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Catchment-storage-command relationship for enhancing water productivity in Kymore plateau, Rewa district of MP

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ABSTRACT:

A field experiment was carried out at kuthulia farm under ICAR project for Dryland Agriculture during 2008 - 2017 for the study of catchment command relationship for rainwater harvesting. The trend of daily rainfall in the catchment area is studied for a period of 10 years i.e., from 2008 to 2017. The highest monthly rainfall recorded was 752.60 mm in the month of August 2016 and the highest yearly rainfall recorded was 1627.4 mm in the year 2016. In the above 10 years period, July (364.7 mm) and August (291.7 mm) months recorded maximum rainfall. The rainfall shows fluctuating nature during the ten years.

KEYWORDS: Catchment command, water harvesting.

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INTRODUCTION:

The monthly and annual rainfall values of Rewa area for a period of 10 years (2008 - 2017) have been recorded (Table 6.1). The minimum value of rainfall as 419.8 mm has been observed during the year of 2009 and the maximum rainfall value has been recorded as 1627.4 mm during 2016. The computed average annual rainfall value is 1007.77 mm. The seasonal variation lies within the range of 8.95 mm to 226.95 mm (Table 6.2). The graphical representation (Figure 6.1) reveals positive trend (2011, 2012, 2013 and 2016) and negative trend (2008,

2009,2010,2014,2015 and 2017) indicating a notable trend of fluctuations in the rainfall. The variation of the rainfall from year to year is indicated by the study of rainfall data. Graph

although the unpredictability is high during individual months, but the rainfall is rather stable over the year as a whole, which is a significant aspect. Even during rainy season the rainfall is subjected to uncertainty of occurrence as marked by prolonged dry spells and aberration in time of commencement and withdrawal and also the total amount received (Sharma, 1996). The annual rainfall data exceeding the computed average annual rainfall value indicates favorable period for recharge of groundwater regime.

MATERIAL AND METHODS:

At JNKVV college of Agriculture Rewa under All India Co-ordinated Research Project for Dryland Agriculture. The study for the catchment command relationship have been carried out from 2008-2017 for effective use of Rainwater harvesting through farm pond in both the season. The soybean and rice crop have been taken in kharif and wheat, mustard, chickpea and coriander taken as rabi crops in rainfed an semi irrigated condition. In this trial the measure study based on the rainfall runoff relationship in catchment command area. The runoff for the study area is calculated using SCS-method for a period of 10 years i.e., 2008-2017. The calculated yearly runoff in mm for the years from 2008 to 2017 is 198.42, 61.38, 173.27, 415.84, 622.56, 583.84, 107.32, 219.71, 791.34 and 294.57 mm respectively.

RESULT AND DISCUSSION:

The average monthly rainfall data from 2008 to 2017 for a period of 10 years have been represented by bar diagram (Figure 2), indicating variations in the amount of rainfall for the period (2008-2017).The observation reveals that the minimum value of 0.74 mm rainfall is recorded in December and maximum value 364.7 mm is recorded in July (Table 2). The calculated values of rainfall during monsoon, winter and summer seasons are 226.95 mm, 16.04 mm and 8.95 mm respectively (Table 2, Figure 2).).

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Table 1: Rainfall data of Rewa area for a period of 10 years from 2008 to 2017

Sr. No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	2008	0	0	0	0	0	182.6	362.6	194.2	73.6	0	0	0	813
2	2009	0	0	0	0	0	14.6	236.8	29.6	138.8	0	0	0	419.8
3	2010	0	0	0	0	0	13.4	219.6	257.4	209.6	18.2	24.2	0	742.4
4	2011	0	3.2	1.4	3.8	21.6	367.8	211.2	347.7	196	0	0	0	1152.7
5	2012	0	0	0	0	0	8.2	736.8	401	142.8	7	0	4.4	1300.2
6	2013	0	59.2	38.4	10.2	0	166.2	503.8	472.8	108.8	138	0	0	1497.4
7	2014	72.6	82.4	5	3	0	50	273.2	109.8	98.4	161	0	3	858.4
8	2015	74.4	4.6	38	15.4	1.6	96.4	266.6	261.8	6	81	0	0	845.8
9	2016	34.4	0	40	0	13.4	61.6	324.8	752.6	380.4	20.2	0	0	1627.4
10	2017	3.2	0	7.4	0	9.4	153.4	511.6	90.4	45.2	0	0	0	820.6
Total		**184.6**	**149.4**	**130.2**	**32.4**	**46**	**1114.2**	**3647**	**2917**	**1400**	**425.4**	**24.2**	**7.4**	**10077.7**
Avg.		**18.46**	**14.94**	**13.02**	**3.24**	**4.6**	**111.42**	**364.7**	**291.7**	**140**	**42.54**	**2.42**	**0.74**	**1007.77**

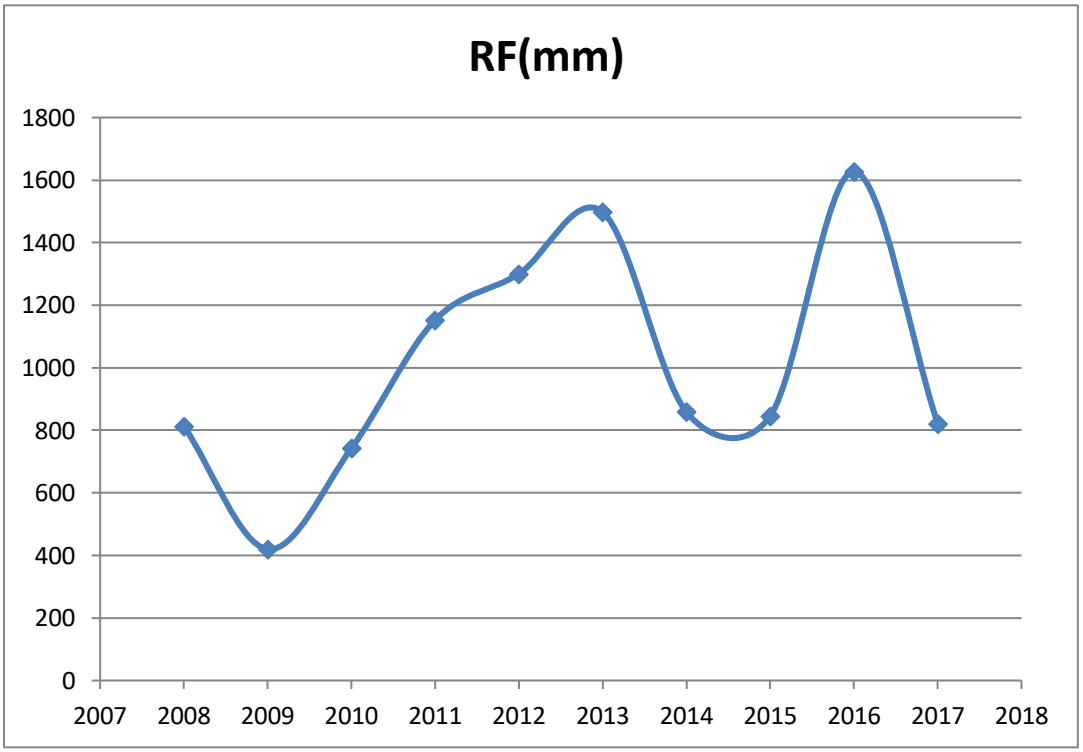

Fig. 1: Total Annual Rainfall of the Rewa study Area (2008-2017)

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Table 2: Analysis of Monthly Rainfall of Rewa, Madhya Pradesh

Sr. No.	Season	Months	Mean Monthly Rainfall(mm)	Average rainfall(mm)
1	Monsoon	June	111.42	226.9525
		July	364.7	
		August	291.73	
		September	139.96	
2	Winter	October	42.54	16.04
		November	2.42	
		December	0.74	
		January	18.46	
3	Summer	February	14.94	8.95
		March	13.02	
		April	3.24	
		May	4.6	

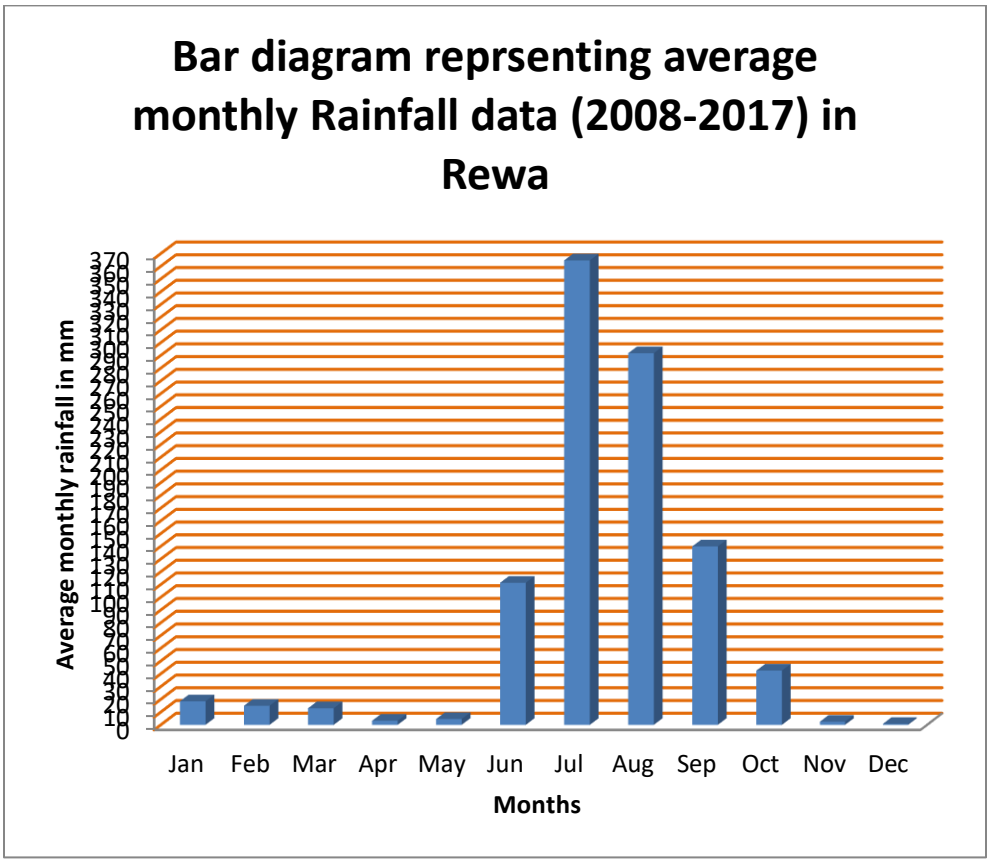

Fig 2: Bar diagram representing average monthly rainfall data (2008-2017) in Rewa.

The monthly and annual runoff values of Rewa area for a period of 10 years (2008 - 2017) have been recorded (Table 3). The minimum value of runoff as 61.38 mm has been observed during the year of 2009 and the maximum runoff value has been recorded as 791.34 mm during 2016. The computed average annual runoff value is 346.80 mm. The average monthly runoff data from 2008 to 2017 for a period of 10 years have been represented by bar diagram (Figure 4), indicating variations in the amount of runoff for the period (2008-2017).

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Table 3: Runoff data of Rewa area for a period of 10 years from 2008 to 2017

Sr. No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	2008	0	0	0	0	0	15	152.7	28.42	2.31	0	0	0	198.43
2	2009	0	0	0	0	0	0	34.67	0	26.71	0	0	0	61.38
3	2010	0	0	0	0	0	0.94	52.17	56.11	62.38	1.54	0.13	0	173.27
4	2011	0	0	0	0	0.79	149.26	70.62	162.6	32.56	0	0	0	415.84
5	2012	0	0	0	0	0	0	406	182.6	33.96	0	0	0	622.56
6	2013	0	1.03	2.22	0	0	36.91	265.8	205	42.84	30	0	0	583.84
7	2014	2.97	5.98	0	0	0	0.56	16.58	14.47	12.32	54.17	0	0	107.05
8	2015	6.44	0	2.46	1.22	0	22.1	81.53	82.96	0	23	0	0	219.71
9	2016	1.3	0	1.73	0	0	7.06	98.44	531.5	147.2	4.06	0	0	791.34
10	2017	0	0	0	0	2.32	10.96	262.2	15.6	3.54	0	0	0	294.57
Total		**10.71**	**7.01**	**6.41**	**1.22**	**3.11**	**242.79**	**1441**	**1279**	**363.8**	**112.8**	**0.13**	**0**	3467.99
Avg.		**1.071**	**0.701**	**0.641**	**0.122**	**0.311**	**24.279**	**144.1**	**127.9**	**36.38**	**11.28**	**0.013**	**0**	**346.799**

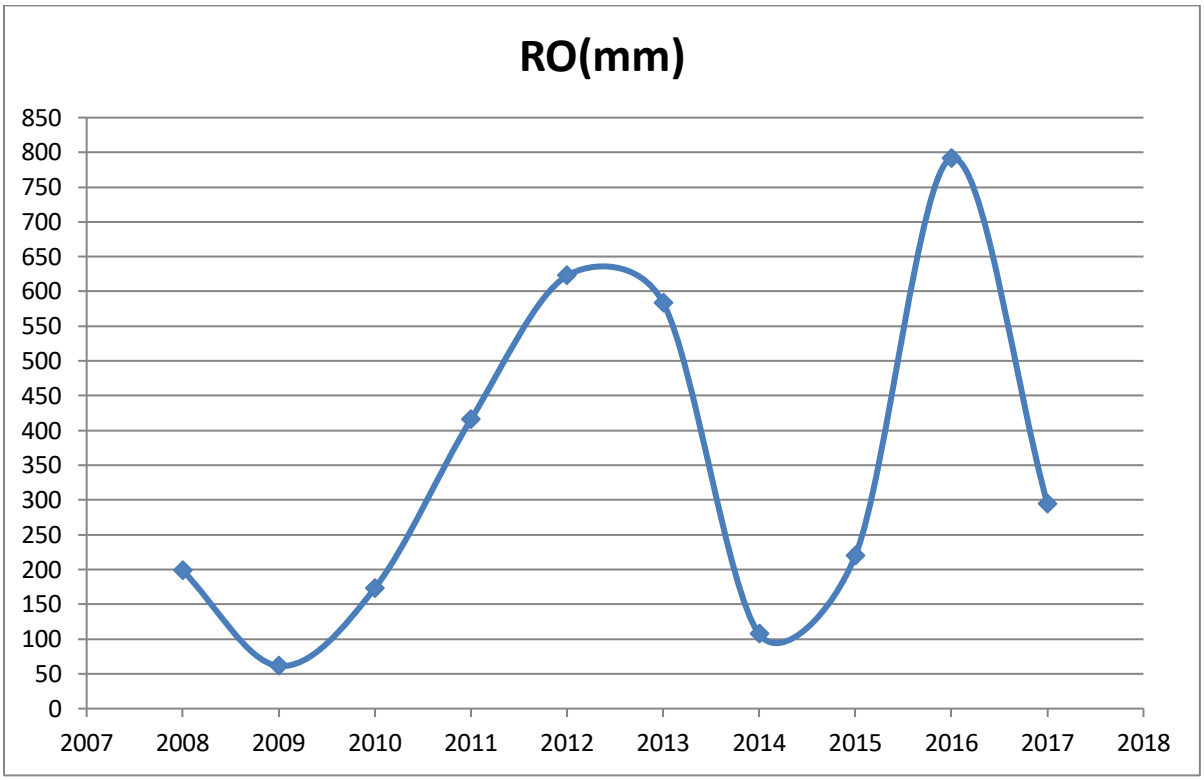

Fig. 3: Total Annual Runoff of the Rewa (2008-2017)

Runoff was estimated by using SCS-CN Method and was analyzed further on daily, monthly and yearly basis. The same was inserted in tabular form and histograms of it were prepared for interpretation. Further graphs were prepared showing linear variation of rainfall-runoff, based on this correlation coefficients were obtained. (Figure 4)

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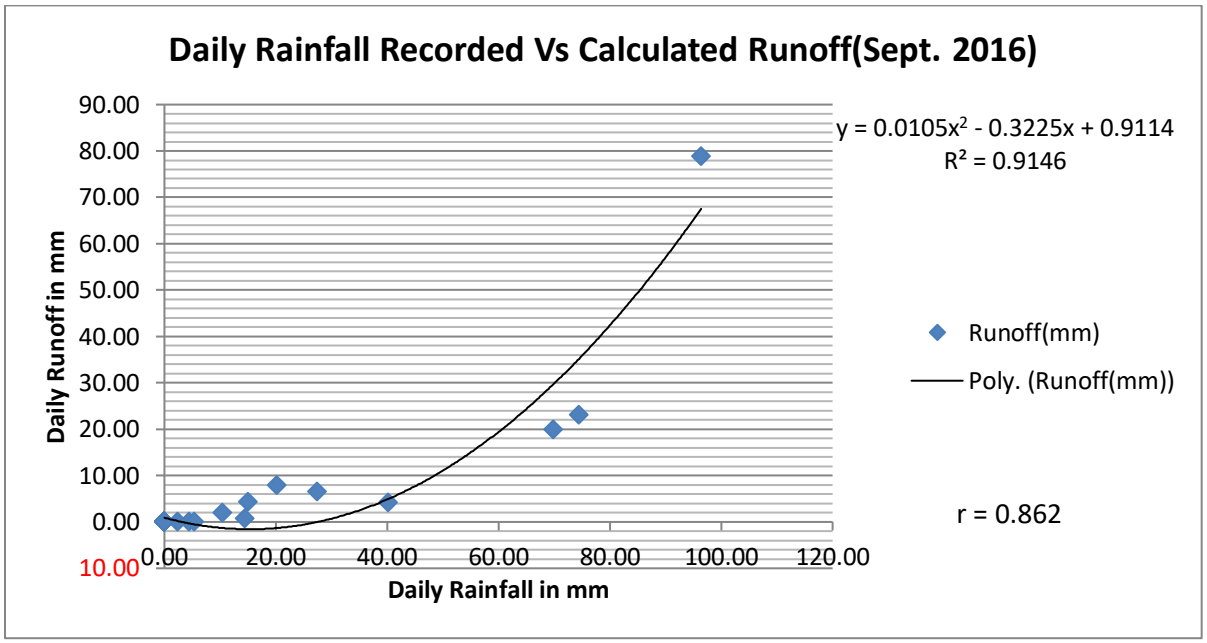

Fig.4: Correlation coefficient for Daily Rainfall-Runoff series

CONCLUSION:

The trend of daily rainfall in the catchment area is studied for a period of 10 years i.e., from 2008 to 2017. The highest monthly rainfall recorded was 752.60 mm in the month of August 2016 and the highest yearly rainfall recorded was 1627.4 mm in the year 2016. In the above 10 years period, July (364.7 mm) and August (291.7 mm) months recorded maximum rainfall. The rainfall shows fluctuating nature during the ten years. The runoff for the study area is calculated using SCS-method for a period of 10 years i.e., 2008-2017. The calculated yearly runoff in mm for the years from 2008 to 2017 is 198.42, 61.38, 173.27, 415.84, 622.56, 583.84, 107.32, 219.71, 791.34 and 294.57 mm respectively. The correlation coefficients for daily, monthly and yearly runoff is 0.862, The graph for the yearly runoff is best fitted than daily and monthly runoff.

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