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Agricultural drought of 1987 monsoon season in India

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ABSTRACT

Using Thornthwaite's technique weekly water balance has been computed for a selected network of stations in India for the monsoon season of the drought year 1987 beginning from June to the end of September utilizing potential evapotranspiration values obtained by Penman's method. Above normal value of weekly aridity index has been taken as the agricultural drought index to demarcate the drought affected areas. Results showed that a major portion of the Gujarat state had continuously been under the grip of moderate to severe drought conditions since 18-24 June till September end. Other areas substantially affected were Rajasthan, Punjab, Haryana, Coastal Andhra Pradesh, Madhya Pradesh, Uttar Pradesh and Vidarbha where prolonged drought spell abating only for short periods prevailed in the season.

Key words: Agricultural drought, Water balance, Aridity index

Agricultural drought in India during 1987 monsoon season (June-September) was attributable to the sudden halt of monsoon during progress phase,delayed onset over the major parts of the country and subsequent subdued rainfall activity.During the last five decades the 1987 monsoon rainfall was comparable with the 1972 monsoon season when only around 20% of the area of the country,mainly from Northeast and Peninsular India, received excess or normal rainfall and about 47% area of the country was affected by meteorological drought.

India being predominantly an agriculture based country, an attempt has been made here to study the incidence, spread, intensification and cessation of the agricultural drought over the country during 1987 monsoon season using 'Aridity Index' (AI) employed earlier by George and Ramasastry (1975), Chowdhury et al. (1977), and Appa Rao *et al.* (1981).

Southwest monsoon of 1987

During 1987, southwest monsoon advanced on time over Kerala on 2 June. Thereafter, it steadily progressed northwards along the west coast and covered up to south Gujarat by 13 June. The Bay branch of the the monsoon covered Andaman and Nicobar Islands by 30 May and covered northeast India by 8th June. Monsoon covered the interior parts of Peninsula and south Madhya Pradesh by 16 June. After 16th further advance halted for about 3 weeks. The second phase of advance commenced on 5 July and ended on 15 July during which it covered the rest of the country outside Haryana, Punjab and northwest Rajasthan. It advanced over those areas on 27 July. The delay in onset was about 4 to 7 days over Madhya Maharashtra, Marathwada, Vidarbha, Bihar Plateau, Jammu and Kashmir, 10 to 15 days over western parts of

Bihar plains, Uttar Pradesh, southwest Rajasthan and Himachal Pradesh, about 20 days over north Madhya Pradesh and East Rajasthan and about 25-27 days over Haryana, Delhi, Punjab and northwest Rajasthan.

During June in most of the subdivisions where the monsoon advanced, its activity was quite subdued (rainfall deficient to scanty). Rainfall during July was much below normal over the country outside the states of northeast India, Konkan, Goa and Telangana. This situation led the combined June and July rainfall in most of the remaining subdivisions to be deficient. During August, rainfall was normal or above normal in the states of northeast India, east Rajasthan, west Madhya Pradesh and Peninsular India but continued to be below normal in rest of the country. Rainfall activity during September was normal or above normal in the Northeast states, east Uttar Pradesh, east Madhya Pradesh, Tamilnadu and south interior Karnataka but Haryana, Punjab, Rajasthan and Gujarat received very little rain in this month. Monsoon withdrawal commenced on 12 September, late by 11 days from the normal.

Prominent synoptic systems during 1987 monsoon included three depressions, all of them developed over land, of which one was in August and two in September and a severe cyclonic storm at the very beginning of the season that recurved and travelled away across Bangladesh ushering in monsoon over Assam and adjacent States. The 1987 monsoon seasonal rainfall departure is shown in Fig. 1.

MATERIALS AND METHODS

The basic input data for this study comprises of weekly rainfall, potential evapotranspiration (Rao *et al.* 1971) and field capacity of soil extracted from the Soil Map of India published by the National Atlas Organization of India.

Analysis was carried out from 22nd meteorological week (mw) (28 May-3 June) to 39th mw (24-30 Sept.) by using weekly Aridity Index (AI). AI was computed by Thornthwaite's water balance technique (1957) for a network of 169 stations uniformly spread over the country.

Above normal value of AI has been taken as an index of agricultural drought and utilized to demarcate the drought affected areas. Drought intensities were defined as follows:

Weekly anomaly of AI	Agricultural drought intensity
1-25	Mild
26- 50	Moderate
>50	Severe

RESULTS AND DISCUSSION

Agricultural drought during 1987 monsoon

Week by week scenario of agricultural drought during 1987 monsoon (Fig.2) has been studied by dividing the monsoon season into three phases :

Phase I: From onset (2 June) till monsoon covered the entire country (27 July)

Phase II : July 28th to the start of withdrawal (12 September)

Phase III : From the start of withdrawal (12Sept.)to the end of monsoon season (30 Sept.).

Fig. 1 : Rainfall Departure (Per cent), June-Sept. 1987.

Phase I : 22nd to30 mw

During this phase from 25th mw (18-24 June) moderate to severe drought situation prevailed over Maharashtra excluding Konkan and Goa, north interior Karnataka , Telangana, north coastal Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, eastern parts of Punjab, Haryana and Himachal pradesh, western parts of Bihar and major portions of Gujarat and Orissa. By 26th mw (25-1 July) the entire India was under the grip of moderate to severe drought except in the northeastern part of India, parts of Peninsular India and Maharashtra excluding Vidarbha mainly caused by the subdued rainfall activity and sudden halt in the progress of southwest monsoon. In the next two weeks i.e. in 27th mw and 28th

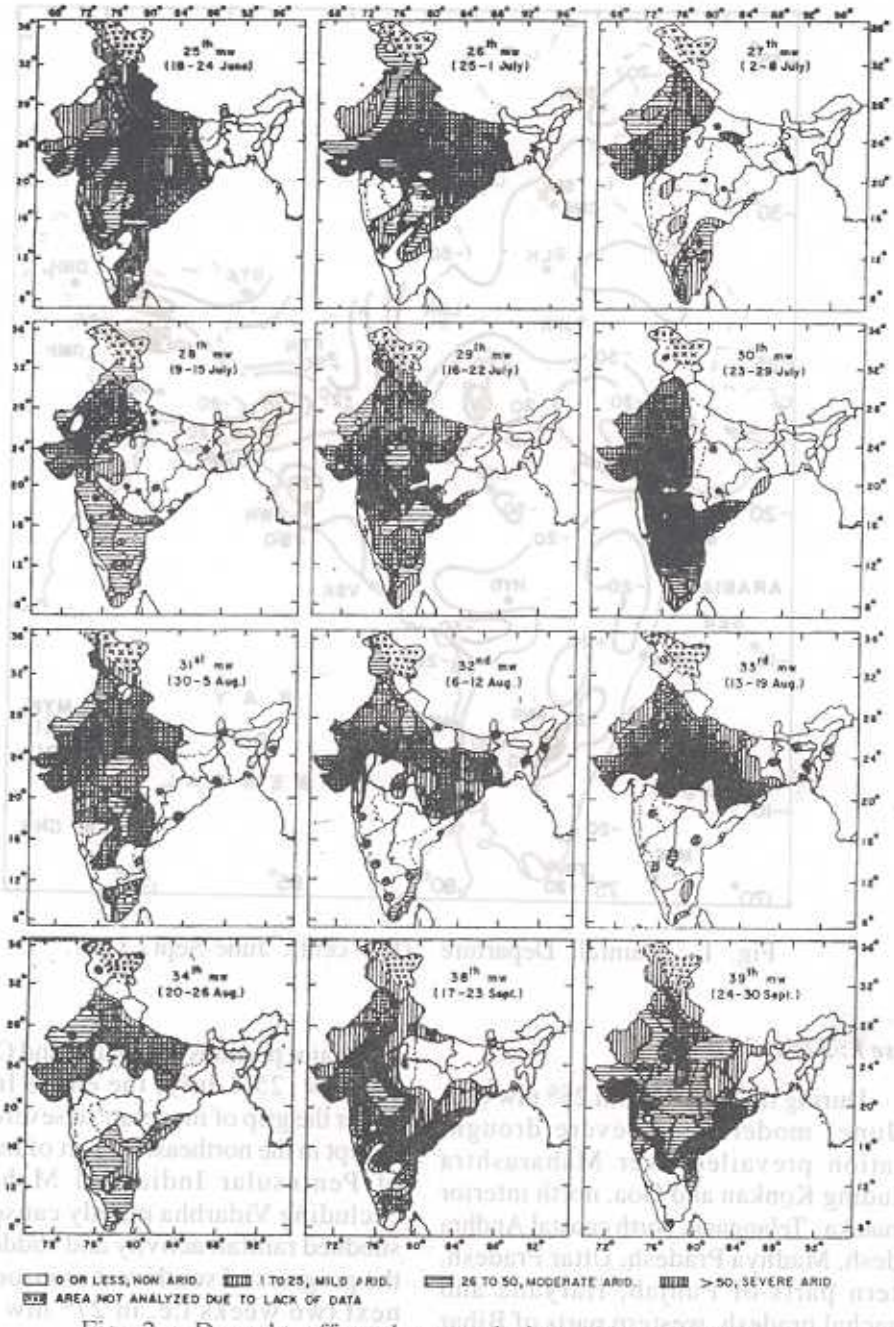

Fig. 2 : Drought affected areas during 1987 monsoon.

mw(2-15 July) drought situation over the major portions of the country eased considerably except in the western and northwestern parts.

Phase II :31st to37mw

Although drought situation prevailed in the 31st mw, in the subsequent three weeks the situation eased in Peninsular and central parts of the country due to rainfall activity in association with a depression. In the next two weeks i. e. in 35th and 36th mw drought was confined to only Saurashtra and Kutch and some parts of west Rajasthan and Punjab.

Phase III : 38th to 39th mw

Monsoon started retreating and in the peninsular region severe drought prevailed over coastal AP and north Tamilnadu.

Thus, during 1987 monsoon season (June-September) the Gujarat state had been most severely affected by moderate to severe drought conditions since 25th mw (18-24 June) till the end of monsoon season. Northeastern parts of India, however, remained practically free from drought conditions during the season where floods caused substantial loss to life and property.

March of agricultural drought at selected stations

Weekly march of agricultural drought at some selected locations (Fig.3) reveals the differences in AI depending on location of a station due to varying nature of monsoon activity within the season.

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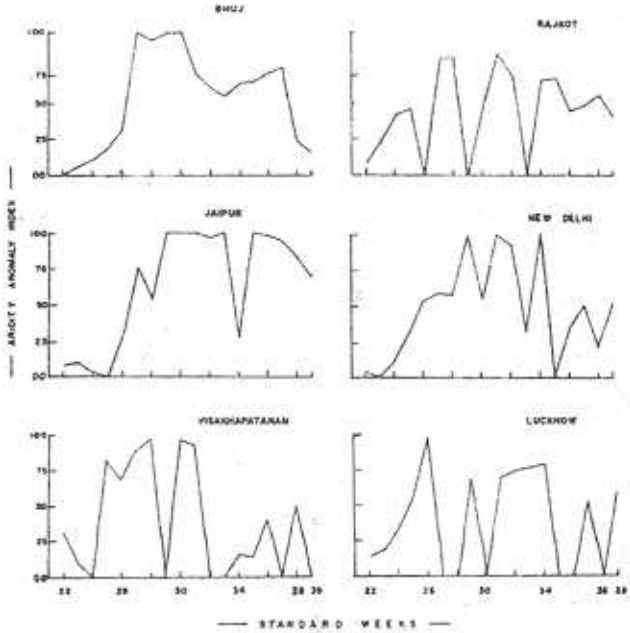

Fig. 3 : Agricultural drought index at some selected locations

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