EDUZONE: International Peer Reviewed/Refereed Multidisciplinary Journal (EIPRMJ), ISSN: 2319-5045
Volume 9, Issue 2, July-December, 2020, Impact Factor: 6.423, Available online at: www.eduzonejournal.com

Determination of rainfed crop growing period in Narmada Basin, India

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ABSTRACT

An attempt has been made to estimate the length of crop growing period with the help of soil moisture conditions for rainfed crops in Narmada Basin, India. For the present study daily rainfall data of at least 35 years have been collected from Indian Meteorological Department (IMD, Pune for 47 rain-gauge stations within the basin. The daily have been converted into weekly data. Probabilistic analysis of rainfall has been carried out by using the technique of Incomplete Gamma Distribution. To estimate the beginning of growing period, weekly data of precipitation and potential evapo-transpiration along with weekly dependable precipitation (20 mm) have been considered. The end of growing period has been determined by using the data of AE/PE from the WATBAL model. Available soil moisture condition is computed by using soil moisture adequacy index.

The study reveals that the average length of growing season for shallow black and skeletal soils varies between 14 and 20 weeks whereas for medium and deep black soils it varies between 16 and 25 weeks and 17 and 28 weeks respectively. The probabilistic analysis of moisture availability indicates that the period of excellent moisture adequacy differs according to rainfall amounts and depth of soils from place to place.

Keywords: Rainfed, Dependable precipitation, Potential evapo-transpiration, Moisture adequacy.

INTRODUCTION

The most important task of agricultural planners is to match the duration of crop growing cycle with sufficient moisture availability period. To plan various agronomic operations, like preparation of the seed-bed, mannuring, sowing, transplanting and harvesting, knowledge of the probable dates of commencement and end of the rainy season is of prime importance. The crop-growing season, particularly in India, is subjected to great fluctuations. While determining the crop growing season for different soils, which have different water holding capacity and moisture availability period, it becomes necessary to identify the time of start and end of growing season, by adopting different criteria. In view of this, the present paper deals with the determination of crop growing season by assessing the reliable duration and characteristics of humid period. This information will be of immense help to farmers in taking proper decision for selection of rainfed crops and cultivation time.

Crop growing season starts with seedling or sowing. At the start of rainy season, seed germination and initial crop growth depend on the amount and frequency of rainfall. Different scientists have given different criteria for commencement of sowing. Robertson (1970) [10] developed a technique to determine the start of the crop-growing period based on climate and soil characteristics. He assumed that the amount of water readily available to the crops is 50% of the available water holding capacity (AWC) at the root zone. Virmani (1975) [13] defined the start of the crop growing season as an event, when 20 mm of rains occur in one or two consecutive days in a week, having a dependable rainfall probability followed by similar or higher probability. However, he did not take into consideration the evaporative demands of the plants. Kowal and Krabe (1972) [7], Raman (1974) [9], Benoit (1977) [2], Ashok Raj (1979) [1], Stern & Coe (1982) [11], Mavi (1986) [8] also defined the start of the growing season with different criteria.

Cocheme and Franquin (1967) [3] proposed a method on the computation of periods at which average rainfall (R) is equal to 1/10, 1 /2 and 1.0 of PET at the beginning, middle and end of the rainy season. The FAO Agro-ecological Zones project (1978) [4] characterizes the length of growing season as a period when available water allows unhindered crop growth. The growing period is defined as a period, in days when rainfall exceeds 50 % of the potential evapo-transpiration.

Taking into account the views of different scientists and agencies, the beginning of growing period i.e. sowing week is defined as a week satisfying the following criteria in the present study.
1] Rainfall in a week should be more than or equal to 0.5 PET.
2] Probability of receiving 20mm rainfall in a week should be at least 70 % and the following week must be a wet week with similar or higher probability.

The first criteria takes into account the fact, that the amount of moisture required to sustain crop germination and emergence, is much below full potential evapotranspiration and during crop emergence in the field, it approximates to about 0.5 PE (Kowal and Kasam, 1978) [6]. Therefore, the amount of moisture supply equal to or greater than 0.5 PE has been considered as being sufficient to meet the water requirement of establishing field crops.

In a given crop-growing season, many times, decisions have to be taken based on the probability of receiving a certain amount of rainfall during a given week and also the probability of rain in the following week. The second criteria accounts for this risk factor for agricultural operational planning.

For deriving the end of growing period and ultimately to derive the length of growing period, soil moisture storage must be taken into consideration. Because for most of the crops, the growing period continues beyond the rainy season and crops often mature on moisture reserves, stored in the soil profile. According to Virmani (1975) [13], for most crops the ratio of actual evapotranspiration to potential evapotranspiration (AE/PE) varies between 0.3 and 0.8. During seedling stage required AE/PE ratio ranges between 0.2 and 0.4. The vegetative growth phase is characterized by ratios of 0.4 to 0.6 and the flowering and reproductive stages by ratios of 0.6 to 0.8 or above. At the harvesting maturity stage, the water requirement of crops is comparatively less. With these factors in view, the end of the growing period is computed on the assumption that the available soil moisture is adequate to maintain an AE/PE ratio of 0.3 or more. Thus, the growing period ends as soon as the ratio of AE/PE drops below 0.3.

STUDY AREA:

Narmada is the fifth largest river of India and the largest west flowing river of the peninsula. It rises near Amarkantak in the Shahdol district of Madhya Pradesh at an elevation of about 1057 meters, in the Maikala Ranges. The river traverses a distance of about 1312 km through Madhya Pradesh, Maharashtra and Gujarat and drains in the Arabian Sea near the Gulf of Cambey. The river Narmada, with its 41 tributaries and number of other streams form the Narmada River System/ Basin. The basin lies between the latitudes 20°20’ and 23°45’N and the longitudes 72°32’ and 81°45’E in central India. Total catchment area of the basin is 98,796 sq.km., out of which about 87.5% lies in the state of Madhya Pradesh, 11% in Gujarat and 1.5% in Maharashtra. The basin has an elongated shape and is oriented in an east-west direction. It is bounded by Vindhya’s in the north; Maikala ranges in the east and Satpura in the south. To the west of it lies the Arabian Sea (Figure 1). The basin is characterized by highly variable relief and topography resulting into wide variations in climate ranging from semiarid to humid tropical. Secondly, it consists of variety of soils such as black, mixed black and alluvial, red and yellow and skeletal.

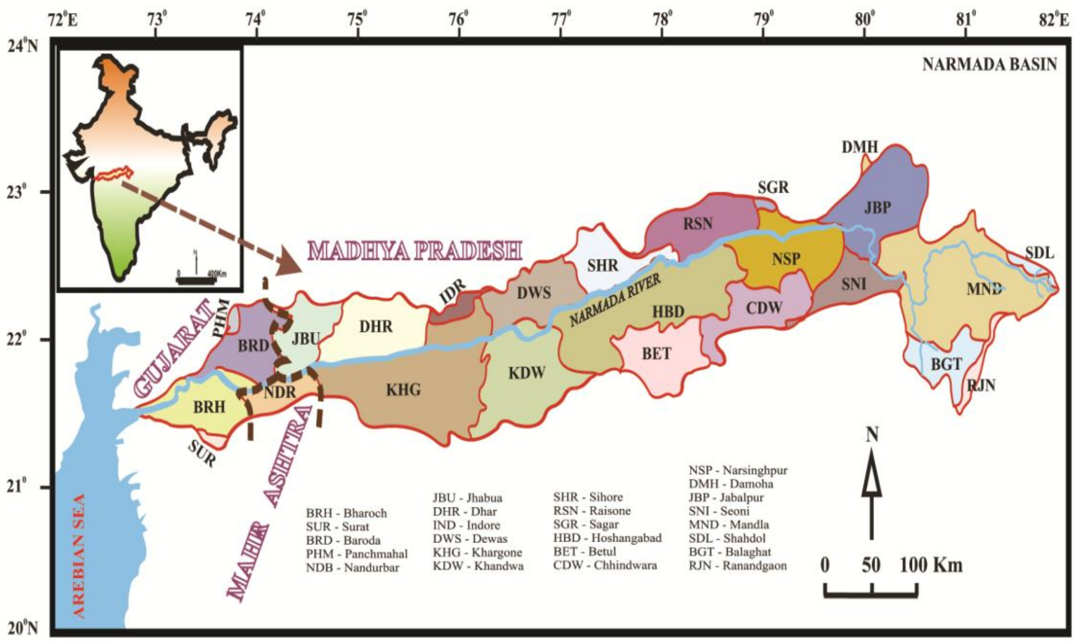

FIG. 1: LOCATION MAP

DATA USED AND METHODOLOGY:

For the present study daily rainfall data available for the period 1901 to 1988 have been collected from Indian Meteorological Department (IMD), Pune for 47 rain-gauge stations within the basin (Figure 2). The daily have been converted into weekly data. Probabilistic analysis of rainfall has been carried out by using the technique of Incomplete Gamma Distribution. To estimate the beginning of growing period, weekly data of precipitation and potential evapo-transpiration along with weekly dependable precipitation (20 mm) have been considered. The end of growing period has been determined by using the data of AE/PE from the WATBAL model developed by Keig and McAlpine (1974) [5].

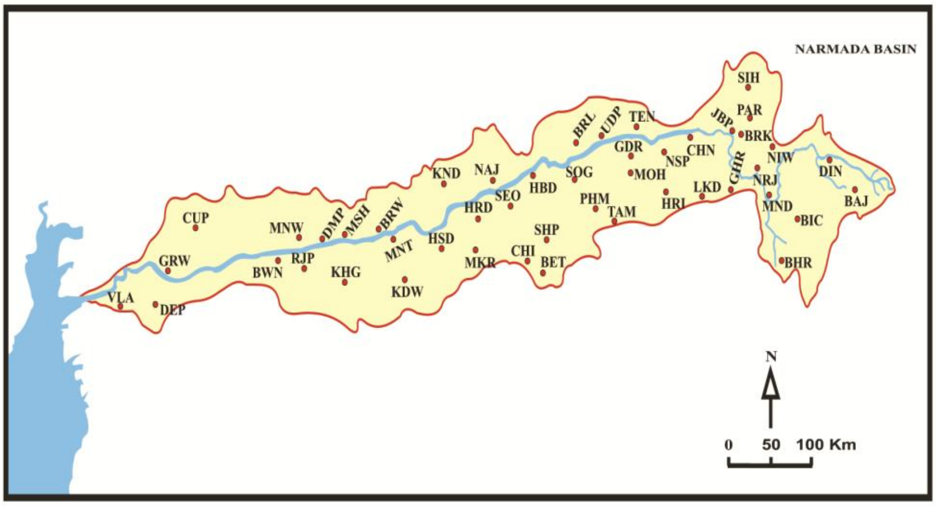

FIG. 2: RAINGAUGE STATIONS

SOURCE: INDIA METEOROLOGICAL DEPARTMENT (1961, 62)

Available soil moisture condition is computed by using Soil Moisture Adequacy Index (SMAI), developed by Thornthwaite and Mather (1955) [12] and Keig and Mc Alpine (1974) [5]. It can be expressed as SMAI = AE/PE *100.

RESULTS AND DISCUSSION

a) Annual Rainfall:

The average annual rainfall in the basin is about 1197 mm, which is more than the country's average (1090 mm). Major parts of this annual rainfall is received during southwest monsoon season (June to September), which accounts for about 90% of the annual rainfall. The upper reaches of the basin receives high amount of rainfall with a normal of 1410 mm; a good portion of this zone gets more than 1500 mm of rain (Fig.3). In the upper plains, the average rainfall is 1300 mm. But this is the zone where the highest rainfall of the basin gets recorded. The area around Pachamarhi and Tamia records the highest rainfall of 2061 mm and 1753 mm, respectively. It is mainly because of the orography. The rainfall decreases drastically towards the leeward side, with effect that Shahpur located further west, about 50 km from Pachmarhi, gets about 1000 mm of rain.

The rainfall further decreases rapidly from 1000 mm at the eastern margin of middle plains of the basin to less than 700 mm towards west (Fig.3). The average annual rainfall of this zone is about 820 mm. This is also the area of least rainfall in the basin. Barwani of Khargone district of Madhya Pradesh record the lowest normal of 639 mm. Rainfall again increases towards west and the western most zone, represented by lower hilly areas and lower plains, receives average annual rainfall of more than 1000 mm.

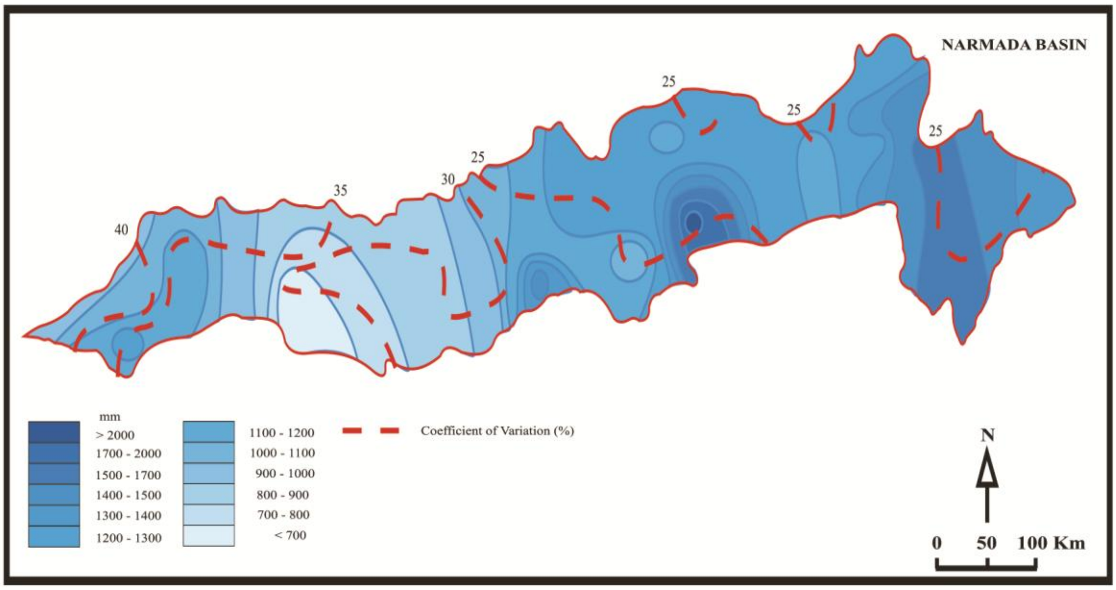

FIG. 3: ANNUAL RAINFALL (mm) AND COEFFICIENT OF VARIATION (%)

b) Crop Growing Season:

By using above mentioned criteria, the average duration of the crop growing season is determined for three types of soils and reported in the table 1.

i) Beginning of the growing period:

The growing season in the upper course of the basin starts in Meteorological Week (MW) 25 (June 18 - 24) [Appendix I]. For many places in the middle course, the sowing week commences in MW 26, while in the lower reaches of the basin, as well as in northern parts of the middle plains, the growing season begins in MW 27 (July 2-8). The sowing week for various places in the study region is reported in the table No. 1.

ii) End of the growing season:

For estimation of the end of the growing season, the moisture stored in the soil has been taken into consideration. The study reveals that the growing season ends earlier in shallow soils, while it is prolonged in the deep soils. In general, the growing season ends between MW 40 to MW 45 for shallow soils, while in deep black soils it extends upto MW 43 to MW 52. It has also been observed that, there is a significant relationship between the end of the growing period and rainfall amount. In the low rainfall areas the growing season ends earlier, while in the heavy rainfall areas it ends later.

iii) Average Length of the Growing season:

The average length of growing season for shallow black and skeletal soils varies between 14 and 20 weeks, while for medium and deep black soils, it varies between 16 and 25 weeks and 17 and 28 weeks respectively (Table 1).

TABLE NO. 1: AVERAGE LENGTH OF THE GROWING PERIOD AT VARIOUS STATIONS IN THE STUDY REGION

Sr.No.	Station	Soil	Starting (sowing week)	Ending	Total Weeks	Total Days	Remark
1	Baihar (BHR)	X Y Z	25	44 49 52	20 25 28	140 175 196	VHP
2	Bajag (BAJ)	X Y Z	25	45 48 52	21 24 28	147 168 196	VHP
3	Bareli (BRL)	X Y Z	26	42 44 47	17 20 22	119 140 154	HP
4	Barerkalan (BRK)	X Y Z	26	42 45 48	17 20 23	119 140 161	VHP
5	Barwaha (BRW)	X Y Z	27	41 43 45	15 17 19	105 119 133	LP
6	Barwani (BWN)	X Y Z	27	40 41 42	14 15 16	105 112 119	LP
7	Betul (BET)	X Y Z	25	43 47 50	19 23 26	133 161 182	HP
8	Bicchia (BIC)	X Y Z	25	44 46 52	20 22 28	140 154 196	VHP
9	C-Udepur (CUP)	X Y Z	27	41 43 45	15 17 19	105 119 133	M.P
10	Chicholi (CHI)	X Y Z	26	43 45 48	18 20 23	126 140 161	HP
11	Chindwara (CHN)	X Y Z	26	42 45 48	17 20 23	119 140 161	HP

12	Dediapada (DEP)	X Y Z	26	40 42 43	15 17 18	105 119 126	HP
13	Dharampuri (DMP)	X Y Z	27	40 42 44	14 16 18	098 112 126	LP
14	Dindori (DIN)	X Y Z	25	43 47 52	19 23 28	133 161 196	VHP
15	Gadarwara (GDR)	X Y Z	26	42 45 48	17 20 23	119 140 161	HP
16	Garudeshwar (GRW)	X Y Z	27	40 42 43	14 16 17	098 112 119	MP
17	Ghansore (GHR)	X Y Z	25	43 47 52	19 23 28	133 161 196	VHP
18	Harda (HRD)	X Y Z	26	42 45 47	17 20 22	119 140 154	HP
19	Harrai (HRI)	X Y Z	26	42 45 48	17 22 23	119 154 161	HP
20	Harsud (HSD)	X Y Z	26	41 43 45	16 18 20	112 126 140	MP
21	Hoshangabad (HBD)	X Y Z	26	42 45 48	17 20 23	119 140 161	HP
22	Jabalpur (JBP)	X Y Z	26	42 45 49	17 20 24	119 140 168	VHP
23	Kannod (KND)	X Y Z	26	42 44 47	17 19 22	119 133 154	MP
24	Khandwa (KDW)	X Y Z	26	41 43 44	16 18 19	112 126 133	LP
25	Khargone (KHG)	X Y Z	26	41 42 44	16 17 19	112 119 133	LP
TABLE 1: CONTINUED							
26	Lakhandone (LKD)	X Y Z	25	43 47 51	19 23 27	133 161 189	HP
27	Maheshwar (MSH)	X Y Z	27	41 43 44	15 17 18	105 119 126	LP
28	Makrai (MKR)	X Y Z	26	41 44 46	16 19 21	112 133 147	HP
29	Manawar (MNW)	X Y Z	27	40 42 43	14 16 17	098 112 119	LP
30	Mandhat (MNT)	X Y Z	26	41 43 45	16 18 20	112 126 140	LP
31	Mandla (MND)	X Y	25	43 47	19 23	133 161	VHP

		Z		52	28	196	
32	Mohapani (MOH)	X Y Z	26	42 46 49	17 21 24	119 147 168	HP
33	Narayanganj (NRG)	X Y Z	26	42 45 48	17 20 23	119 140 161	VHP
34	Narsinghpur (NSP)	X Y Z	26	42 45 46	17 20 21	119 140 147	HP
35	Nasrullaganj (NAJ)	X Y Z	26	42 45 47	17 20 22	119 140 154	HP
36	Niwas (NIW)	X Y Z	26	43 45 48	18 20 23	126 140 161	VHP
37	Pachmari (PHM)	X Y Z	25	44 48 52	20 24 28	140 168 196	VHP
38	Pariat (PAR)	X Y Z	26	42 45 48	17 20 23	119 140 161	VHP
39	Rajpur (RJP)	X Y Z	26	40 42 43	15 17 18	105 119 126	LP
40	Seoni (SEO)	X Y Z	26	42 45 47	17 20 22	119 140 154	HP
41	Shahpur (SHP)	X Y Z	26	43 46 49	18 21 24	126 147 168	HP
42	Sihora (SIH)	X Y Z	27	42 45 48	16 19 22	112 133 154	VHP
43	Sohagpur (SOP)	X Y Z	26	42 45 48	17 20 23	119 140 161	HP
44	Tamia (TAM)	X Y Z	26	43 46 49	18 21 24	126 147 168	VHP
45	Tendukhera (TEN)	X Y Z	26	42 45 48	17 20 23	119 140 161	HP
46	Udaipur (UDP)	X Y Z	26	42 45 47	17 20 22	119 140 154	HP
47	Valia (VAL)	X Y Z	27	40 42 43	14 16 17	098 112 119	MP

NOTE: VHP-Very High Potential; HP- High potential; MP- Medium Potential; LP- Low Potential
X- Soil with AWC 100mm; Y-Soil with AWC 150 mm; Z- Soil with AWC 200 mm.

Sr. No.	Soil type	Available Water Holding Capacity (AWC) in mm
1	X: Skeletal, Shallow black and Red & Yellow soils	100
2	Y: Medium black soils	150
3	Z: Deep black soils	200

Source: Virmani et al., 1976

c) SOIL MOISTURE ADEQUACY INDEX (SMAI):

To find out the degree of moisture adequacy or deficiency, available soil moisture condition is computed by using Soil Moisture Adequacy Index (SMAI), developed by Thornthwaite and Mather (1955) [12] and Keig and Mc Alpine (1974) [5]. It can be expressed as
SMAI = AE/PE *100.

With the help of SMAI, the moisture availability situation during the growing period can be categorized as per table given below.

TABLE NO. 2: CLASSIFICATION OF SOIL MOISTURE CONDITION ON THE BASIS OF SMAI

Sr. No.	SMAI (%)	Moisture condition
1	>75	Excellent with nil water stress
2	51-75	Good with slight water stress
3	26-50	Poor with moderate drought
4	≤25	Very poor with severe drought period

The soil moisture adequacy index has been computed for all the stations. Due to space limitation, however, for selected stations SMAI is illustrated in figure 5.

It is clear from the figure that, for most of the stations excellent soil moisture condition is available for continuous 13 to 20 weeks on three different types of soils. At Barwani, which is representative of low potential agro-climatic zone (Zone A) [Refer Fig.4], for shallow soils excellent moisture is available for continuous 13 weeks (MW 27 to MW 39), while severe water stress occurs from MW 44. In case of medium and deep black soils, excellent soil moisture condition prevails for continuous 14 /13 weeks.

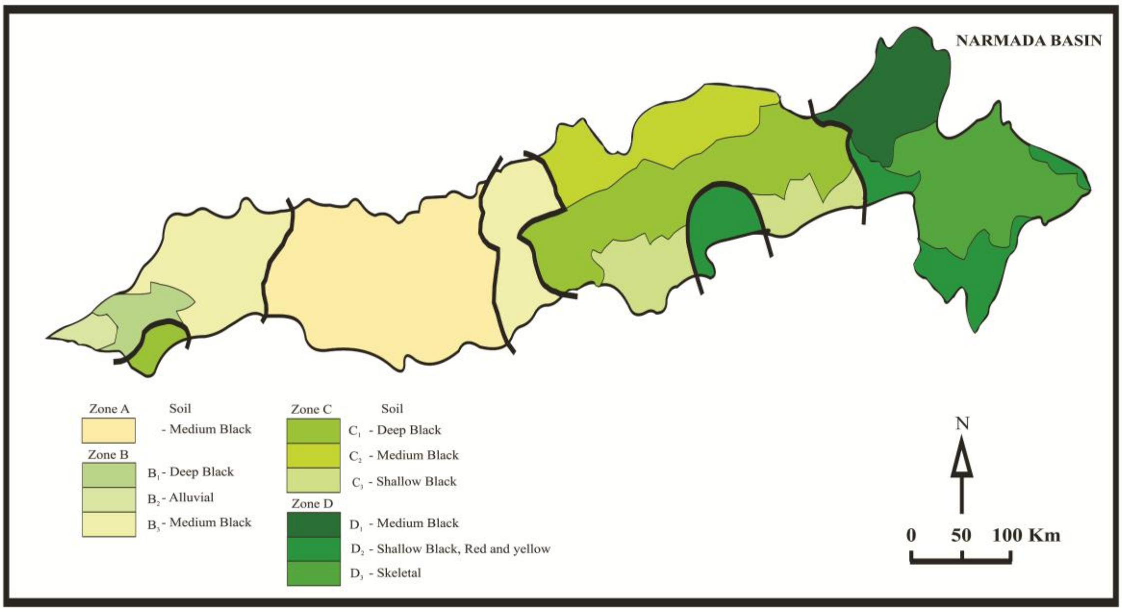

FIG. 4: AGROCLIMATIC ZONES OF NARMADA BASIN

The landscape of Chota Udepur, can be considered as representative of agro-climatic zone B (Moderate Potential), where the moisture condition is excellent for 16 weeks (MW 27 to MW 42) in predominant medium black soils. After MW 48, the region faces the problem of severe water stress.

At Hoshangabad, representative of agro-climatic zone C (High Potential), excellent moisture condition prevails for continuous 18 weeks (MW 27 to MW 44) in predominant deep black soils. This is followed by a slight water stress during MW 45 to MW 48.

At Mandla, representative of zone D (Very High Potential), excellent moisture condition prevails for continuous 18 weeks (MW 25 –MW 42) in skeletal soils and in deep soils this situation extends for 22 weeks, from MW26 to MW 47 (June 25 – Nov., 25).

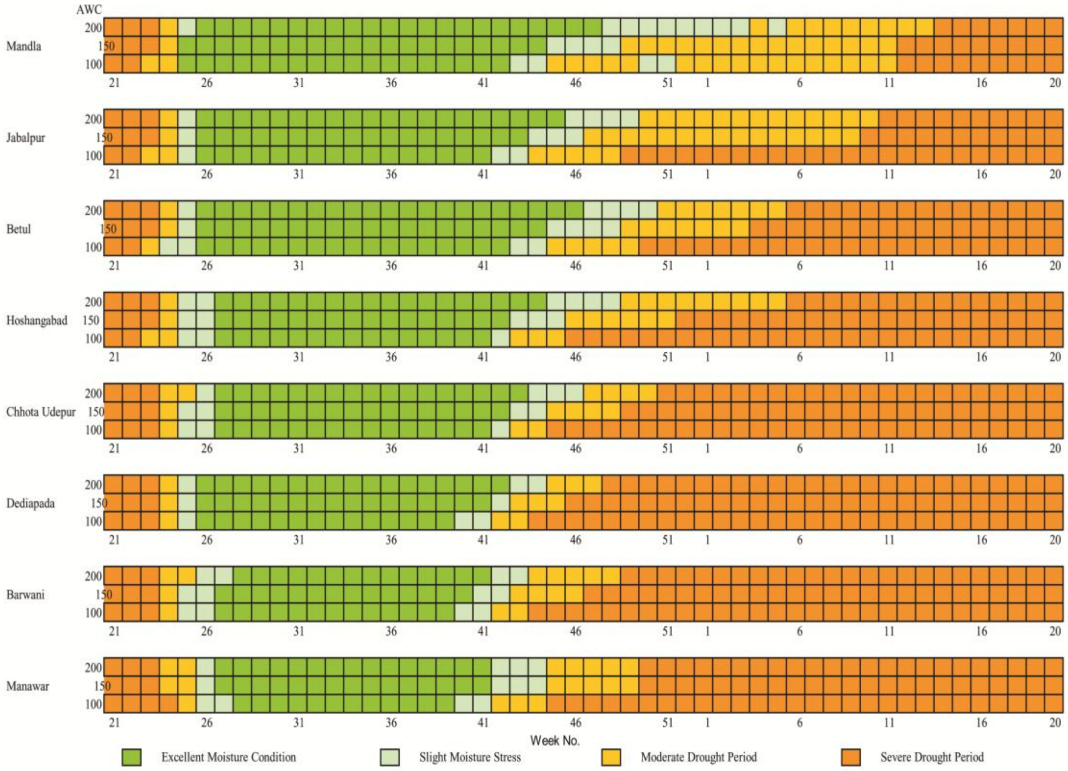

FIG.5: WATER AVAILABILITY PERIOD FOR SELECTED LOCATIONS

The probabilistic analysis of moisture availability has been carried out for all stations. Due to space limitation, however, probability of AE/PE ≥ 0.75 and ≥ 0.75 in different soil types for only two stations is given in Table 3. The probabilistic analysis of moisture availability indicates that the period of excellent moisture adequacy differs according to rainfall amounts and depth of soils from place to place. In the western part of zone A (Low Potential Agroclimatic Zone), the period of excellent moisture adequacy varies between 10 to 11 weeks in shallow soils, while in medium and deep soils, it ranges between 12 to 13 weeks in 7 out of 10 years (for example in Barwani, Table 3). In the eastern parts of the same zone however (for example in Khandwa), this condition prevails for continuous 13 weeks, from MW 28 to MW 40 (July 9 – Oct. 7) in shallow soils. The same period would extend upto MW 45 in deep soils (Table 3).

The analysis of moisture adequacy for zone B (Moderate Potential) reveals that the period of excellent moisture adequacy varies between 13 and 14 weeks for shallow soils and in deep soils, it ranges between16 to 18 weeks in 7 out of 10 years. For shallow soils of zone C (High Potential Agroclimatic Zone), the period of excellent moisture adequacy extends for 14/15 weeks and for deep soils, this condition is noted for 17/18 weeks. In case of zone D (Very High Potential Agroclimatic Zone), the period of excellent moisture adequacy for shallow soils ranges between 15 and 16 weeks starting from MW26, while for deep soils the same period ranges between 19 and 20 weeks (MW26 to MW 44/45).

CONCLUSION

The present analysis reveals that in shallow black soils and skeletal soils of the very high potential zone, the length of the growing period varies between 14 and 20 weeks. In medium and deep soils, however, this period further extends to 16 to 25 weeks and 17 to 28 weeks respectively. This study also reveals that in zone A, growing season starts late and terminates earlier, squeezing the growing period, while for zone D, the growing period of 140 to 196 days in medium and deep black soil permits growing a variety of kharif crops and even rabi crops without irrigation.

The probabilistic analysis of moisture availability indicates that the period of excellent moisture adequacy differs according to rainfall amounts and depth of soils from place to place. In the western part of zone A, the period of excellent moisture adequacy varies between 10 to 11 weeks in shallow soils, while in medium and deep soils, it ranges between 12 to 13 weeks in 7 out of 10 years. On the other hand, in very high potential agroclimatic zone D, for deep soils excellent moisture adequacy period ranges between 19 and 20 weeks.

TABLE: 3
PROBABILITY OF AE/PE ≥ 0.75 AND ≥ 0.25 IN DIFFERENT SOIL TYPES

	BARWANI						KHANDWA					
MW No.	AWC 100		AWC 150		AWC 200		AWC 100		AWC 150		AWC 200	
	0.75	0.25	0.75	0.25	0.75	0.25	0.75	0.25	0.75	0.25	0.75	0.25
23	0.09	0.30	0.05	0.29	0.05	0.28	0.11	0.25	0.10	0.20	0.10	0.20
24	0.28	0.55	0.26	0.51	0.26	0.51	0.21	0.40	0.19	0.41	0.17	0.40
25	0.36	0.62	0.34	0.61	0.32	0.59	0.49	0.66	0.46	0.62	0.45	0.62
26	0.49	0.80	0.45	0.80	0.43	0.77	0.56	0.89	0.55	0.86	0.52	0.86
27	0.61	0.94	0.60	0.94	0.57	0.94	0.71	0.90	0.71	0.95	0.70	0.95
28	0.79	0.94	0.73	0.94	0.70	0.93	0.80	0.96	0.77	0.95	0.76	0.95
29	0.79	0.98	0.74	0.98	0.73	0.99	0.86	0.98	0.85	1.00	0.84	1.00
30	0.82	0.95	0.80	0.96	0.80	0.98	0.93	0.99	0.94	0.99	0.94	0.99
31	0.77	0.99	0.79	0.99	0.77	0.99	0.95	0.99	0.96	0.99	0.94	0.99
32	0.77	0.99	0.75	0.99	0.75	0.99	0.94	1.00	0.94	1.00	0.94	1.00
33	0.80	0.99	0.79	1.00	0.79	1.00	0.91	1.00	0.93	1.00	0.91	1.00
34	0.82	1.00	0.82	1.00	0.81	1.00	0.89	0.98	0.94	0.99	0.94	0.99
35	0.81	0.98	0.84	1.00	0.84	1.00	0.93	0.99	0.96	0.99	0.96	0.99
36	0.77	0.95	0.84	0.99	0.85	1.00	0.89	0.98	0.93	0.99	0.94	1.00
37	0.75	0.95	0.77	0.98	0.82	0.98	0.86	0.99	0.90	1.00	0.93	1.00
38	0.73	0.94	0.80	0.96	0.84	0.96	0.84	0.98	0.94	0.99	0.94	1.00
39	0.66	0.91	0.74	0.96	0.79	0.96	0.75	0.94	0.88	0.98	0.93	0.98
40	0.54	0.82	0.64	0.90	0.73	0.91	0.61	0.91	0.79	0.96	0.86	0.98
41	0.40	0.69	0.56	0.89	0.64	0.90	0.36	0.77	0.65	0.93	0.82	0.96
42	0.24	0.56	0.46	0.74	0.56	0.84	0.25	0.60	0.49	0.86	0.70	0.93
43	0.12	0.40	0.25	0.64	0.40	0.75	0.15	0.41	0.25	0.75	0.54	0.86
44	0.11	0.26	0.14	0.57	0.28	0.69	0.12	0.34	0.21	0.62	0.35	0.81
45	0.09	0.25	0.17	0.46	0.21	0.62	0.11	0.31	0.24	0.50	0.34	0.75
46	0.08	0.20	0.09	0.34	0.17	0.52	0.06	0.24	0.12	0.38	0.24	0.65
47	0.10	0.15	0.09	0.29	0.15	0.49	0.14	0.25	0.12	0.40	0.25	0.62
48	0.10	0.20	0.10	0.30	0.11	0.40	0.11	0.25	0.11	0.40	0.15	0.52
49	0.04	0.15	0.03	0.22	0.05	0.32	0.09	0.22	0.10	0.31	0.12	0.46
50	0.04	0.12	0.04	0.16	0.04	0.29	0.09	0.20	0.10	0.25	0.10	0.38
51	0.03	0.10	0.03	0.12	0.03	0.21	0.09	0.19	0.09	0.24	0.11	0.38
52	0.00	0.06	0.00	0.11	0.00	0.15	0.03	0.17	0.03	0.20	0.04	0.31

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APPENDIX I
GUIDE TO THE STANDERD METEOROLOGICAL WEEKS

Week No.	Dates	Week No.	Dates
MW 1	Jan 1 - 7	MW 27	July 2 - 8
MW 2	Jan 8 - 14	MW 28	July 9 - 15
MW 3	Jan 15 - 21	MW 29	July 16 - 22
MW 4	Jan 22 - 28	MW 30	July 23 - 29
MW 5	Jan 29 - Feb 4	MW 31	July 30 - Aug 5
MW 6	Feb 5 - 11	MW 32	Aug 6 - 12
MW 7	Feb 12 - 18	MW 33	Aug 13 - 19
MW 8	Feb 19 - 25	MW 34	Aug 20-26
MW 9	Feb 26 - Mar 4 *	MW 35	Aug 27 - Sep 2
MW 10	Mar 5 - 11	MW 36	Sep 3 - 9
MW 11	Mar 12 - 18	MW 37	Sep 10 - 16
MW 12	Mar 19 - 25	MW 38	Sep 17 - 23
MW 13	Mar 26 - Apr 1	MW 39	Sep 24 - 30
MW 14	Apr 2 - 8	MW 40	Oct 1 - 7
MW 15	Apr 9 - 15	MW 41	Oct 8 - 14
MW 16	Apr 16 - 22	MW 42	Oct 15 - 21
MW 17	Apr 23 - 29	MW 43	Oct 22 - 28
MW 18	Apr 30 - May 6	MW 44	Oct 29 - Nov 4
MW 19	May 7 - 13	MW 45	Nov 5 - 11
MW 20	May 14 - 20	MW 46	Nov 12 - 18
MW 21	May 21 - 27	MW 47	Nov 19-25
MW 22	May 28 - June 3	MW 48	Nov 26 - Dec 2
MW 23	June 4 - 10	MW 49	Dec 3 - 9
MW 24	June 11 - 17	MW 50	Dec 10 - 16
MW 25	June 18 - 24	MW 51	Dec 17-23
MW 26	June 25 - July 1	MW 52	Dec 24 - 31**

Note: * In leap year the week No. 9 will be 26 February to 4 March,
i e. 8days instead of 7 days.
** Last week (ie. week No. 52) will have 8 days, 24 to 31 December.