

RESEARCH PAPER

Estimation of yearly, monthly and weekly drought for Parbhani district

S.H. JEDHE, S.B. JADHAV* AND V.P. MANDALE

Technology Mission on Citrus, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.) INDIA

(Email: jedhesh07@gmail.com)

College of Agriculture Engineering and Technology, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.)

INDIA (Email: vpmandale@rediffmail.com)

ABSTRACT

The rainfall distribution of Parbhani district of Maharashtra state is quite erratic in space and occurrence of drought is common. In this study, 21 years (1991-2011) of rainfall data of Parbhani have been analyzed on yearly, monthly and weekly basis for predicting the water drought, normal and surplus events for crop planning in the region. Weekly drought normal and surplus events give a more precise idea about crop planning. The analysis has revealed that the assessment of drought on weekly basis is very important for better crop planning particularly in rainfed area. As analysis base period decreases the percentage of drought increases subsequently from year to month and from month to week. It has been also reveals that there is a need of assured supplemental irrigation facility in Rabi and summer season crops.

Key Words : Effective rainfall, Drought, Surplus, Normal

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The occurrence of rainfall is greatly varies across the country and frequent dry spell observed in the many parts of Maharashtra state. Most of the central Maharashtra districts have reported drought conditions of varying magnitude at different points of time. Generally, drought occurs when a region receives below average rainfall. The scenario of agricultural drought in Parbhani district falls under contingent drought, which results from variable and irregular pattern of rainfall. The adequacy of rainfall to meet water requirement of the crop and other consumptive and non-consumptive need of water is a basic requirement for crop planning. The rainfall is one of the most important and governing factor in the planning and operation strategies of any agricultural programme for any given area. As such, proper and specific information about the rainfall distribution pattern over a period for a particular place is quintessential for proper and optimal planning of requisite irrigation system and cropping pattern. The major share of conjunctive water need of the country during entire calendar year is met by the rainfall, which occurs in the monsoon period. There is large variation in distribution of rainfall from year to year. In respect of this study twenty one year's rainfall have been

*** Author for correspondence**

S.B. Jadhav, College of Agriculture Engineering and Technology, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.) INDIA

(Email: sbjadhav_aep@rediffmail.com)

analyzed to determine the period of water deficit, surplus and normal for crop planning at various levels such as yearly, monthly and weekly bases.

RESEARCH METHODOLOGY

The study was carried out for Parbhani district of Maharashtra state at an altitude of 409 m above mean sea level. Parbhani is intersected by 19°08' N latitude and 76°50' E longitude. Daily rainfall data was collected from Metrological Department, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. Daily rainfall data was converted on yearly, monthly and weekly basis and event are classified as drought, surplus and normal. If 'A' is the mean weekly rainfall for 21 years of data from 1991 to 2011, then a week receiving rainfall less than 75 per cent of 'A' value is defined as drought week and greater than 125 per cent of 'A' value is defined as surplus week. Week having rainfall between 75 per cent of 'A' value and 125 per cent of 'A' value is considered as normal week. Same criteria were applied for monthly and yearly events.

The last day of every year (365th day) and last 2 days of a leap year are accounted in the 52nd week.

RESULTS AND REMONSTRATION

In order to stabilize crop production at a certain level even in low rainfall years, it is essential to plan agricultural

operation on a scientific basis by making the best use of rainfall potential of the area. It is necessary to know the minimum assured rainfall at the time of different farming operations and growth stages.

Table 1 reveal that the average annual rainfall for Parbhani is 876.9 mm with a standard deviation of 222.7 mm with co-efficient of variation 25.4 per cent. The mean annual rainfall varies from the minimum of 575.2 mm in the year 2004 to the maximum of 1159 mm in the year 2006. About 61.9 per cent were normal years, 23.81 per cent as drought years and 14.29 per cent as surplus years. There were 13 normal years, 5 drought years and only 3 surplus years. Yearly rainfall only gives general idea about climate and it is less important regarding crop planning point of view.

From Table 2 reveals that the distribution of monthly rainfall pattern indicates that on an average the February month receives the lowest rainfall (3.2 mm) and July receives the highest rainfall (252.5 mm). The average monthly rainfall during 1991-2011 was 77.3 mm with an average standard deviation of 68 mm and 138.3 per cent co-efficient of variation. The number of drought event are more than that of normal and surplus event for all months. The drought events are observed in January, February, March, April, May, November and December months. Normal event observed in October months and most of the surplus events from June- September. On an average of occurrence of drought, normal and surplus months is

Table 1 : Yearly rainfall of Parbhani district

| | | | | | | | | | | | |
|-------------|-------|-------|-------|--------|-------|-------|-------|--------|--------|-------|---------------------|
| Year | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Rainfall mm | 822.7 | 593.1 | 792.7 | 779.1 | 635.0 | 995.9 | 970.3 | 1086.1 | 952.8 | 998.0 | 1121.7 |
| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Average rainfall mm |
| Rainfall mm | 864.6 | 767.4 | 575.2 | 1365.3 | 994.6 | 853.8 | 648.1 | 625.2 | 1295.2 | 677.5 | 876.1 |

Table 2 : Monthly rainfall of Parbhani district

| Month | Average rainfall | Standard deviation | Co-efficient of variation (%) |
|-----------|------------------|--------------------|-------------------------------|
| January | 7.88 | 14.14 | 179.38 |
| February | 3.24 | 7.21 | 222.63 |
| March | 9.73 | 18.29 | 187.97 |
| April | 8.21 | 9.26 | 112.82 |
| May | 15.98 | 24.18 | 151.32 |
| June | 145.54 | 96.46 | 66.28 |
| July | 252.46 | 187.94 | 115.88 |
| August | 196.49 | 136.80 | 69.63 |
| September | 171.93 | 88.24 | 51.32 |
| October | 81.49 | 70.78 | 86.85 |
| November | 27.62 | 39.06 | 141.40 |
| December | 7.06 | 19.35 | 274.25 |
| Average | 77.30 | 59.31 | 138.31 |

| Table 3 : Weekly rainfall of Parbhani district | | | |
|---|---------------------|-----------------------|-----------------------|
| Meteorological week | Average rainfall mm | Standard deviation mm | Coef of variation (%) |
| 1. | 2.13 | 8.05 | 377.22 |
| 2. | 4.40 | 10.08 | 229.24 |
| 3. | 0.45 | 2.05 | 458.26 |
| 4. | 0.48 | 2.18 | 458.26 |
| 5. | 0.77 | 2.59 | 338.46 |
| 6. | 2.15 | 6.64 | 309.19 |
| 7. | 0.10 | 0.44 | 458.26 |
| 8. | 0.68 | 3.10 | 458.26 |
| 9. | 1.23 | 3.69 | 300.23 |
| 10. | 4.09 | 12.37 | 302.31 |
| 11. | 3.45 | 11.45 | 332.12 |
| 12. | 0.92 | 1.88 | 205.06 |
| 13. | 0.22 | 0.88 | 392.56 |
| 14. | 1.65 | 3.71 | 224.59 |
| 15. | 4.03 | 7.81 | 193.78 |
| 16. | 0.87 | 2.45 | 281.49 |
| 17. | 1.82 | 5.52 | 303.34 |
| 18. | 1.58 | 3.80 | 241.29 |
| 19. | 0.87 | 2.06 | 237.82 |
| 20. | 6.21 | 20.03 | 322.37 |
| 21. | 6.12 | 9.25 | 150.99 |
| 22. | 7.59 | 27.93 | 368.26 |
| 23. | 28.61 | 44.34 | 154.96 |
| 24. | 34.80 | 29.05 | 83.47 |
| 25. | 40.09 | 49.67 | 123.91 |
| 26. | 44.72 | 57.68 | 128.96 |
| 27. | 47.38 | 49.32 | 104.09 |
| 28. | 44.76 | 57.31 | 128.04 |
| 29. | 28.50 | 34.65 | 121.58 |
| 30. | 12.52 | 17.35 | 138.58 |
| 31. | 45.67 | 54.13 | 118.52 |
| 32. | 58.23 | 74.52 | 127.96 |
| 33. | 30.74 | 32.23 | 104.85 |
| 34. | 62.87 | 62.96 | 100.15 |
| 35. | 52.21 | 48.58 | 93.04 |
| 36. | 43.34 | 43.11 | 99.47 |
| 37. | 36.65 | 50.99 | 139.12 |
| 38. | 40.76 | 39.61 | 97.20 |
| 39. | 23.97 | 40.76 | 170.05 |
| 40. | 25.81 | 43.74 | 169.47 |
| 41. | 22.93 | 37.08 | 161.70 |
| 42. | 18.80 | 39.48 | 210.03 |
| 43. | 5.72 | 18.17 | 317.45 |
| 44. | 4.41 | 11.11 | 251.63 |
| 45. | 6.72 | 14.71 | 218.81 |
| 46. | 4.69 | 10.61 | 226.07 |
| 47. | 9.30 | 20.59 | 221.37 |
| 48. | 5.28 | 22.25 | 421.61 |
| 49. | 4.40 | 14.12 | 321.23 |
| 50. | 1.34 | 6.02 | 449.77 |
| 51. | 0.06 | 0.28 | 458.26 |
| 52. | 0.47 | 1.86 | 395.54 |
| Average | 16.11 | 22.58 | 246.16 |

64.6, 6.75 and 28.57 per cent, respectively. The precautionary moisture conservation measures should be adopted during post monsoon period to ensure better crop condition in *Rabi* season.

The estimation of weekly rainfall and drought is more significant for crop planning and on farm water management practices in rain-fed and irrigated areas. Weekly available moisture variation is more critical to crop growth. The number of drought, normal and surplus weeks observed gives a clear idea about crop management practices. From Table 3, the number of drought weeks is more than the normal and surplus weeks. Average weekly rainfall during 1991-2011 was 16.1 mm with a average standard deviation of 22.6 mm and co-efficient of variation 246.2 per cent. On an average, 7th week was the driest and 34th week was the surplus; during summer season all weeks are drought; during monsoon season only 30th week was drought and total remaining weeks were surplus; during winter season only week number 40, 41 and 42 was surplus weeks and remaining season was drought. It was indicated that the overall drought week are 73.7 per cent while the surplus weeks are 20.9 per cent and 5.9 per cent normal weeks. Therefore, most of the weeks in winter and summer season need supplemental irrigation to mitigate soil moisture stress during crop growth. It is clear from the analysis that crop planning on weekly basis is more appropriate than that at monthly or yearly basis. It is observed that within a month there were week-to-week rainfall variations causing temporary drought spells, which are not reflected in monthly or yearly data analysis. If these drought weeks coincide with the critical stage of crop growth there will be considerable damage to the valuable standing field crops.

Conclusion :

- During 1991 to 2011, on an average the drought, normal and surplus years were 23.81, 61.9 and 14.29 per cent, respectively. The percentage of drought normal and surplus months were 64.6, 6.76 and 28.57 per cent, respectively; occurrence of drought, normal and surplus weeks were 73.7, 5.9 and 20.9 per cent, respectively. This trend indicates that on short term basis the occurrence of drought is more apparent in Parthian district. Hence, the analysis of short-term (week) rainfall data must be used for better crop planning in the Parbhani district.
- As analysis base period decreases the percentage of drought increases subsequently from year to month and from month to week.
- The number of drought weeks are more than that of normal and surplus weeks, for timely germination and proper growth of *Rabi* and survival of summer crops the facility of assure irrigation is necessary.

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