Journal of Agrometeorology 7 (1) : 110-114 (June 2005)

Short Communication

Drought over Rajasthan during the year 1987

M.L. JAT, RAJ VIR SINGH[1] and J.K. BALYAN
Dryland Farming Research Station, Arjia, Bhilwara
Department of S.W.E., C.T. A.E., Udaipur

In Rajasthan, agriculture is primarily rain dependent. Every year its fate oscillates with the onset, progress, quantity, and spatial distribution of rainfall. Thus, failure of monsoon in an area, where more than two-third of the area under cultivation is rainfed and where irrigation system is poor and insufficient, often creates critical fall in employment, food, fodder and drinking water for both men and cattle. Agricultural drought does not begin when rain ceases but rather only when plant roots can no longer get moisture Thornthwaite and Mather (1955) in the needed amount.

Droughts have an origin and spread as well as decay (Linsley, 1959). Spread of drought was studied earlier by Subrahmanyam and Sastri, 1971, Malini, 1981, Sastri and Malakar, 1981, and Ram Mohan *et. al.* 1984.

In the present study meteorological and soil data from eight stations (Table 1) representing different agro-climatic zones for a period of 15 years (1981-1995) were used.

References evaporations (ETo) was computed by Penman-Monteith method as suggested by Allen *et.al.* (1998). Drought was evaluated (Table 1) following the criteria proposed by Subrahmanyam and Sastri (1969):

Departure of aridity index from median	Drought intensity
$<1/2\ \sigma$	Moderate
$1/2\ \sigma$ to σ	Large
6 to 2σ	Severe
$> 2\sigma$	Disastrous

Where σ is standard deviation of aridity index

Departures of weekly water deficiency from the cumulative normal (15 years) were taken and expressed as ratios of the normal water need. For depicting the spread of drought the departure of actual weekly water deficiencies from normal values were calculated for all the stations and were expressed as a per cent of water need

Table 1: Drought years and their severities during 1981-1995

Station	Severity of drought				Total drought years
	Moderate	Large	Severe	Disastrous	
Jodhpur	1988 -	1984,1985,1986,1989, 1991	1987	-	7
Sriganagar	1989,1990,1993	1984,1991	1981, 1987	-	7
Fatehpur	1987,1993	1984,1985,1990, 1995	1989	-	7
Pali	1993,1995	1984,1985,1986	1981, 1987	-	7
Jaipur	1981,1985,1988,1989	1984,1986	1987	-	7
Udaipur	1988,1991,1993	-	1986, 1987, 1995	-	6
Banswara	1983,1989	1985,1992	1986,1991	1987	7
Kota	-	1984,1986,1992	1981,1989, 1991	1987	7

(Eto).

According to drought classification, year 1987 was identified as a severe drought year for the state of Rajasthan. Drought occurred in 7 out of 15 years at all the stations under study except at Udaipur, where its frequency of occurrence is 6. Jaipur experienced most moderate drought years (4) compared to nil at Kota. Sriganganagar and Udaipur experienced 3 moderate drought years and Fatehpur, Pali and Banswara experienced 2 moderate drought years. The frequency of occurrence of large drought years varies from zero at Udaipur to 5 at Jodhpur.

It is also interesting to note that the years 1987 was either a severe or disastrous drought year at all the stations except at Fatehpur where a moderate drought was experienced during 1987.

Spread of drought

Disastrous droughts usually do not

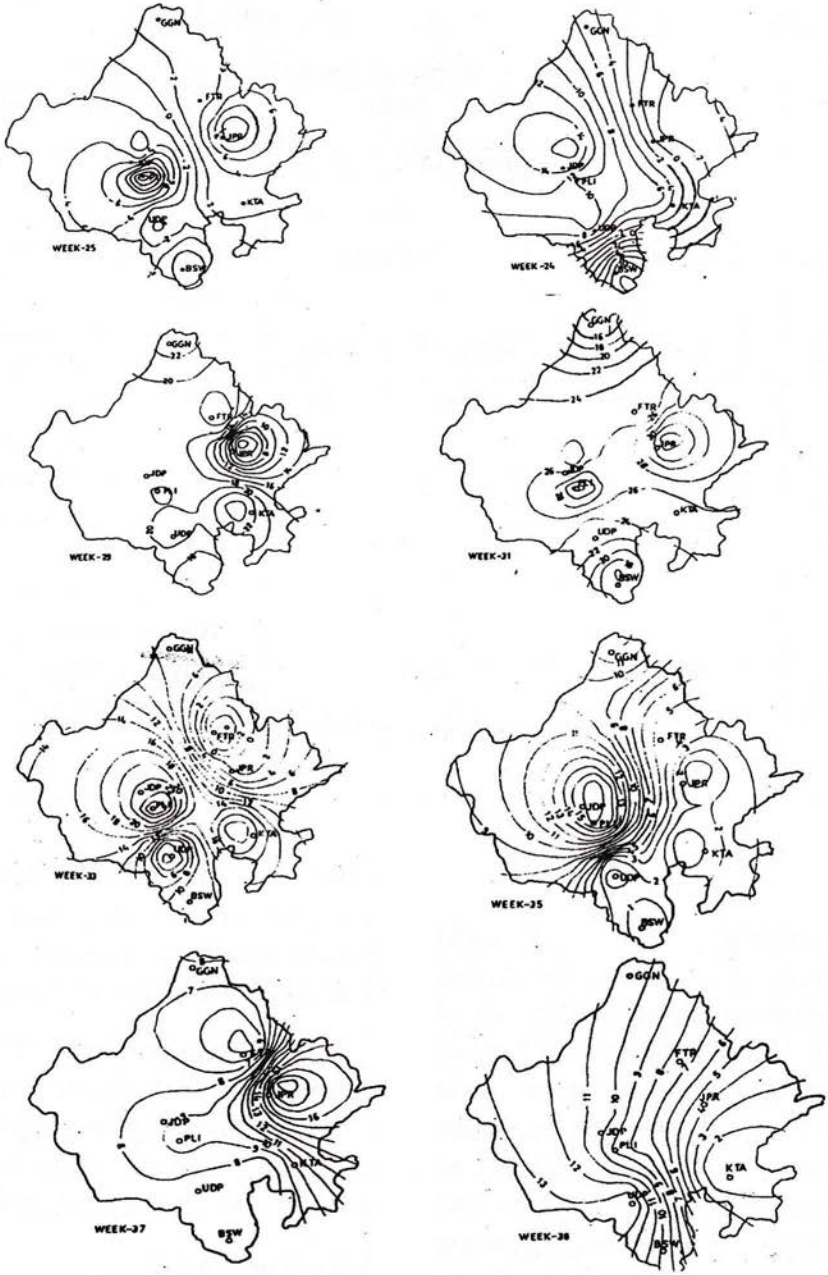

Fig 1 : Weekly variation in drought spread over Rajasthan during the year-1987

occur all of a sudden without warning, but they are usually the result of culmination of a weather sequence that requires time to develop. In Rajasthan, often some part or the other experiences localized drought. However, in some years, such as 1987 the whole state experiences drought conditions. Spread of drought in 1987 based on the departures of actual weekly water deficiency from normal to the ratio of annual water need and expressed in 1000 units are presented from 25rd to 39th week, during the main rainy season in the state (Fig. 1).

The zone of maximum drought intensity changed both its intensity and location in different weeks indicating a sequential pattern of drought spread and decay over the state. There were no drought conditions until 25th week in Banswara region. This region experiences moist sub-humid type of climate over the state in comparison to the other regions of the state. Also interesting is the fact that the lowest water deficiencies were observed in Jodhpur region, which records the lowest annual rainfall. It indicates that effect of disastrous drought is discernible earlier in the region of the high rainfall than in the low rainfall regions. Thus during the year 1987 the water deficiency remained slightly pronounced in the southern region of Rajasthan (except in the Udaipur region) during 23rd - 26th week i.e. even before the monsoon onset, with elongation of the isoclines in the south-west direction into the Pali and Jodhpur regions. By 27th week, the drought conditions not only intensified but one definite core of severe drought could be identified in Pali region. However, the decreasing gradient continued to be in north-south direction and from south toward the southwest. Jodhpur and Pali regions recorded lowest intensity during the 28th week.

During the 30th and 31st weeks, drought spread all over the Rajasthan state had experienced 'large drought' conditions. Drought intensity had eased off in the Fatehpur region by 32nd to 34th weeks, in the Udaipur region by 32nd to 35th weeks and in the Banswara and Kota regions by 34th to 35th weeks. By the 36th week Banswara region had lowest water deficiency. By the 38th week, Kota and Banswara had experienced lowest water deficiency. By the 39th week with lesser water deficiency (except around the Fatehpur region) over the rest of the state the drought core had merged with the seasonal drought associated with withdrawal of the monsoon.

Thus, the study indicates that the occurrence and spread of disastrous drought in 1987 may not be a sporadic

event in Rajasthan state but it showed a general tendency to follow a pattern of incidences. The effect of drought is more discernable and may occur early in regions receiving comparatively higher rainfall than regions of lower rainfall.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. A.N. Mathur, Dean, Collage of Technology Engineering, Udaipur and also Dr. Pratap Singh, Director Research, Maharana Pratap University of Agriculture & Technology, Udaipur for providing facilities and encouragement during the course of study.

REFERENCES

Allen , R.G.I.S., Pereia , Daes D. and Smith, M. 1998. Crop evapotranspiration,

Guideline for Computing Crop Water requirements. FAO irrigation and Drainage paper, Rome, Italy. p.300.

Malini, B.H. 1981. Patterns of aridity spread and severity of drought in Andhra Pradesh. *The Indian Geographical J.* 56 (1) :30-36.

Linsley, Jr, R.K., Kohler, M.A. and Philhaus, J.C.H. 1959. Applied Hydrology New York, M.C. Grand Hills. P. 581.

Ram Mohan , H. S., Juliet, S.M. and Valsala, P. 1984 . An agroclimatic approach to the assessment of tropical drought. *Mausam*, 38 (3) : 291-294.

Sastri, A .S.R.A.S. and Malakar, A.R. 1981. Climatological analysis of drought over north west India during the year 1979. *Mausam*, 35 (3): 259-262.

Subrahamanyam, V.P. and Sastry, C.V.S. 1969. Some aspects of drought climatology of the dry sub-humid zones of south India. *J.Met.Soc. Japan*, 47: 239-244.

Subrahmanyam , V.P. and Sastri, C.V.S. 1971. New techniques in drought analysis. *Annals Arid Zone*, 10 (2&3) : 120-135.

Thornthwaite , C.W. and Mather, J.R. , 1955 . The water balance Publ. In clim Drexel Inst. Tech., 8:104.