

# Rainfall Distribution and Its Variation in the Indapur Tahsil District Pune Maharashtra

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**Abstract:** Indapur tahsil is one of the drought-prone areas in Pune district. It is always known as a region of scarce rainfall in Maharashtra. The study area comes under the rain-shadow region, due to which it is considered as a drought-prone area. The average annual rainfall is 503.8 mm. The onset of monsoon, amount of rainfall and the variability of rain are very irregular in the study area. As such, a large part of agricultural land depends on the monsoon and there is an uncertainty of rainfall. The majority of small and marginal farmer and landless depends on agriculture, especially in the dry area. The present research work secondary data sources are used. In addition to this detail, spread of average annual rainfall which has been analysed for more than 90 years of data has also been considered for interpretation. All the supported data is collected from different offices and online. There are seven watershed areas in the study area. Average rainfall distribution spread over the entire study area thus produced in grid format has been used for volumetric analysis. The average annual volume of rainfall is 1052.46 MCM. The very low rainfall volume is observed to the northern side and very high rainfall volume is observed to the eastern side of Indapur tahsil.

**Key words:** distribution, rainfall, variation, watershed.

## 1. Introduction:

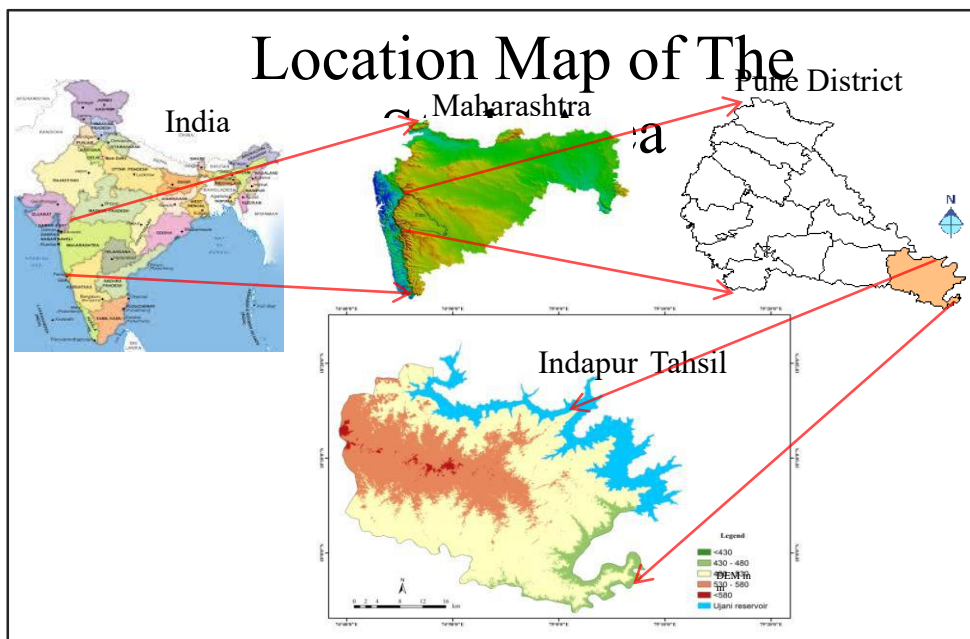
Investigations of Rao and Mishra (1971) have shown that annual rainfall of India is quite stable in general, but it is most uncertain in the north-western parts of the country. Currently, the main problem emerging in many parts of the world is water scarcity. The Indapur tahsil being a semi arid and arid track incorporated under the Drought Prone Area Programme (DPAP) the area is characterized by scanty and uneven rainfall ranges from 450 to 550 mm.. The Rainfall is mainly received from the south-west monsoon. Monsoon sets in the month of June and lasts up to the month of October. Monsoon onsets first week of June and having its peak period during the month of September and October. It is also characterizes by uneven and scanty rain with long dry spell during summer. The highest rainfall is observed in the in 2009 and it is recorded to be 1103 mm at Bawada and minimum at Sansar 85 mm in 2003. Agro climatically, this study area belongs to scarcity zone of rainfall to about 80 to 90 percent received from southwest monsoon and remaining very less rainfall receives from retreat of monsoon. It can be clearly noticed that rainfall distribution decreases steadily from north-west to south-east direction. The study area comes under the rain shadow region, hence rainfall is very irregular. The onset of monsoon, amount of rainfall and the variability of rain are very irregular in the study area.

## 2. Objectives

- To understand rainfall condition.
- To study the variation of the rainfall.
- To analyze the rainfall distribution in the study area.

## 3. Study area

Indapur tahsil is one of the tahsils in the Pune district consisting of 142 villages along with one urban centre in the study area. There are eight revenue circles in the tahsil. The area extends from 17° 53' 42" to 18° 19' 58" North latitudes and 74° 39' 16" to 75° 09' 39" East longitudes (**Fig. 1**). The area is drained by the river Bhima on north and east both sides. Nira River flows south of Indapur tahsil. Total geographical area of the tahsil is 1575.38km<sup>2</sup> (Census 2011), out of which Nira river



**Fig. 1** Location map

catchment area compress about 586.8 km<sup>2</sup> and Bhima river catchment covers an area of 902.43km<sup>2</sup>. Nira River joins the Bhima River at famous tourist place i.e. Narsinhapur village after travelling a course of 209 Kms. The slope of region is towards east. There are three soil types, namely, coarse shallow, medium black and deep black soils occupying 30, 40 and 30 percent respectively.

**4. Database and methodology:**

For the present research work secondary data source are used. This work is to develop digital database at large scale using spatial and attribute data. The spatial data comprise of all the thematic and topographic maps and the attribute or non-spatial data is created mainly rainfall information. All the supported data is collected from survey of India, WRIS NRSC Governments of India, Maharashtra State Gazetteer Pune District, Mahaagri.gov.in/rainfall/ntest2.asp, Maharashtra Government’s department of irrigation, department of agriculture and Tahsil office, Indapur etc. These data base converted to Microsoft access format to suit to the link up for processing through Arc View 9.3, Surfer version 10, Global Mapper version 11.

**5. Rainfall distribution and its variation :**

The rainfall is varied from season to season. Monsoon is the main rainy season in the study area. The monsoon starts as early in June and continues up to September, sometimes continues till the month of October as noted from the rainfall records during the years (1999-2018). The data recorded at the different rainfall stations of the study area form the main source of information for surface water resources.

However, the data are still inadequate for planning and integrated management of the water resources. In general a few rainfall stations have continuous records. However, in some cases the continuity is not maintained. As far as rainfall record frequency is concerned, the study area is lacking in daily rainfall data. On the other hand, the monthly records are available for a period of 19 years (1999-2018) from 8 stations in the study area. Mean annual rainfall increases from east to west part of the study area. The average annual rainfall recorded at Bawada, Indapur and Sansar station is more than 550 mm and at Anthurne, Walchandnagar, Nimgaon, Bhigwan and Shetphalgadhe rainfall receives less than 470 mm over a period of 19 years. Average annual rainfall distribution over the Indapur tahsil is shown in **table 1 and fig. 2**.

**Table 1** Annual Average Rainfall of Indapur tahsil in mm (1999 – 2018)

Sr. No.	Month/Name of rainfall station	Indapur	Sansar	Anthurne	Walchadnagar	Nimgaon	Bhigwan	Shetphlgadhe	Bawada
1	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
3	March	0	0	0	0	0	0	0	0

4	April	0.76	0	0	0	0	0	0	0
5	May	14.71	18.87	12.53	5.53	17.2	17.01	15.47	25.4
6	June	111.05	90.2	68.48	68.9	74.67	75.55	76.88	89.2
7	July	83.88	58.67	51.83	47.91	47.97	74.09	69.48	71.67
8	August	96.88	58.2	72.67	62.33	45.73	68.83	51.11	90.73
9	September	156.19	158.65	103.41	120.74	131.27	122.83	134.77	186
10	October	91.54	141.4	50.33	52.96	56.13	56.39	59.7	77.87
11	November	9.65	8.8	5.87	3.9	6.2	7.35	59.83	9.73
12	December	0	0	0	0	0	0	0	0
	Total	564.66	534.79	365.12	362.27	379.17	422.05	467.24	550.6

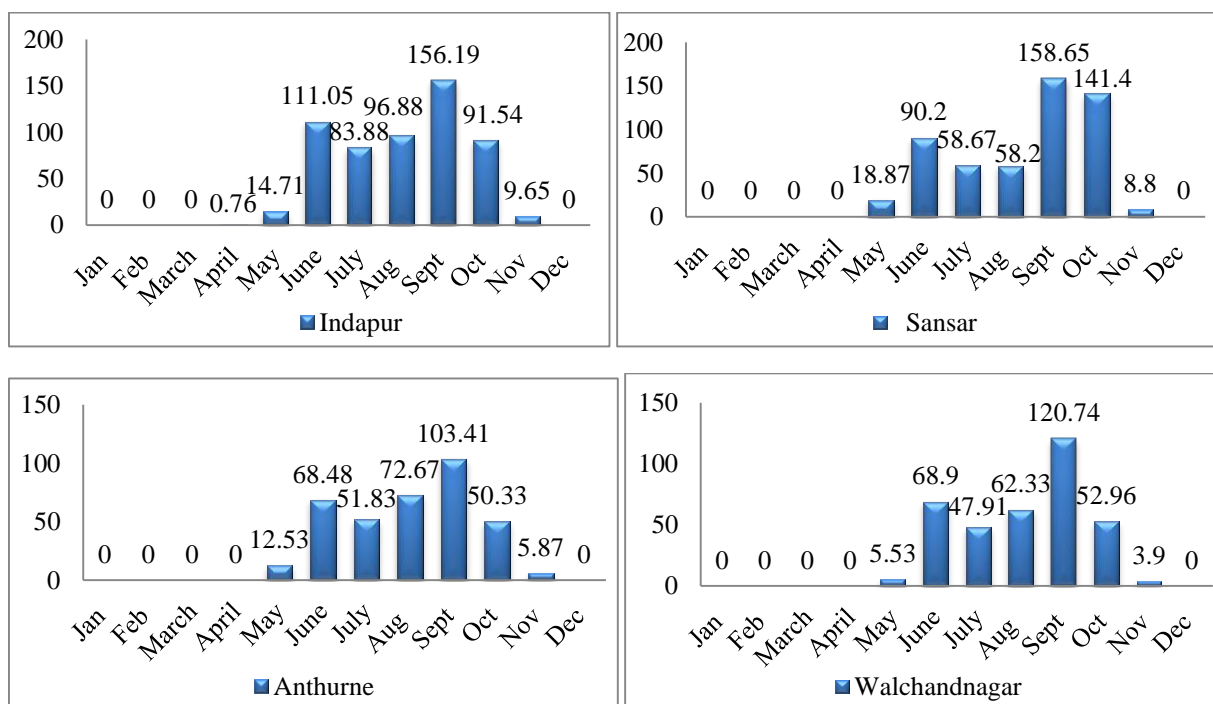
Source: Agriculture and Tahsil office, Indapur (2019).

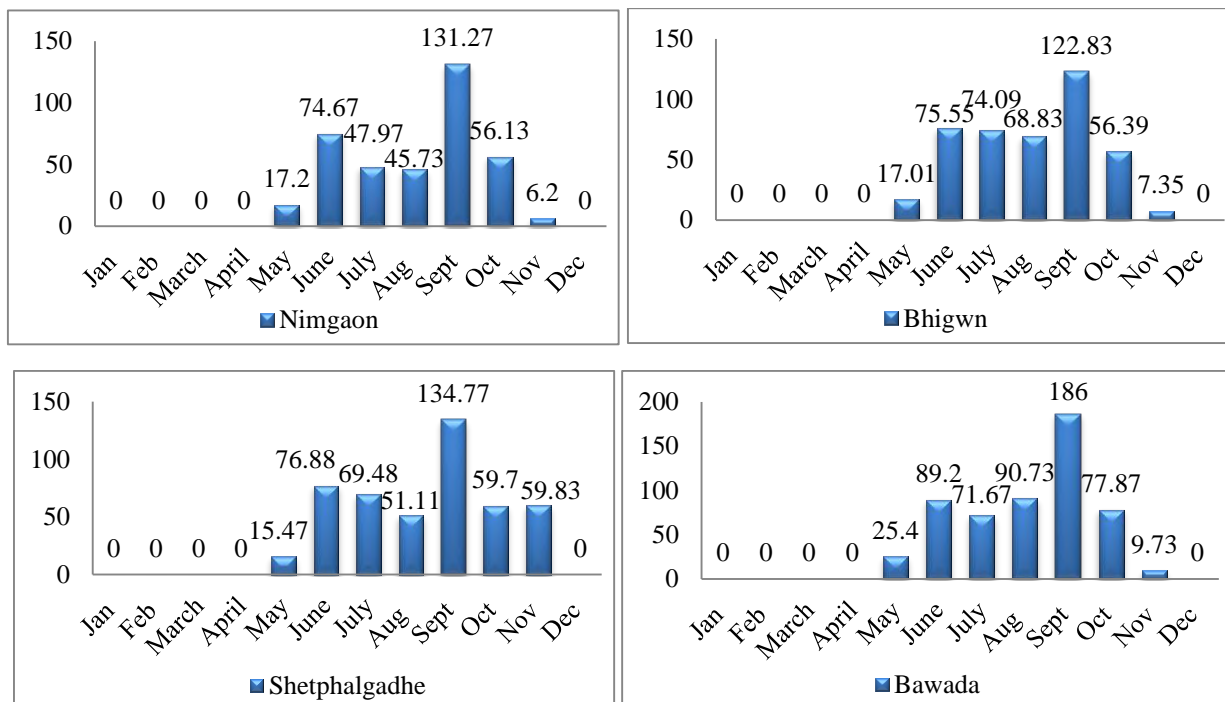
The study area receives nearly 75% mean annual rainfall by south –west monsoon, that blows from Arabian Sea and remaining rainfall receives from retreating monsoon. The rainfall is low in the central part of the study area due to the topographic effects. Monthly maximum rainfall occurs in June to September. The highest monthly mean rainfall occurs at Bawada station in the month of September (457 mm). The rainfall records of the five stations (Anthurne, Nimgaon, Shetphalgadhe, Bhigwan and Walchandnagar) situated in the eastern and central part of the study area which receives less rainfall than the remaining part of the study area.

However, the lowest mean monthly average rainfall occurred in the month of May and November with values reaching between 15mm to 10 mm. It can be concluded that the monsoon season is the only important rainy season in the study area. During the south west monsoon, the study area receives high amount of rainfall. Retreating monsoon contributes around 15% of the mean seasonal totals. Whereas pre monsoon season contributes about 10% of the total mean seasonal rainfall.

On the basis of 79 years average rainfall it is observed that and the actual rainfall received in the study area is highly uncertain. Fig. 3a for the year of 1999 and Fig. 3b for the year of 2018. The actual rainfall receives greater than the average rainfall in 1999 and vice a versa condition in the year 2018.

Fig. 2 Station wise annual average rainfall (mm) distribution in the study area





Source: Agriculture and Tahsil office, Indapur (2019).

Fig. 3a and 3b Average and actual rainfall in the study area in mm

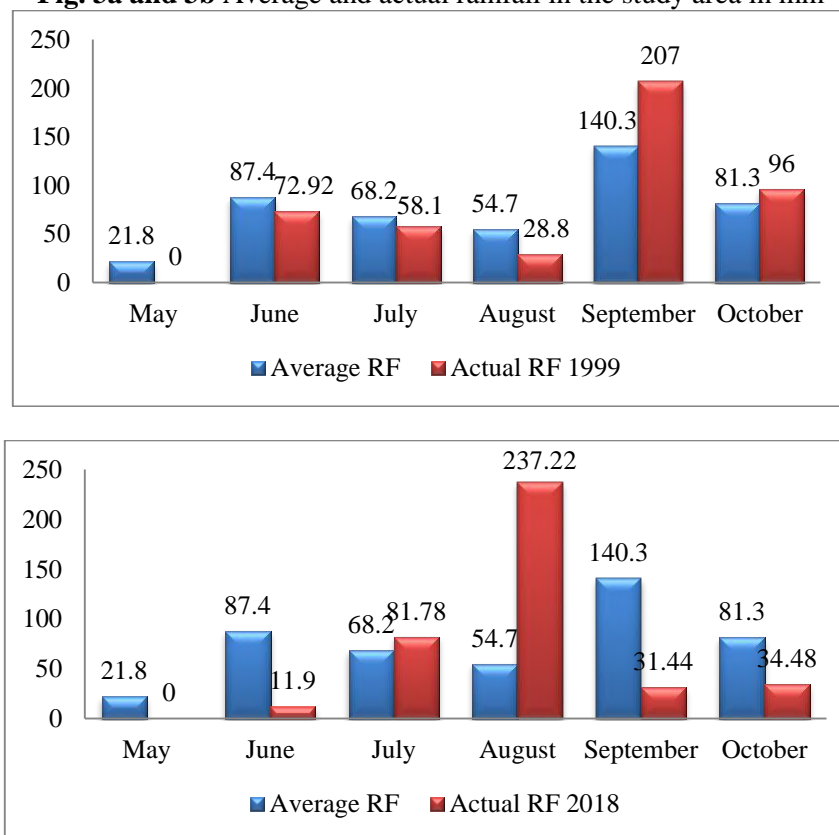


Fig. 3b

Source: Mahaagri.gov.in/rainfall/ntest2.asp and Agriculture & Tahsil office, Indapur.

6. Rainfall volume computation:

In the study area, the uncertainty of rainfall is a routine picture which has been reflected on total landuse pattern as well. Moreover, the irrigation is provided through canals, wells etc. to support irrigated crops up to some extent.

Database on rainfall has been made available from variety of sources i.e. Food and Agriculture Organization (FAO) grid of climate data, Water Resources Information System (WRIS) from river atlas of India (2014). The data obtained is of a longer period around hundred years or more and therefore considered as a final data set for present analysis.

**Grid operations**

Average rainfall distribution spread over the entire study area thus produced in grid format has been used for volumetric analysis. The area of tahsil segmented into sub basins has been used for the analysis and the volume of total rainfall has been computed accordingly.

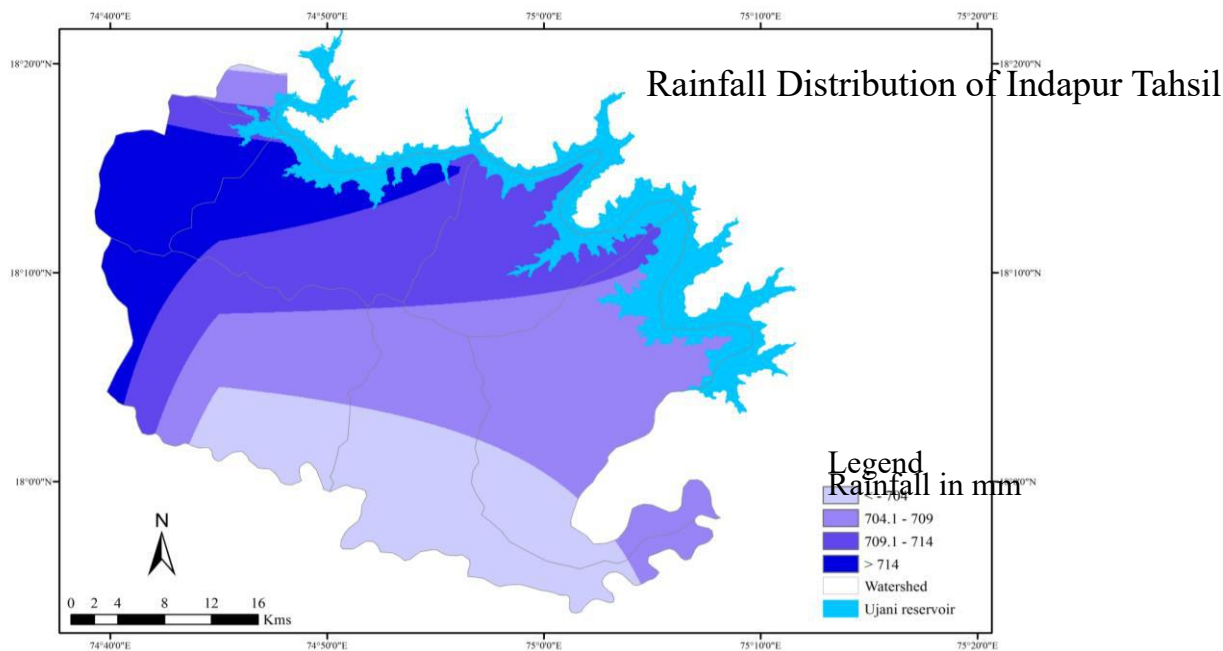
**Total volume average of rainfall**

Sub basin wise total volume of rainfall thus computed is displayed in table 2 Fig. 4a and 4b clearly indicates that, the average annual volume of rainfall is 1052.46 MCM. The very low rainfall volume is observed to the northern side sub basin of the tahsil (BM-61) accounts 16.43 MCM i.e. 1.56% and very high rainfall volume is observed to the eastern side sub basins of Indapur tahsil (BM-78) accounts 247.95 MCM which covers around 23.56% of the total study area.

**Table 2 and Fig. 4b** Watershed wise computation of volume of rainfall

Sr. No.	Name of area	Surface area in		Rainfall volume	
		Km <sup>2</sup>	%	M <sup>3</sup>	in %
1	Bhigwan-BM61	24.72	1.57	16434626513	01.56
2	Loni-BM66	193.87	12.31	130769925147	12.43
3	Palaasdev-BM67	241.88	15.35	161222847818	15.32
4	Akole-BM68	124.42	7.90	83873429156	07.97
5	Sansar-BM76	337.28	21.41	224940004744	21.37
6	Nimgaon-BM77	281.58	17.87	187270276730	17.79
7	Indapur-BM78	371.63	23.59	247957793057	23.56
	Total	1575.38	100.00	1052468903164	100.00

Source: By author



Source: www.india.wris.nrsc.gov.in Fig. 4a

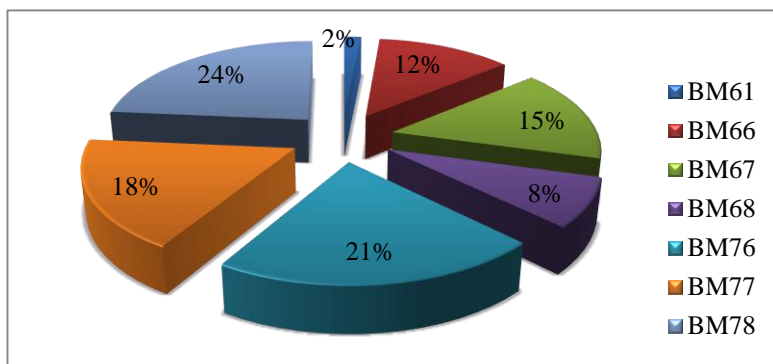


Fig. 4b

## 7. Conclusions:

The rainfall distribution shows two distinctive peaks one around June and other around October. A delayed arrival and an earlier withdrawal of the monsoon cuts short the rainy period. Generally the maximum rainfall is in August or September. The average annual volume of rainfall is 1052.46 MCM. The very low rainfall volume is observed to the northern side sub basin of the tahsil (BM-61) accounts 16.43 MCM i.e. 1.56% and very high rainfall volume is observed to the eastern side sub basins of Indapur tahsil (BM-78) accounts 247.95 MCM which covers around 23.56% of the total study area.

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