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NAKSHATRA BASED RAINFALL ANALYSIS AND ITS IMPACT ON CROPS DURING MONSOON SEASON AT HIRIYUR STATION



Krishnamurthy K. N. and Gowda D. M.

Department of Ag. Statistics, University of Agricultural Sciences, Bengaluru.

ABSTRACT

Agricultural production in India mainly depends upon the monsoon rainfall. Its timely onset, spread over the country and distribution is important for seasonal crops. One of the traditional ways the farmers of India in general and its Southern States in particular study rainfall patterns is through solar constellations called "Nakshatras". In the present paper, a brief analysis of rainfall based on Nakshatra periods is considered. The daily rainfall data for a period of 30 years from 1984 -2013 was collected from the Regional Research Station located at Hiriya Taluk. The analysis reveals that the periods from Punarvasu to Chitta which covered the monsoon period received less quantity of rainfall,

it was conducive to take up Kharif crops like Ragi, Maize, Minor millets, Pulses, Cotton, Oil seeds, Jowar and Sunflower. Further, the trend in Mrugashira, Aridhra, Pushya, Makha, Pubba and Chitta Nakshatra periods were increasing whereas Rohini, Punarvasu, Aslesha, Uttara and Hastha Nakshatra periods were decreasing. Uttara (14th Sept – 26th Sept) and Hastha (27th Sept – 10th Oct) Nakshatras received maximum average rainfall of 54.7 mm and 65.6



mm respectively. This period was beneficial for sustainable growth of the crops.

KEYWORDS : Monsoon Season , Rainfall Analysis , Agricultural production .

INTRODUCTION

Agriculture is the backbone of Indian economy. Agricultural production mainly depends upon the occurrence of rainfall during the cropping season. The timely onset, its distribution and sufficient monsoon rainfall is the key for better agricultural production in the country which directly influences

rural poverty alleviation (Varshneya et al, 2011). There is considerable traditional knowledge of variability of rainfall patterns, since rainfed cultivation has been carried out for several centuries in India. The periods used by the farmers are however, not weeks or months but so-called “Nakshatras” which are 13- or 14-day periods based on calendar. The Nakshatras are constellations through which the sun passes in a year. There are 27 Nakshatras in a year viz., Purvashada, Uttarabhadrapada, Shrivana, Danista, Purvabhadra, Uttarabhadra, Revathi, Ashwini, Bharini, Krutika, Rohini, Mrugashira, Aridhra, Punarvasu, Pushya, Aslesha, Makha, Pubba, Uttara, Hastha, Chitta, Swathi, Vishaka, Anuradha, Jyeshtha and Moola Nakshatras. Of these, the periods from Rohini to Chitta Nakshatras cover the monsoon season. The Nakshatra commences when the sun enters the specific constellation. Thus, the knowledge of the variability in these time units rather than weeks or months is considered important by the traditional farmers in Karnataka and other neighboring States. The appropriate time for farming operations can also be worked out in terms of these time periods (Subash et al., 2011). In order to translate the meteorological events into farmer’s terminology, it is necessary to perform rainfall analysis in Nakshatra periods. Not many reviews are available but however, the following recent studies have been documented.

Rao et al. (2000) have suggested a crop model PNUTGRO based on Nakshatra periods in which an optimum sowing window for rainfed groundnut crop for Ananthpur region has been given. Gadgil and Rao (2000) have developed an approach for identifying appropriate strategies for rainfed regions based primarily on information and prediction of climate variability during Nakshatra periods. De et al. (2004) performed a time series analysis of rainfall on different Nakshatra periods covering Indian monsoon season. Bavadekar et al. (2008) have carried out Nakshatra-wise rainfall analysis for drought prone areas of Maharashtra. Chinnchorkar et al. (2013) on their study of rainfall variability at Anand in middle Gujarat region have concluded that rainfall during Punarvasu and Pushya is more assured than in other Nakshatras, while it is least assured during Makha and Pubba Nakshatras. Chhabra and Haris (2014) have compiled the indigenous knowledge related to climatic parameters, their forecasting during different time periods of a year (Nakshatras) based on experiences of the farmers and comparing indigenous knowledge with modern scientific analysis of weather data and their relationship with wheat and rabi maize yield in Patna, Bihar. Hazra et al. (2014) have proposed a mixture model of two distributions for each Nakshatra periods for the Eastern plateau of India. In the present study Nakshatra based rainfall analysis has been carried out in order to study its trend in each Nakshatra period as well as to study its impact on the crops during monsoon at Hiriyr station.

METHODOLOGY

The daily rainfall data recorded at Regional Research Station (RRS), Hiriyr for 30 years from 1984 to 2013 was used to analyze Nakshatra-wise rainfall distribution at Hiriyr station. Of the 27 Nakshatras, 11 Nakshatras from Rohini (May 25 to June 7) to Chitta (Oct.11-Oct.23) were considered for the analysis. The mean, standard deviation, coefficient of variation (CV%), minimum and maximum rainfall during Nakshatra periods were calculated. The trend analysis of rainfall at each Nakshatra period has been carried out. Crop calendar during Nakshatra periods have been documented.

RESULTS AND DISCUSSION

Characterization of Nakshatra-wise rainfall

Eleven Nakshatras were considered for analysis because this period coincides with the crop growing period of Kharif season. The descriptive statistics of Nakshatra-wise rainfall is presented in Table 1. It was observed that maximum rainfall occurred during Pubba Nakshatra (237.8 mm) followed

by Chitta Nakshatra (211.7 mm) whereas minimum rainfall during this season was 0.0 mm. The mean rainfall was observed to be highest during Hastha Nakshatra (65.6 mm) while the lowest was during Aridhra Nakshatra (12.1 mm). The Coefficient of variation was found to be very high for all the Nakshatra periods except Hastha Nakshatra which showed a CV of 75.2 per cent.

Fig. 1 show the Nakshatra-wise distribution of mean rainfall. From the diagram, we observe that Rohini and Mrugashira Nakshatra periods cover the pre-monsoon period whereas Punarvasu to Chitta Nakshatras constitute the monsoon season.

Table. 1: Descriptive Statistics for Nakshatra-wise Rainfall (mm) at RRS, Hiriyr Station from 1984 – 2013

Nakshatra	Period	Mean	SD	CV	Minimum	Maximum
Rohini	May.25 - Jun.7	37.2	42.5	114.2	0.0	134.1
Mrugashira	Jun.8 - Jun.21	29.4	36.1	122.8	0.0	144.0
Aridhra	Jun.22 - Jul.5	12.1	22.1	182.6	0.0	100.4
Punarvasu	Jul.6 - Jul.19	26.4	35.7	135.2	0.0	129.4
Pushya	Jul.20 - Aug.2	16.9	15.6	92.3	1.0	58.4
Aslesha	Aug.3 - Aug.16	38.4	36.7	95.6	0.0	176.4
Makha	Aug.17 - Aug.30	35.3	41.8	118.4	0.0	130.8
Pubbha	Aug.31 - Sep.12	30.3	49.5	163.4	0.0	237.8
Uttara	Sep.13 - Sep.26	54.7	62.7	114.6	0.0	210.6
Hastha	Sep.27 - Oct.10	65.6	49.3	75.2	0.0	160.2
Chitta	Oct.11 - Oct.23	38.3	48.9	127.7	0.0	211.7

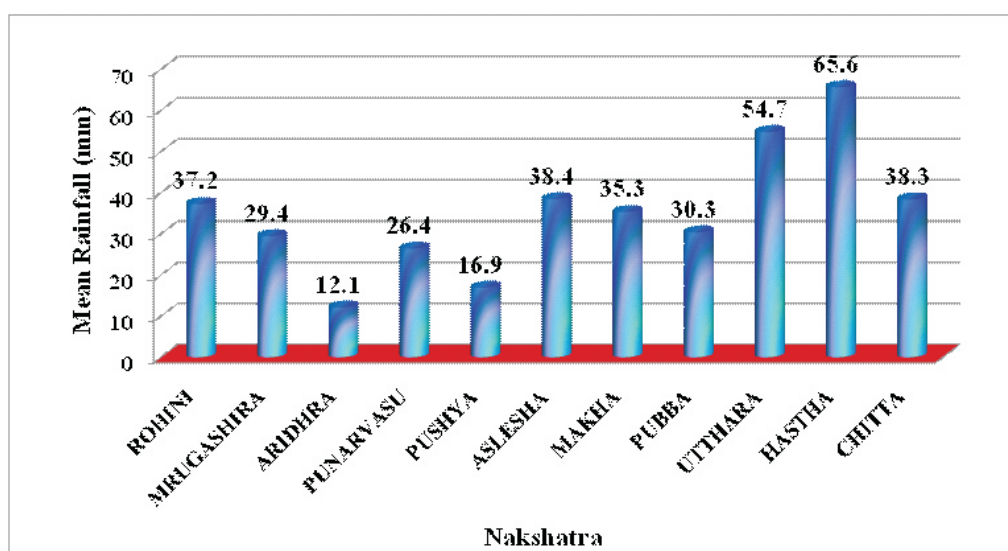


Fig.1: Nakshatra-wise mean rainfall (mm) at Hiriyr station from 1984-2013.

Highest rainfall and Trend analysis of rainfall during Nakshatra periods

The highest rainfall during Nakshatra periods are presented in Table 2. The rainfall during Nakshatra periods ranged from 58.4 mm to 237.8 mm. Pubba Nakshatra received the highest rainfall of 237.8 mm during 2013 followed by Chitta Nakshatra of 211.0 mm. The low rainfall of 58.4 mm was recorded for Pushya Nakshatra during 2010. The trend equations fitted (Fig. 2) for each of the Nakshatra periods revealed both increasing and decreasing trends. The Nakshatras such as Mrugashira, Aridhra, Pushya, Makha, Pubba and Chitta had an increasing trend whereas Rohini, Punarvasu, Aslesha, Uttara and Hastha Nakshatras showed a decreasing trend in rainfall. This shows that during pre-monsoon period like Rohini, received an average of 134.1 mm rainfall during which land preparation and sowing of crops can be taken up while the Nakshatra periods from Aridhra to Uttara which covers the monsoon season are well suited for Kharif crops like Ragi, Maize, Minor millets, Pulses, Cotton, Oil seeds, Jowar and Sunflower.

Table 2: Nakshatra-wise highest Rainfall (mm) and its trend equations

Season	Nakshatra	Period	Highest Rainfall		Trend equation
			Amount (mm)	Year	
Pre-monsoon	Rohini	May.25-Jun.7	134.1	1988	$Y = 355.6 - 0.1590X$
	Mrugashira	Jun.8-Jun.21	97.8	2002	$Y = -231.5 + 0.1305X$
Monsoon	Aridhra	Jun.22-Jul.5	100.4	2004	$Y = -1001.9 + 0.5073X$
	Punarvasu	Jul.6-Jul.19	129.4	1989	$Y = 808.6 - 0.3914X$
	Pushya	Jul.20-Aug.2	58.4	2010	$Y = -878.7 + 0.4482X$
	Aslesha	Aug.3-Aug.16	176.4	2000	$Y = 1047.3 - 0.5048X$
	Makha	Aug.17-Aug.30	130.8	2010	$Y = -3610.9 + 1.8245X$
	Pubba	Aug.31-Sep.12	237.8	2013	$Y = -4541.0 + 2.2874X$
	Uttara	Sep.13-Sep.26	210.6	2009	$Y = 2365.8 - 1.1564X$
	Hastha	Sep.27-Oct.10	160.2	1992	$Y = 2505.5 - 1.2208X$
Post-monsoon	Chitta	Oct.11-Oct.23	211.0	2007	$Y = -1899.7 + 0.9697X$

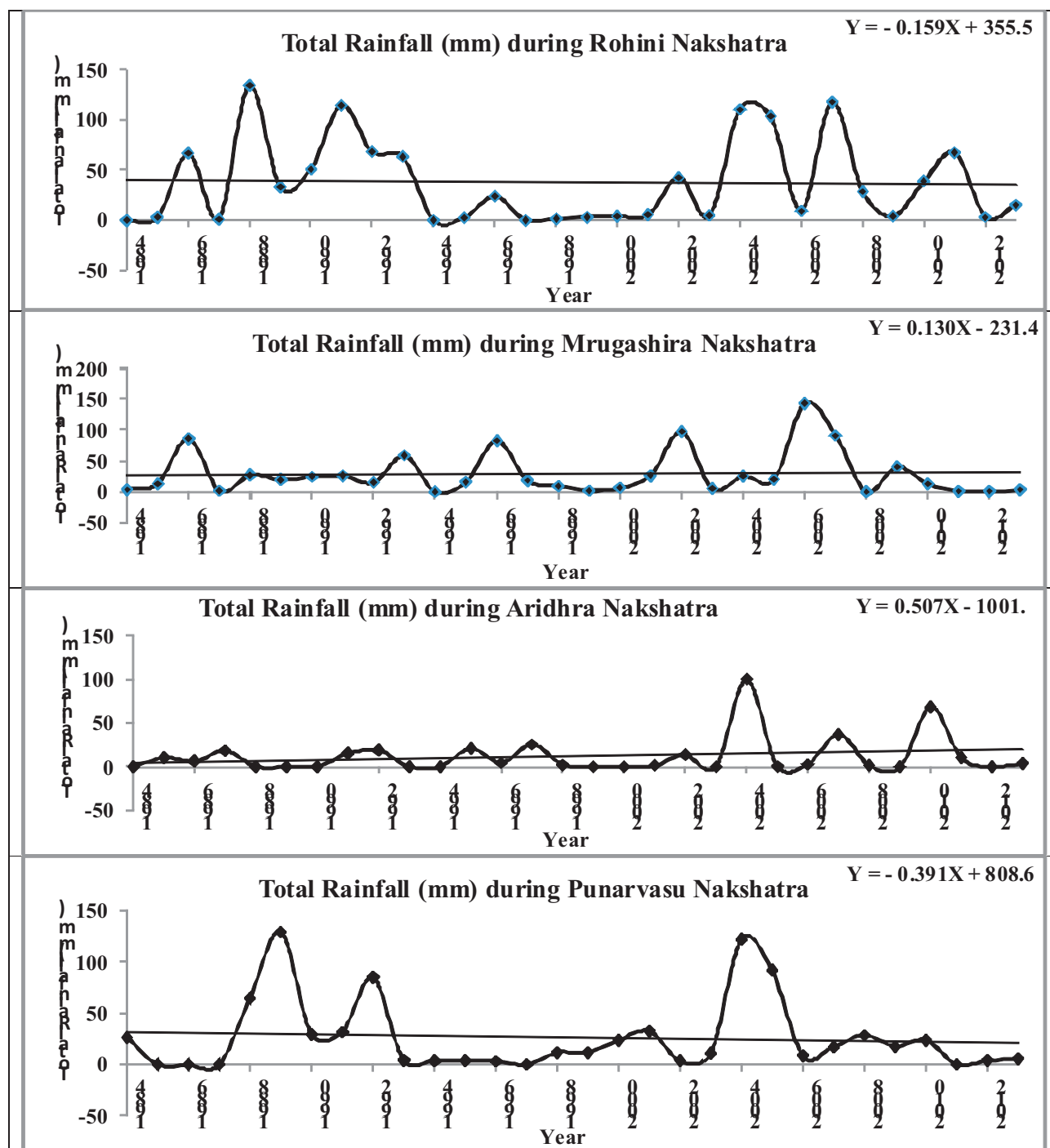


Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013.

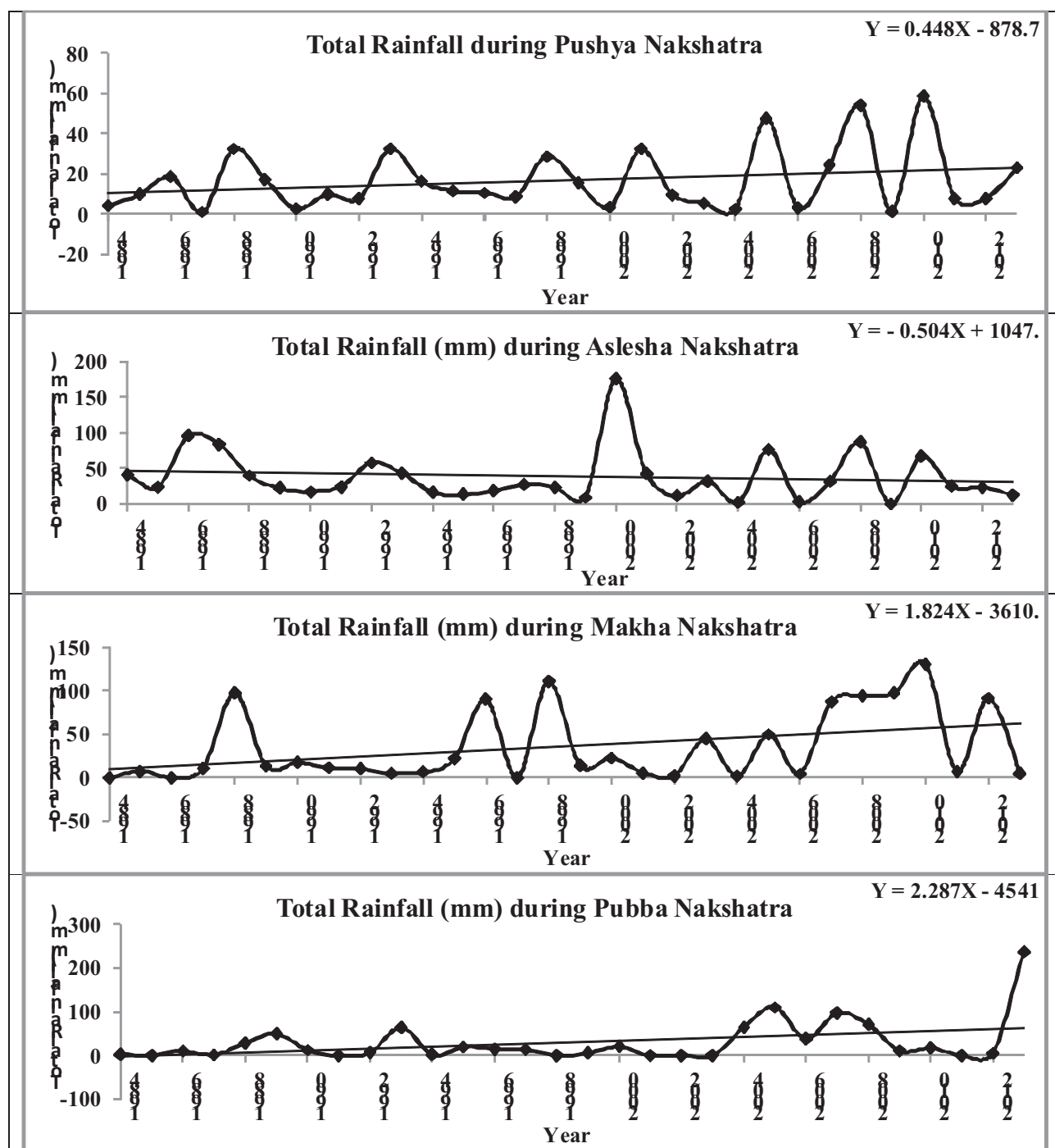


Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013(Contd.)

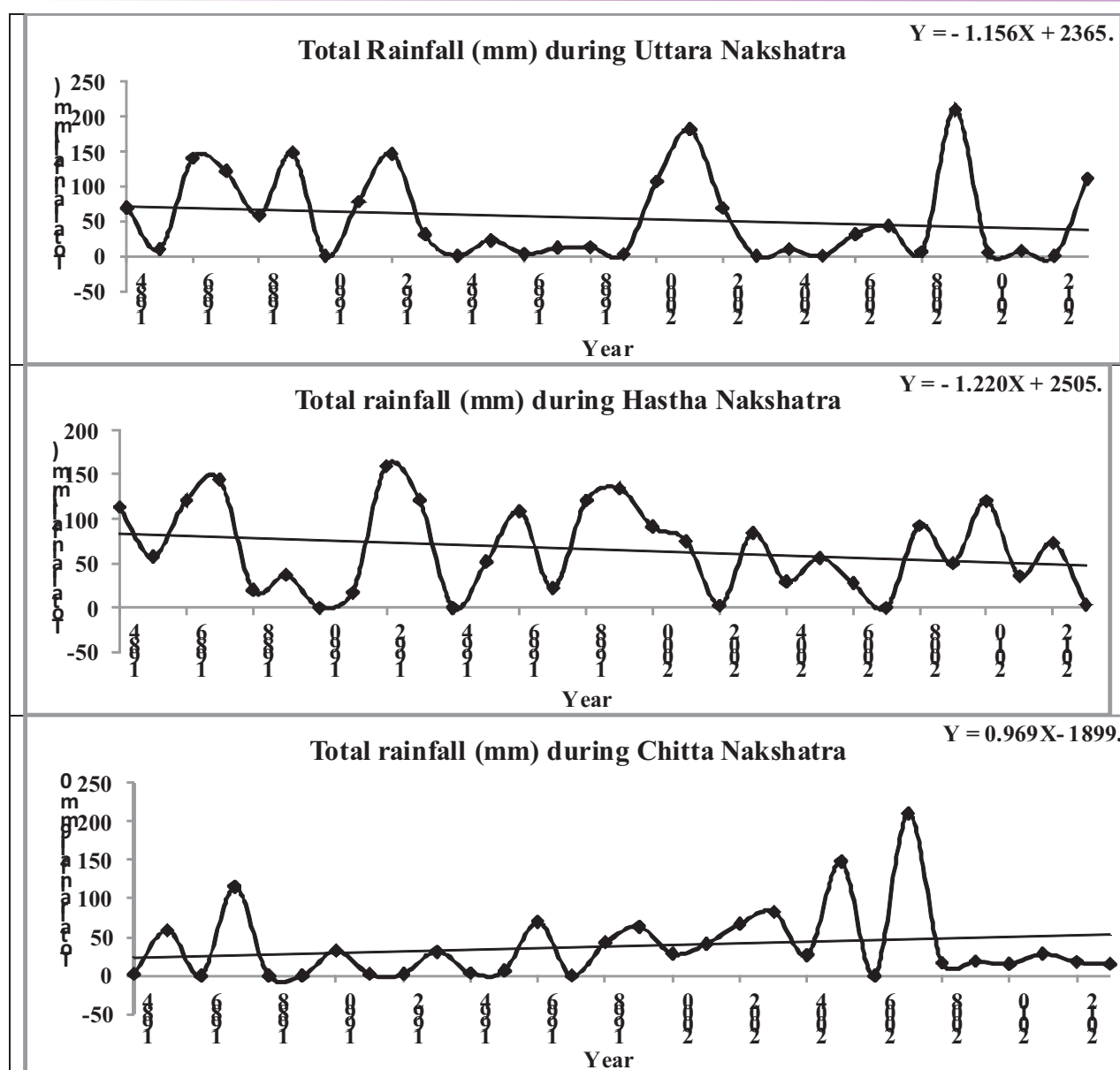


Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013 (Contd.)

Contingent crop planning during Nakshatra periods at RRS, Hiriyr station

It is well known that Farmers in South India are familiar with rainfall during Nakshatra periods than with Calendar months or Weeks. In order to translate the meteorological events into Farmer's terminology, it was decided to perform rainfall analysis in Nakshatra periods. Initially, the rainfall normal's for each of the Nakshatra periods were computed and a schematic diagram was developed indicating the crops to be selected for Nakshatra periods based on the Package of Practices. Fig 3 gives the crop Calendar for rainfall during Nakshatra periods at RRS, Hiriyr station. From the figure, it reveals that Rohini (25th May – 6th June) Nakshatra had an average rainfall of 37.2 mm, which was suitable for Farmers to take up sowing of crops like Minor millets, Pulses, Jowar, Ground nut and other Oil seeds. The pre monsoon season extended till Mrugashira (8th June – 21st June) Nakshatra with an average rainfall of 29.4 mm during which the sowing of crops like Cotton, Tobacco and Ragi in addition

other crops can be taken up. The monsoon season starts from Punarvasu (6th July – 27th July) to Chitta (11th Oct – 23rd Oct). This period was conducive to take up Kharif crops like Ragi, Maize, Minor millets, Pulses, Cotton, Oil seeds, Jowar and Sunflower. Uttara (14th Sept – 26th Sept) and Hastha (27th Sept – 10th Oct) Nakshatra received maximum average rainfall of 54.7 mm and 65.6 mm respectively. This period was beneficial for sustainable growth of the crops.

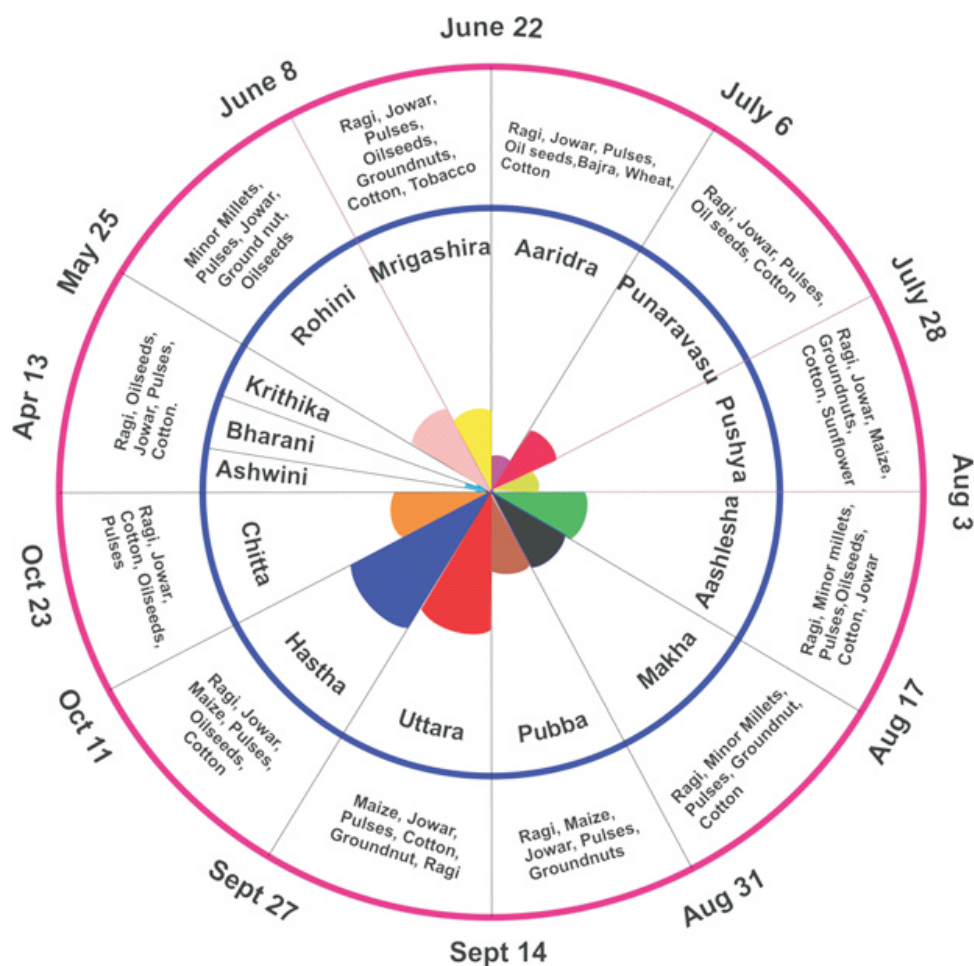


Fig. 3: Crop selection for Rainfall in different Nakshatra periods at RRS, Hiriur station

CONCLUSION

The RRS, Hiriur station had highest rainfall during Pubba, Uttara and Chitta Nakshatras while lowest during Pushya Nakshatra. The average rainfall ranged between 58.4 mm (Pushya) and 237.8 mm (Pubba). This station had good monsoon rainfall extending from Aridhra to Uttara. However, the period showed decreasing trends during Rohini, Punarvasu, Aslesha, Uttara and Hastha Nakshatras while the periods during Mrugashira, Aridhra, Pushya, Makha, Pubba and Chitta had an increasing trend. The crop Calendar for Rainfall during Nakshatra periods at RRS, Hiriur station revealed good rains during Rohini (25th May – 6th June) Nakshatra. The Farmers during this period take up sowing of crops like Minor millets, Pulses, Jowar, Ground nut and other Oil seeds. The pre monsoon season extended till Mrugashira (8th June – 21st June) Nakshatra, during which the sowing of crops like Cotton, Tobacco and

Ragi in addition other crops can be taken up. The monsoon season started from Punarvasu (6th July – 27th July) to Chitta (11th Oct – 23rd Oct). Though the period received less quantity of rainfall, it was conducive to take up Kharif crops like Ragi, Maize, Minor millets, Pulses, Cotton, Oil seeds, Jowar and Sunflower. Uttara (14th Sept – 26th Sept) and Hastha (27th Sept – 10th Oct) Nakshatra received maximum average rainfall of 54.7 mm and 65.6 mm respectively. This period was beneficial for sustainable growth of the crops.

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