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Study Of Talukawise Rainfall Pattern In Beed District Of Maharashtra Using Long Term Weather Data

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ABSTRACT

The research work on "Study of taluka wise rainfall pattern in Beed district of Maharashtra using long term weather data" was conducted during 2015-16at Department of Agricultural Meteorology, College of Agriculture, VasantraoNaik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra (India).The historical daily data of rainfall at each taluka of Beed district was collected for 30 years (1986-2015) from Maharashtra Agriculture and Statistical Department, Pune and District CollectorateOffice of Beed district. The collected rainfall data were categorized as annual, seasonal, monthly and weekly basis for the study of rainfall characterization.The results indicated that onset of monsoon in Beed district was observed in 23rd MW and withdrawal was in 43rd MW. Monthly mean lowest rainfall amongst all the taluka was noticed in both Majalgaon and Paralitaluka (0.0 mm) in February month and highest rainfall was noticed in Ambejogaitaluka (199.0 mm) in August month. The mean seasonal rainfall distribution of Beed district obtained in various season was Viz.,winter 1.6 mm (1.0 %), summer 14.8 mm (2.2 %), monsoon 584.1 mm (53.11 %) and post-monsoon 92.2 mm (7.53 %). The highest rainfall in monsoon season was recorded in Ambejogaitaluka (676.1 mm). The annual mean rainfall (normal) of Beed district was 692.8 mmprevailed in 38.4 rainy days. While, the taluka-wise mean rainfall (normal) was observed as Viz., in Beed (719.2mm), Patoda (669.6 mm), Ashti (670.2 mm), Gevrai (678.0 mm), Majalgaon (726.3 mm), Ambejogai (786.5 mm), Kaij (723.5 mm), Parali (715.9 mm), Dharur (693.9 mm), Vadvani (679.9 mm) and ShirurKasartaluka (558.0 mm). It means that intra-taluka variation of normal rainfall was high and it ranged from lowest in ShirurKasartaluka(558.0 mm) and highest inAmbejogaitaluka (786.5 mm). The statistical analysis for rainfall variability was worked out and it was intra-annual as well as intra-taluka variation in Beed district. It was ranged between 20.0 to 25.3 per cent with annual mean 38.4 rainy days yr^{-1}.

Key words: *Agro-climate zone, Beed district, Long term data, Rainfall pattern, Statistical analysis*

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INTRODUCTION

Rainfall is the important element of Indian economy. Although, the monsoon affects most part of India, the amount of rainfall varies from heavy to scanty on different parts. There is great regional and temporal variation in the distribution of rainfall. Over 80 per cent of the annual rainfall is received in the four rainy months of June to September. The average annual rainfall is about 125 cm, but it has great spatial variations. The two significant features of India's rainfall is that in north India; rainfall decreases westward and in Peninsular India, except Tamil Nadu; it decreases eastward.

Monsoon is the important season of Indian Agriculture; because of 70 per cent total cultivated area of the country is under rain fed. The uncertainty of rainfall as well as its uneven distribution during the crop growth period affects the agriculture production adversely. It is described that all possible efforts be made to understand and predict the weather well in advance. So the farmer can get sufficient time to cope with prevailing situation.As the rainfall and its distribution plays important role in deciding the success or failure of a crop in a given season. The study of rainfall and their interaction with soil are useful for the places of various management of farm operations like land preparation, preparation of seed bed, manuring, sowing time, fertilizer application, irrigation, harvesting and threshing etc. The selection of a crop for the zone is based on the rainfall, soil type and climatic condition i.e. rainfall of locality, the probable information about weather condition in adverse is used for planning suitable management strategy to escape from weather aberrations (Maniyar*et al.*,2007).

The total area of Beed district is10,693km^2 (4,129 sq.m). It lies between 18^0 28$'$ altitude and 19^0 28$'$ latitude and between 74^0 54$'$ altitude and 76^0 57$'$ longitude. It includes eleven (11) tehsils Viz., Beed, Ashti, Patoda, ShirurKasar, Gevarai, Ambajogai, Vadwani, Kaij, Dharur, Parali (Vaijanath) and Majalgaon. It is surrounded by Aurangabad and Jalna in the North, Parbhani and Latur in the East, Ahmednagar and Osmanabad in the South and Ahmednagar in the West. Godavari is the most significant river that flows on the borderline of Georai and MajalgaonTehsils.

Beed district falls under two agro-climatic zones i.e. Central Maharashtra Plateau (CMP) Zone and Western Maharashtra Dry or Scarcity (SC) Zone. Monsoon generally starts in the 2nd week of June and continues up to the end of September. The range of monsoon is between 458 mm and 814 mm. Though the mean annual rainfall of district comes in the assured rainfall. From october to February, the climate is cold and dry. Cold waves occur at times between November to January. Temperature during the summer season reaches 40 to 45 degree Celsius. In general, the climate is pleasant. The main business in the district is agriculture, but adequate and timely rains rarely occur, consequently there is at times a scarcity period; as most of the agriculture depends on the rain. Two harvest as *Kharif* and *Rabi* are adopted. The information on different aspects of rainfall pattern of each taluka of Beed district will be helpful for suggesting agricultural cropping plans to the farmers. Thus, keeping this view in mind; the present investigation was carried out during 2015-16.

MATERIALS AND METHODS

Amongst the weather parameters, rainfall is an important factor for living entity; especially to human being. Every drop of rainfall received during the crop growth stages has its own share in influencing the crop yields. Thus, this combined effect of rainfall on the crop yields can be studied on the basis of rainfall pattern prevailing during the crop growth stages. The approach, therefore involves identification of rainfall patterns and establishing association between rainfall patterns and the crop yields. The important aspects like onset and withdrawal of monsoon, distribution of monsoon and break in monsoon of Beed district are analyzed by using statistical techniques.

Collection of meteorological data: - Taluka-wise daily rainfall data for Beed district of last 30 years (1986-2015) was collected from the website (Anonymous, 2015) of Department of Agriculture and Statistics, Govt. of Maharashtra and Beed district Collectorate Office for statistical analysis. The rainfall data for Vadavani and ShirurKasartalukawere available from 1998 onwards and rainfall data for Parali and Dharurtalukawere available from 1993 onwards.

Processing of data: - The collected data of each taluka were summed up on meteorological weekly, monthly, seasonally and annually basis. The year was partitioned into standard meteorological week (MW) as per meteorological calendar, starting from 1st January of each year and ending on 31st December of the same year. Calendar month-wise data was processed and tabulated for further analysis.

Statistical analysis:- The data collected for each taluka of beed district Viz., Beed, Patoda, Ashti, Gevrai, Ambejogai, Majalgaon, Kej, Parali, Dharur, Vadavani and Shirur Kasar were subjected to statistical analysis such as mean (A), standard deviation (SD), coefficient of variation (CV), extreme lowest and highest and rainy days (Panse and Sukhatme, 1967).

Annual, seasonal, monthly, weekly rainfall variability

$$\textbf{Mean (A)} = \sum_{i=1}^{n} x/n$$

Standard Deviation

$$\delta = \sqrt{\frac{\sum (x - y)^2}{n - 1}}$$

C.V. (%) coefficient of variation

$$\text{C.V. (\%)} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

Where,

x = Annual/Seasonal/Monthly/Weekly rainfall of ith year,
n = Number of year,
$\bar{y}$ = Mean Annual/Seasonal/Monthly/Weekly rainfall

RESULTS AND DISCUSSION

The present investigation on "Rainfall variability analysis of Beed district of Maharashtra using long term weather data" was carried out during 2015-16 at Department of Agricultural Meteorology, College of Agriculture, Vasantrao Naik Marathwada KrishiVidyapeeth, Parbhani, Maharashtra (India). The daily rainfall data was collected for each taluka of Beed district for the period of 30 years (1986-2015) and it was summed up on meteorological weekly, monthly, seasonally, annual 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. The data of rainfall was available from 1993 to 2015 for Parali and Dharurtaluka and 1998 to 2015 for Vadvani and ShirurKasartaluka.

Taluka-wise rainfall characterization of Beed district.

a.Seasonal rainfall

The data of mean seasonal rainfall during 1986-2015 of each taluka in Beed district are given in Table 1.The statistical analysis for variability was observed within the year and season to season in Beed district it was ranged between 8.14 per cent (post-monsoon) to 64.48 per cent (winter). Annual mean rainfall for Beed district was recorded as 692.8 mm with annual variation of 8.12 per cent. The seasonal distribution of rainfall in Beed district was noted in winter season (1.6 mm), summer (14.8 mm), monsoon (584.1 mm) and in post-monsoon (92.4 mm).It means that Beed district received maximum rainfall in monsoon i.e. during *kharif*season and thereafter in post-monsoon i.e. during *Rabi* season. Hence, this region comes under assured *kharif*seasonand also useful for*rabi*season to cultivate different crops. These results are in conformity with Maniyar*et al.* (2007).During summer season, 15.7, 14.4, 13.2, 14.9, 15.7, 17.9, 14.2, 14.2, 9.7, 17.6 and 14.9 mm mean rainfall was noted in Beed, Patoda, Ashti, Gevrai, Majalgaon, Ambejogai, Kaij, Parali, Dharur, Vadvani and ShirurKasartaluka, respectively. In monsoon season, 607.1, 554.7,555.4, 570.2, 611.0, 676.1, 623.3, 597.1, 590.5, 577.3 and 462.4 mm rainfall was noticed in Beed, Patoda, Ashti, Gevrai, Majalgaon, Ambejogai, Kaij, Parali, Dharur, Vadvani and ShirurKasartaluka, respectively. Post-monsoon season rainfall was observed as in Beed 94.2, Patoda 98.7, Ashti 100.8, Gevrai 91.8, Majalgaon 98.8, Ambejogai 90.4, Kaij 84.9, Parali 103.3 , Dharur 89.6, Vadvani 83.7 and ShirurKasartaluka 80.2 mm. The highest rainfall in monsoon season was observed in Ambejogaitaluka (676.1 mm) and the lowest in ShirurKasartaluka (464.4 mm). These result showed that generally, the winter, pre-monsoon and post-monsoon rainfall were found much more variable than South-West monsoon (Bhimsingh*et al.,* 2014).The mean monthly rainfall gradually increased generally from January onwards and received peak in July; which thereafter decreased and it was minimum in the month of December(Chakraborty and Mandai, 2008).

b. Seasonal rainy days

The data of seasonal mean rainy days during 1986-2015 of each taluka in Beed district are given in Table 2. The seasonal mean rainy days recorded during summer season were Viz., in Beed (1.2), Patoda (1.0), Ashti (1.1), Gevrai (0.7), Majalgaon (0.9), Ambejogai (0.9), Kaij (0.8), Parali (1.0), Dharur (0.7), Vadvani (0.9) and ShirurKasar (0.9). Inmonsoon season they were Viz., inBeed (31.7), Patoda (32.7), Ashti (30.7),Gevrai (31.1), Majalgaon (32.9), Ambejogai (36.2), Kaij (34.7), Parali (33.9), Dharur (34.5), Vadvani (30.7) and ShirurKasar (26.9). While, in post-monsoon season theywere Viz., 5.4, 5.3, 5.5, 4.4, 4.6, 5.5, 4.9, 5.3, 5.3, 4.3 and 3.8rainy days in Beed, Patoda, Ashti, Gevrai, Majalgaon, Ambejogai, Kaij, Parali, Dharur, Vadvani and ShirurKasartaluka, respectively.

c. Annual rainfall

The data of mean annual rainfall are given in Table 3. The annual rainfall data were statistical analyzed for Beed district and within the year and taluka to taluka; it ranged (C.V. %) between 24.9 to 34.8 per cent. The annual mean rainfall for Beed district was 692.8 mm.

The data indicated that mean annual rainfall ranges from lowest 558.0 mm (ShirurKasar) and highest 786.5 mm (Ambejogai). While, the lowest and highest annual mean rainfall were Viz., in Beed 322.9 mm (1991) and 1228.2 mm (1989), Patoda 346.4 mm (2012) and 1155.0 mm (1998), Ashti 265.4mm (2012) and 1005.6 mm (2004), Gevrai 266.4 mm (2012) and 1124.2 mm (1988), Majalgaon 288.3 mm (1991) and 1313.5 mm (1988), Ambejogai 428.9 mm (1994) and 1047.0 mm (1998), Kaij 315.0 mm (1991) and 1242.5 mm (1998), Parali 318.2 mm (2014) and 1216.1 mm (1998), Dharur 330.9 mm (2015) and 1163.1 mm (2010), Vadvani 287.5 mm (2000) and 1048.3 mm (2005) and ShirurKasartaluka as 248.8 mm (2012) and 1155.0 mm (1998). From the data it is understood that the annual mean rainfall i.e. normal rainfall for Beed district was 692.8 mm. Similar results were reported by Rai and Singh (2009), Rani *et.al* (2014) and Kulkarni *et.al* (2008).

d. Annual rainy days

The data of annual rainy days during 1986-2015 of each taluka are given in Table 4. The statistical analysis for variability was worked out and it showed that intra-annual as well as intra-taluka variation in

Beed district ranged between 20.0 to 25.3 per cent with 38.4 annual mean rainy days yr^{-1}. However, the lowest and highest annual mean rainy days in Beed were 20 rainy days yr^{-1}(1991) and 58 rainy days yr^{-1}(1981), Patoda 21 (1991) and 57 (1988 and 2010), Ashti 24 (1991) and 54 (2010), Gevrai 25 (1991) and 55 (1990), Majalgaon 24 (1991) and 58 (2010), Ambejogai 28 (1986) and 61 (2013), Kaij 25 (1991) and 59 (1990), Parali 28 (2004 and 2014) and 61 (2013), Dharur 23 (2014) and 59 (2003 and 2010), Vadvani 20 (2000) and 50 (2013) andShirurKasartaluka 19 rainy days yr^{-1} (2000) and 52 rainy days yr^{-1} (1998). Hence, the change in rainfall and rainy days is not uniform in the region and varied regionally. However, it is also not considerable for agriculture business. It is clearly understood that the micro-meteorological changes were observed in intra-taluka and intra-annual and which affects agriculture production and productivity

SUMMARY AND CONCLUSION

The seasonal rainfall distribution of Beed district noticed in winter season was 1.6 mm, summer 14.8 mm, monsoon 584.1 mm and post monsoon 92.4 mm. The highest rainfall in monsoon season was recorded in Ambejogaitaluka as 676.1 mm and the lowest was in ShirurKasar as 464.4 mm.

In summer season; mean rainy days recorded was in Beed (1.2), Patoda (1.0), Ashti (1.1), Gevrai (0.7), Majalgaon (0.9), Ambejogai (0.9), Kaij (0.8), Parali (1.0), Dharur (0.7), Vadvani (0.9) and ShirurKasar (0.9). On the other hand, in monsoon season;itwas recorded as in Beed (31.7), Patoda (32.7), Ashti (30.7), Gevrai (31.1), Majalgaon (32.9), Ambejogai (36.2), Kaij (34.7), Parali (33.9), Dharur (34.5), Vadvani (30.7) and ShirurKasar (26.9). Similarly, in post-monsoon season; mean rainy days recorded was 5.4, 5.3, 5.5, 4.4, 4.6, 5.5, 4.9, 5.3, 5.3, 4.3 and 3.8 in Beed, Patoda, Ashti, Gevrai, Majalgaon, Ambejogai, Kaij, Parali, Dharur, Vadvani and ShirurKasartaluka, respectively.

The annual mean rainfall i.e. normal of Beed district was 692.8 mmprevailed in 38.4 rainy days. While, the taluka-wise mean rainfall (normal) noted as in Beed (719.2 mm), Patoda (669.6), Ashti (670.2), Gevrai (678.0), Majalgaon (726.3), Ambejogai (786.5), Kaij (723.5), Parali (715.9), Dharur (693.9), Vadvani (679.9) and ShirurKasartaluka (558.0 mm). It means that intra-taluka variation of normal rainfall was high and it ranged from lowest in ShirurKasartaluka (558.0 mm) and highest in Ambejogaitaluka (786.5 mm). The statistical analysis for rainfall variability was worked out and it was intra-annual as well as intra-taluka variation in Beed district. It was ranged between 20.0 to 25.3 per cent with 38.4 annual mean rainy days yr^{-1}.

Table 1.Taluka-wise seasonal mean rainfall (mm) of Beed district

MET. SEASON	BEED	PTD	ASHTI	GEV	MAJ	AMB	KAJ	PAR	DHR	VAD	SH K.	MEAN	SD	CV(%)
Summer	15.7	14.4	13.2	14.9	15.7	17.9	14.2	14.2	9.7	17.6	14.9	14.8	2.20	14.92
Monsoon	607.1	554.7	555.4	570.2	611.0	676.1	623.3	597.1	590.5	577.3	462.4	584.1	53.11	9.09
Post-Mon.	94.2	98.7	100.8	91.8	98.8	90.4	84.9	103.3	89.6	83.7	80.2	92.4	7.52	8.14
winter	2.2	1.8	0.8	1.1	0.8	2.1	1.1	1.3	4.1	1.3	0.5	1.6	1.00	64.48
Total	719.2	669.6	670.2	678.0	726.3	786.5	723.5	715.9	693.9	679.9	558.0	692.8	56.29	8.12

Table 2Taluka-wise seasonal mean rainy days of Beed district

MET. SEASON	BEED	PTD	ASH	GEV	MAJ	AMB	KEJ	PAR	DHR	VAD	SHRK	MEAN	S.D.	C.V.(%)
Summer	1.2	1.0	1.1	0.7	0.9	0.9	0.8	1.0	0.7	0.9	0.9	0.9	0.15	16.74
Monsoon	31.7	32.7	30.7	31.1	32.9	36.2	34.7	33.9	34.5	30.7	26.9	32.4	2.55	7.87
Post-Mon.	5.4	5.3	5.5	4.4	4.6	5.5	4.9	5.3	5.3	4.3	3.8	4.9	0.58	11.72
winter	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.4	0.2	0.1	0.2	0.09	48.06
Total	38.5	39.1	37.4	36.4	38.6	42.8	40.6	40.3	40.9	36.1	31.7	38.4	3.00	7.80

Table 3Taluka-wise annual mean rainfall (mm) of Beed district.

YEAR	BEED	PATODA	ASHTI	GEVRAI	MAJAL	AMBEJ	KEJ	PARALI	DHARUR	VADAVANI	SHR K.	MEAN
1986	641.6	481.5	574.0	470.2	592.3	561.7	591.8	NA	NA	NA	NA	559.0
1987	759.0	686.9	650.5	769.0	667.6	865.0	756.5	NA	NA	NA	NA	736.4
1988	1170.6	893.5	679.9	1124.2	1313.5	1039.4	1130.2	NA	NA	NA	NA	1050.2
1989	1228.2	914.8	888.7	883.8	798.6	1023.3	1158.7	NA	NA	NA	NA	985.2
1990	1076.3	1032.2	791.8	1049.1	1152.0	1012.4	1100.2	NA	NA	NA	NA	1030.6
1991	322.9	412.6	730.2	388.1	288.3	442.2	315.0	NA	NA	NA	NA	414.2
1992	691.0	740.2	487.8	953.2	914.8	995.6	799.8	NA	NA	NA	NA	797.5
1993	569.6	866.6	675.7	582.6	755.2	633.2	682.4	763.6	778.7	NA	NA	700.8
1994	423.8	427.9	343.6	466.9	542.0	428.9	413.4	410.5	449.0	NA	NA	434.0
1995	640.5	557.0	525.1	613.0	600.4	773.2	518.2	641.1	562.0	NA	NA	603.4
1996	1032.2	782.6	722.9	728.0	676.8	992.4	909.9	823.5	850.5	NA	NA	835.4
1997	678.6	686.0	589.2	635.3	866.6	876.4	766.7	900.7	620.0	NA	NA	735.5
1998	1158.9	1155.0	958.6	1100.7	1110.5	1047.0	1242.5	1216.1	1101.0	958.6	1155.0	1109.4
1999	504.2	615.0	979.4	684.0	510.0	826.2	724.5	720.1	659.5	404.3	487.0	646.7
2000	841.3	562.0	900.6	503.4	559.6	875.5	821.6	884.4	895.0	287.5	310.4	676.5

*** NA – Not available data**

Contd.....

YEAR	BEED	PATODA	ASHTI	GEVRAI	MAJALG	AMBEJ	KEJ	PARALI	DHARUR	VADAVANI	SHR K.	MEAN
2001	744.4	735.9	663.4	644.0	788.7	799.9	531.2	798.3	659.0	683.2	695.0	703.9
2002	552.0	522.8	783.8	690.7	649.0	667.7	457.0	735.0	680.0	566.0	445.0	613.5
2003	488.0	367.0	620.9	660.0	742.7	758.4	624.2	743.5	869.6	692.0	540.0	646.0
2004	577.4	720.0	1005.6	603.5	558.0	634.6	436.4	367.7	600.0	405.0	597.0	591.4
2005	878.9	729.0	406.5	900.0	867.4	914.0	1118.1	604.5	741.0	1048.3	675.0	807.5
2006	681.1	868.2	927.3	777.0	719.9	825.0	818.8	563.7	579.0	634.3	697.0	735.6
2007	668.3	701.6	749.0	609.0	766.6	706.2	510.8	926.0	690.0	747.0	573.0	695.2
2008	714.0	570.0	624.0	614.0	587.7	722.0	632.1	810.0	637.0	677.0	536.0	647.6
2009	777.0	768.0	806.0	786.0	673.0	885.0	713.0	645.0	745.0	743.0	785.0	756.9
2010	817.0	830.0	959.0	895.0	1138.0	1012.0	1020.0	1056.0	1163.1	1034.0	646.0	960.9
2011	980.0	616.0	523.0	701.0	686.0	1009.0	743.0	563.0	869.0	858.0	534.0	734.7
2012	421.8	346.4	265.4	266.4	497.3	436.2	436.2	652.4	541.8	497.0	248.8	419.1
2013	655.6	623.7	474.2	557.8	834.0	795.3	647.3	810.0	604.0	879.8	458.2	667.3
2014	448.8	471.7	397.8	416.6	407.8	501.3	672.4	318.2	334.6	483.5	366.6	438.1
2015	433.7	404.1	401.1	266.4	524.7	534.7	412.1	512.4	330.9	640.0	294.4	432.2
Total	21576.7	20088.2	20105.0	20338.9	21789.0	23593.7	21704.0	16465.7	15959.7	12238.5	10043.4	18536.6
Mean	719.2	669.6	670.2	678.0	726.3	786.5	723.5	715.9	693.9	679.9	558.0	692.8
S.D.	241.1	199.1	205.3	221.1	230.0	196.0	251.8	213.2	205.3	218.7	211.6	188.1
C.V%	33.5	29.7	30.6	32.6	31.7	24.9	34.8	29.8	29.6	32.2	37.9	27.1

Table. 4Taluka-wise annual mean rainy days of Beed district

YEAR	BEED	PATODA	ASHTI	GEVRAI	MAJALG	AMBEJ	KEJ	PARALI	DHARUR	VADAVANI	SHR K.	Mean
1986	30.0	29.0	31.0	29.0	40.0	28.0	29.0	NA	NA	NA	NA	30.9
1987	42.0	35.0	34.0	32.0	40.0	50.0	46.0	NA	NA	NA	NA	39.9
1988	58.0	57.0	45.0	51.0	52.0	58.0	51.0	NA	NA	NA	NA	53.1
1989	43.0	38.0	46.0	47.0	42.0	51.0	55.0	NA	NA	NA	NA	46.0
1990	52.0	50.0	48.0	55.0	52.0	55.0	59.0	NA	NA	NA	NA	53.0
1991	20.0	21.0	24.0	25.0	24.0	29.0	25.0	NA	NA	NA	NA	24.0
1992	29.0	30.0	31.0	29.0	31.0	39.0	33.0	NA	NA	NA	NA	31.7
1993	38.0	44.0	44.0	39.0	44.0	41.0	46.0	42.0	47.0	NA	NA	42.8
1994	26.0	26.0	35.0	26.0	33.0	30.0	29.0	33.0	29.0	NA	NA	29.7
1995	33.0	34.0	34.0	32.0	38.0	39.0	34.0	43.0	34.0	NA	NA	35.7
1996	50.0	48.0	46.0	41.0	40.0	49.0	48.0	45.0	50.0	NA	NA	46.3
1997	40.0	47.0	36.0	42.0	44.0	45.0	56.0	36.0	39.0	NA	NA	42.8
1998	45.0	52.0	48.0	42.0	47.0	52.0	47.0	51.0	45.0	48.0	52.0	48.1
1999	32.0	39.0	33.0	33.0	30.0	38.0	29.0	43.0	34.0	24.0	28.0	33.0
2000	31.0	30.0	32.0	30.0	29.0	31.0	35.0	36.0	29.0	20.0	19.0	29.3
2001	32.0	36.0	32.0	34.0	36.0	40.0	39.0	38.0	36.0	35.0	32.0	35.5
2002	27.0	32.0	28.0	25.0	26.0	37.0	28.0	37.0	37.0	31.0	22.0	30.0

*** NA – Not available data Contd.....**

Contd.....

YEAR	BEED	PATODA	ASHTI	GEVRAI	MAJAL	AMBEJ	KEJ	PARALI	DHARUR	VADAVANI	SHIR K.	Mean
2003	37.0	30.0	31.0	38.0	36.0	43.0	42.0	43.0	59.0	41.0	29.0	39.0
2004	36.0	44.0	37.0	32.0	32.0	40.0	38.0	28.0	42.0	30.0	29.0	35.3
2005	40.0	40.0	30.0	38.0	34.0	50.0	56.0	40.0	40.0	35.0	37.0	40.0
2006	35.0	44.0	45.0	40.0	31.0	42.0	40.0	32.0	36.0	33.0	36.0	37.6
2007	33.0	37.0	40.0	35.0	36.0	45.0	34.0	43.0	43.0	32.0	35.0	37.5
2008	42.0	30.0	31.0	36.0	37.0	34.0	36.0	40.0	43.0	31.0	29.0	35.4
2009	45.0	52.0	41.0	31.0	41.0	42.0	42.0	40.0	43.0	44.0	33.0	41.3
2010	45.0	57.0	54.0	52.0	58.0	55.0	58.0	54.0	59.0	49.0	42.0	53.0
2011	38.0	42.0	36.0	39.0	38.0	46.0	36.0	29.0	45.0	47.0	29.0	38.6
2012	38.0	32.0	26.0	31.0	39.0	33.0	33.0	45.0	42.0	35.0	24.0	34.4
2013	57.0	46.0	45.0	43.0	56.0	61.0	47.0	61.0	49.0	50.0	42.0	50.6
2014	35.0	31.0	37.0	31.0	30.0	35.0	30.0	28.0	23.0	28.0	26.0	30.4
2015	46.0	39.0	41.0	34.0	42.0	47.0	37.0	39.0	37.0	37.0	27.0	38.7
Total	1155.0	1172.0	1121.0	1092.0	1158.0	1285.0	1218.0	926.0	941.0	650.0	571.0	1026.3
Mean	38.5	39.1	37.4	36.4	38.6	42.8	40.6	40.3	40.9	36.1	31.7	38.4
S.D.	8.9	9.3	7.5	7.8	8.4	8.8	9.9	8.0	8.7	8.7	8.0	8.6
C.V.(%)	23.1	23.9	20.0	21.4	21.8	20.5	24.4	19.9	21.3	24.2	25.3	22.4

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