crops in most of the years and to develop the area into a bread basket for the State.

Raman (1974) had used duration between specified wet spells as a measure of drought proneness. Interspell duration is seen to be more than 26 days in the chronic areas, more than 20 days in severe drought areas but less than 16 in the hardly drought prone area. However, areas of high interspell durations are not necessarily chronic areas as in Vidarbha. This is due to the higher rainfall amounts during wet spells in these areas providing adequate soil moisture for crop use. Choudhury *et al.* (1979) have suggested and used duration of spells of rain below specified amounts as a measure of *Agricultural Drought*. However, such a delineation does not conform to the picture that emerges above. The delineation of drought prone areas made out by Biswas and Khambete (1977) on the basis of ratios of weekly rainfall at 50% probability to potential evapotranspiration is seen to fit the above delineation better.

Regarding areal spread of drought the fact that Vidarbha constitutes a region which is hardly prone to droughts needs to be kept in view. Of the others, it is seen from Fig. 2 that drought occurs frequently in the districts of Sangli, Solapur, Satara, Pune, Ahmednagar, Nasik, Dhulia and Jalgaon.

Of the 8 districts, years in which only one district had fairly widespread or widespread drought while the others had less severe categories of drought were noted. These years, which could be considered as drought-free years were seen to be the following :

1909, 1910, 1914, 1915, 1916, 1926, 1928, 1931, 1932, 1933, 1938, 1944, 1959, 1962, 1963, 1964 and 1969.

Similarly taking those years in which widespread or fairly widespread droughts have occurred as extreme years it is seen that extensive droughts have occurred in 1902, 1904, 1905, 1911, 1918, 1920, 1922, 1925, 1936 and 1952.

It would be interesting to compare the crop yields, drought reports and drought relief measures in the

above two sets of years. This, however, would form a separate communication.

*Acknowledgement*

The authors are thankful to the National Data Centre for supply of monthly rainfall data for the period 1901 to 1970 for taluk level stations in the Dry Farming Tract of Maharashtra in magnetic tape form and for the use of Roberton 1040 computer. They are also thankful to Smt. V. V. Kanade and Shri J. K. Kate for assisting in computer work and preparation of diagrams.

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