SEASONAL RAINFALL VARIABILITY ANALYSIS IN NANDURBAR DISTRICT OF MAHARASHTRA STATE

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Abstract

Among the total rainfall received from SW monsoon season, June to September month and October recorded higher rainfall than remaining months. This rainfall coincides with reproductive stage of kharif as well as timely sowing of rabi crops. However, average rains received from South-West rainfall was 705.8 mm of rainfall, which contributed 79.86 per cent over the period of 56 years, followed by North-East rains received 83 mm contributing 9.37 per cent, summer rains received 63 mm rainfall contributing 7.11 per cent and winter rains received 34 mm rainfall contributing 3.84 per cent of annual rainfall . This reveals and confirms that the South-West rainfall played major role with respect to the contribution of rainfall.
Key words Seasonal, Rainfall, Variability, Analysis, Maharashtra state

Introduction

In predominantly agricultural country like India, national economy is largely dependent on the agricultural production. The major agricultural enterprise component is still under rainfed cropping and hence agricultural production is still dependant on vagaries of monsoon. This situation is likely to remain so in near future also. So, the economic prosperity of India is very intricately connected with monsoon. Indian monsoon is highly erratic in nature both in quantum as well as distribution. The time of arrival of monsoon, cessation and distribution controls agricultural production and hence, the livelihood of the people. It is said that "Indian agriculture is gamble of monsoon and its failure and success mars or makes their destiny".

In many areas, the total precipitation is sufficient for one good crop and in some cases for two crops in a year. Because of the uncertainty and the ever-present risk of drought, the farmers are generally reluctant to adopt the high yielding varieties, fertilizers and other inputs. So, there is an urgent need for new techniques of resource management which will effectively conserve and utilize soil water.

Nandurbar district is bounded by 21^0 00' to $22^0$03' North and latitude $73^0$31' to $74^0$32' East longitude. Nandurbar district comprises six tahsils namely Akkalkuva, Nandurbar, Navapur, Shahada, Taloda, and Akrani. The district has total area of 5034.23 sq. km. In Nandurbar district the average of rainfall is 885.8 mm. The rainfall in the eastern part of the district is minimum and Shahada comes under this category. The rainfall increases in the westwards of the district Akkalkwa and Nawapur comes under the major rainfall area in the district.

The climate of Nandurbar District is generally hot and dry. As the rest of India Nandurbar District has three distinct seasons; Summer, Monsoon /Rainy and the Winter season. Summer is from March to mid of June. Summers are usually hot and dry. During the month of May the summer is at its peak. Temperatures can be as high as 45° Celsius during the peak of Summer. The Monsoon sets in during the mid or end of June. During this season the weather is usually humid and hot.

Materials and Methods

The important aspects like monthly rainfall variability in Nandurbar district of Maharashtra state is studied. The historical daily data of rainfall at each tahsil of Nandurbar district was collected from (1) India Meteorological Department, Pune (2) College of Agriculture, Pune and (3) Zonal Agricultural Research Station, Solapur.

The daily data collected for each tahsil were summed up on meteorological monthly basis. For calculation of meteorological monthly basis, the year was partitioned as per meteorological calendar, starting from 1st January of each year and ending on 31st December of the same year. Calendar month wise data were processed and tabulated for further analyses. The Weather Cock software developed by CRIDA, Hyderabad was used for analysis of different weather parameters *viz.*, seasonal rainfall variability analysis.

Daily rainfall data was recorded at each tahsil headquarter were collected and used for Nandurbar district study. The daily rainfall data of 06 tahsils were available for last 56 years (1961-2016) and these data were used for further analysis and the result to that effect are presented.

The data collected for each tahsil of Nandurbar district were subjected to statistical analyses such as standard deviation, coefficient of variation, extreme lowest and the highest tahsil wise seasonal rainfall variability were estimated by forward and backward accumulation from the computerized programme named Weather Cock developed by CRIDA, Hyderabad.

Seasonal rainfall variability (S)

$$\text{Seasonal mean rainfall (S)} = \frac{\sum_{i=1}^{n} S_i}{n}$$

Standard deviation (mm):

$$S.D. = \sqrt{\frac{(S_i - \bar{S})^2}{n}}$$

Seasonal Coefficient of variation (C.V.%)

$$C.V. = \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

Where,
S_i = Seasonal rainfall of ith year   C.V. = Coefficient of variation
S.D. = Standard deviation   n = Number of years
S = Mean seasonal rainfall

Results and Discussion

Seasonal rainfall variability:

The data pertaining to tahsilwise seasonal rainfall analysis are presented in Table. The season wise rainfall was analyzed for South-West, North-East, Summer and Winter seasons according to the tahsils of Nandurbar district. The rainfall was observed in all the seasons. However, average rains received from South-West rainfall was 705.8 mm of rainfall, which contributed 79.86 per cent over the period of 56

years, followed by North-East rains received 83 mm contributing 9.37 per cent, summer rains received 63 mm rainfall contributing 7.11 per cent and winter rains received 34 mm rainfall contributing 3.84 per cent of annual rainfall. This reveal and confirms that the South-West rainfall played major role with respect to the contribution of rainfall. The mean rainfall for the period of 56 years was 885.8 mm with 35.87 per cent coefficient of variation, while least variation was observed in South-West rainy season followed by North-East, which means the distribution of rainfall during the South-West season is more even as compared to the other seasons.

The tahsilwise mean seasonal rainfall was found maximum at (1133 mm) at Navapur, (1025 mm) at Akkalkuva , (876.5 mm) at Akarni, (832.4 mm) at Taloda, (760.7 mm) at Nandurbar, (686.9 mm) at Shahada. This reveals that though heavy rains near the Sahyadris in Navapur and Akkalkuva plentifull in the hilly parts of Akarni, Taloda, Nandurbar and Shahada the rainfall was uncertain. This was because of the variation in topography and Geographical location of all the tahsils. Deka and Nath (2000) worked on same objectives of rainfall analysis for three distinct crop seasons. These are summer (March to May), *kharif* (June to September) and *rabi* (October to February). The highest rainfall occurs during *kharif* season (1232.2 mm) followed by *summer* (478.6 mm) and *rabi* (220.4 mm) seasons.

1. South-West monsoon:

It was observed that the rainfall received from South-West monsoon was highest in navapur (828.1 mm rainfall with 35.03 per cent variation), Akarni (820.8 mm rainfall with 37.02 per cent variation), Taloda (781.9 mm rainfall with 33.22 per cent variation), Akkalkuva (753.5 mm with 40.30 per cent variation), Nandurbar (547.7 mm rainfall with 39.47 per cent), Shahada (503.0 mm rainfall with 45.13 per cent variation). This trend shows rainfall variation due to agroclimatic conditions and topographical differences. Gare *et al.* (2000) studied rainfall variability analysis at Gadhinglaj (Maharashtra) and concluded that *kharif* season was more assured than the *rabi* season and MW 29 was suitable for dry seeding in that area.

2. North –East monsoon:

The rainfall received from North-East monsoon showed highest rainfall in Navapur (123.5 mm rainfall with 85.47 per cent variation), followed by Akkalkuva (115.9 mm with 89.19 per cent variation), Nandurbar (89.3 mm with 73.87 per cent variation), Shahada (80.6 mm with 76.79 per cent variation), Akarni (46.8 mm rainfall with 91.39 per cent variation), Taloda (41.8 mm with 107.51 per cent variation). Hence this distribution of rainfall showed that the North-East rainfall was highest in Southern part of Nandurbar district and lowest in Northen part of Nandurbar. The variation in rainfall may be due to agroclimatic conditions and topographical differences.

Krishnakumar and Prasad Rao (2008) studied the trends and variability in north east monsoon rainfall over Kerala. They observed that the monthly rainfall over Kerala showed an increasing tendency during October and November with a decreasing in December. Such trend was more evident since 1961 onwards. The monthly rainfall range as well as its variability was less during excess rainfall years when compared to that of deficit rainfall years.

3. Summer and Winter season Rainfall:

Rainfall received from winter and summer season were negligible as compared to other two seasons. However, summer showers were highest in Navapur recording 118.6 mm with 92.29 per cent variation and Akkalkuva recording 94.9 mm rainfall with 71.47 per cent variation over other tahsils. Also, the winter showers were highest in Navapur recording 62.8 mm rainfall with 114.02 per cent variation and Akkalkuva recording 61.1 mm rainfall with 140.45 per cent variation over other tahsils. Thus, this rain was useful for *rabi* cropping. The summer showers were important from preparatory tillage point of view.

Hence from all these observations it was concluded that South-West (June to September) monsoon season plays an important role in all the tahsils of Nandurbar district, which gave assured rainfall during *kharif* season crops of different growing periods such as short duration and medium duration crops that could be safely be grown under rainfed cropping system. However, the good quantum of rainfall received in North-East (October to December) monsoon season (post-monsoon) help in proper establishment and early growth of rainfed *rabi* crops. Sahu (2008) carried out probability analysis of rainfall for Junaghar. They observed that at 80 per cent probability level, the rainfall available in the first (May- Aug.) and second (Sept.- Nov.) season are more than the water requirement of the crops which were grown in that region. In the third (Dec.-April) season, the rainfall availability was not enough to support any crop without irrigation.

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Table 1: Tahsilwise seasonal rainfall (mm) variation in Nandurbar district (1961-2016)

ahsils	Season wise rainfall (mm) and coefficient of variation (%)														
	South-West			North -East			Summer			Winter			Total (mm)		
	RF	S.D.	C.V. %	RF	S.D.	C.V. %	RF	S.D.	C.V. %	RF	S.D.	C.V. %	(Jan-Dec)	S.D.	C.V. %
Akarni	820.82	303.9	37.02	46.75	42.72	91.39	8.59	20.15	234.54	0.36	1.23	342.05	876.52	305.23	34.82
Akkalkuva	753.53	303.67	40.3	115.89	103.36	89.19	94.89	67.82	71.47	61.07	85.77	140.45	1025.38	405.6	39.56
Nandurbar	547.7	216.2	39.47	89.3	66.0	73.87	80.0	73.2	91.55	43.7	50.3	114.97	760.7	253.2	33.29
Navapur	828.1	290.11	35.03	123.52	105.57	85.47	118.64	109.49	92.29	62.78	71.59	114.02	1133.04	382.44	33.75
Shahada	503.03	226.99	45.13	80.57	61.87	76.79	67.53	40.99	60.7	35.76	44.64	124.83	686.89	282.61	41.14
Taloda	781.87	259.72	33.22	41.79	44.93	107.51	8.28	31.25	377.52	0.5	1.94	388.68	832.44	271.65	32.63
District mean	705.8	266.8	38.36	83.0	70.7	87.37	63.0	57.2	154.68	34.0	42.6	204.17	885.8	316.8	35.87

Per cent contribution to total rainfall	79.68	9.37	7.11	3.84	100.00

RF = Rainfall (mm) , SD = Standard deviation , CV% = Co-efficient of variation (%)