STATISTICAL DISTRIBUTION OF RAINFALL DATA AND PROBABILITIES OF THE NUMBER OF RAINY DAYS

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SUMMARY: Agricultural production is affected to a large extent by the amount of rainfall, so it is essential to have a thorough record of rainfall data. Along with the rainfall the number of rainy days play a vital role in every field of planning. With the help of the previous records the distribution of the rainfall data and the probabilities of the number of rainy days can be found and the future predicted. In this article we restrict ourselves to the Faisalabed district. The distribution of the rainfall data and the probabilities of the number of rainy days have been calculated for the three decades of each month along with the probabilities of a month.

Key Word: Rain fall.

INTRODUCTION

Rainfall has been very important since the creation of human beings on earth. Primitive man felt the need of shelter basically for his safety against winter rainfall. As the sense of man developed and the society became modern relative to the ancient man, he thought over this parameter in order to avoid the damages caused by the rainfall and to reap the benefits of it. Ours is a more modern life and so in every sphere of life we have to consider the weather for the betterment of ourselves. It is strongly realized that amount different weather factors rainfall and the number of rainy days are most important, because of their role particularly in the field of agriculture. The effect of the rainfall is considerably good and beneficial for the crop at the time of germination while it could be detrimental to the crop at the time of harvesting and so may be a cause for huge damage to the crop along with the diversity for the farmers and to the general public as well.

Gangopadhya and Sarkar (1) studied the influence of the amount and distribution of rainfall on wheat yield and calculated the total variation in yield accounted for by the rainfall distribution.

Thompson (3,4) studied the effect of rainfall on crop yield taking into account the amount of monthly rainfall data and concluded that amount of rainfall plays a crucial role in different stages of crop growth. The weather along with technology is the cause of 80 to 92 percentage variability in the yield.

Raudkivi (2) has calculated the rainfall probabilities using the Markow chain model and described how these are used to describe the hydrological phenomena.

In the present article we first see the month wise distribution of the rainfall data and secondly we calculate the probabilities of the number of rainy days.

MATERIALS AND METHODS

The study of the distribution of rainfall data is very important before we proceed further. In the present study firstly we calculate month wise distribution for the rainfall data in the Faisalabed District. The data from 1941 to 1986 is taken from the meteorological observatory of the University of Agriculture Faisalabad. Unfortunately the data from 1936 to 1940 was not available, so the data of 68 years has been used for the study of the rainfall distribution.

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The data is analyzed using the MICROSTAT Package and the summary statistics regarding distribution of rainfall data is given in Table 1.

Secondly the data consisting of forty three years (1944-1986) of daily values of the rainfall obtained from the meteorological observatory of the department of Agricultural meteorology, University of Agriculture Faislabad is used to calculate the probabilities of the number of rainy days. The total number of rainy days for each month with some rainfall are calculated, while the number of days in which there is only tracing are not included in, for this purpose. These total number of rainy days per decade.

Frequency table for both monthly and decade wise number of rainy days are prepared. Then the probabilities of the number of rainy days in a decade and in a month are given in Tables 2 and 3 respectively.

RESULTS AND DISCUSSION

From Table 1 it is clear that minimum monthly total rainfall is zero millimeters all the time throughout the year except in July where it is minimum having a value of 8 millimeters. The maximum total monthly rainfall throughout the year remained maximum in the month of July reaching a value of 480 millimeters where as it is only 46.23 millime-

Table 1: Summary Statistics of the Rainfall Data

Month	Arithmatic Mean	Sample Standard Deviation	Min	Max	Moment Coeff. of skewness	Moment Coeff. of Kurtosis	Chi-sqr Values
Jan.	12.997	13.83	0.00	63.5	1.25	4.24	47.77
Feb.	15.74	20.75	0.00	97.7	1.91	6.77	48.23
Mar.	20.65	20.79	0.00	83.1	1.05	3.37	46.82
Apr.	16.4	18.36	0.00	76.7	1.61	5.25	32.00
May.	11.92	13.68	0.00	81.03	2.34	11.06	28.94
Jun.	25.41	25.24	0.00	97.1	1.196	3.577	37.88
Jul.	99.34	74.41	8.00	480.1	2.21	11.53	10.82
Aug.	99.48	77.17	0.00	379.73	1.424	5.75	4.71
Sep.	35.90	45.399	0.00	271.02	2.628	12.694	28.94
Oct.	5.67	10.51	0.00	46.23	2.23	7.39	174.82
Nov	2.76	8.16	0.00	54.36	4.58	26.53	205.41
Dec.	7.74	11.71	0.00	50.29	1.74	5.41	143.53

Table 2: Monthly Probabilities (No. of Rainy Days)

S. No	Months	Number of Rainy Days													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Jan.	.30	.30	.21	.12	.05	.02	-	-	-	-	-	-	-	-
2.	Feb.	.30	.30	.12	.16	.05	.05	.02	-	-	-	-	-	-	-
3.	Mar.	.30	.16	.16	.14	.12	.07	.02	-	-	-	-	-	-	-
4.	Apr.	.25	.21	.30	.12	.09	-	-	-	.02	-	-	-	-	-
5.	May.	.35	.28	.23	.14	-	-	-	-	-	-	-	-	-	-
6.	Jun.	.19	.35	.12	.28	.05	.02	-	-	-	-	-	-	-	-
7.	Jul.	-	.07	.14	.19	.12	.12	.12	.07	.09	.02	.02	-	.02	.02
8.	Aug.	-	.07	.12	.21	.09	.25	.07	.07	.09	.02	-	-	-	-
9.	Sep.	.30	.16	.23	.19	.09	.02	-	-	-	-	-	-	-	-
10.	Oct.	.65	.30	.05	-	-	-	-	-	-	-	-	-	-	-
11.	Nov	.70	.18	.12	-	-	-	-	-	-	-	-	-	-	-
12	Dec.	.60	.23	.09	.05	.02	-	-	-	-	-	-	-	-	-

NOTE: The measurable amount of rainfall in any day has been considered as the rainy day (whatever the quantity of rainfall it may be, in order to give full weightage to the minimum raiinfull as well).

ter in the month of October. The chi-square test indicated the distribution of the rainfall data normal in the months of July and August while it has shown a deviation from normality in the remaining months. This suggests that we should not assume normal distribution for the months other than July and August for the purposes of prediction. Some other skewed distribution like Gamma distribution extreme value distribution etc. may give better results.

Probabilities of the number of rainy days have been calculated both on the monthly basis and on decade basis. The total number of rainy days that have come to the scene during any month are thirteen while the decade-wise probabilities show that there are eight number of rainy day out of ten days at the most. The decades of each month have been divided in such a way that first two decades of each month are of ten days, while the number of days in the third decade varies from eight to eleven depending upon the nature of the month.

Table 3: Decade Wise Probabilities Number of Rainy Days.

S. No	Months	Decd	Number of Rainy Days								
			0	1	2	3	4	5	6	7	8
1.	Jan.	1.	.60	.14	.16	.07	.03	-	-	-	-
		2.	.63	.21	.09	.05	.02	-	-	-	-
		3.	.37	.37	.21	.05	-	-	-	-	-
2.	Feb.	1.	.51	.35	.09	-	.03	.02	.05	-	-
		2.	.42	.30	.16	.07	.05	-	-	-	-
		3.	.58	.21	.12	.05	.04	-	-	-	-
3.	Mar.	1.	.51	.21	.21	-	-	.02	-	-	-
		2.	.37	.23	.23	.10	.07	-	-	-	-
		3.	.32	.30	.16	.14	.05	.03	-	-	-
4.	Apr.	1.	.53	.21	.14	.07	.05	-	-	-	-
		2.	.46	.30	.12	.07	-	0.5	-	-	-
		3.	.58	.28	.09	.05	-	-	-	-	-
5.	May.	1.	.70	.19	.07	.04	-	-	-	-	-
		2.	.51	.28	.12	.09	-	-	-	-	-
		3.	.58	.30	.07	.05	-	-	-	-	-
6.	Jun.	1.	.60	.30	.10	-	-	-	-	-	-
		2.	.49	.32	.14	.05	-	-	-	-	-
		3.	.46	.30	.16	.05	.03	-	-	-	-
7.	Jul.	1.	.28	.25	.23	.09	.07	.05	.03	-	-
		2.	.09	.30	.23	.21	.09	.03	.05	-	-
		3.	.19	.21	.23	.09	.12	.07	.02	.05	.02
8.	Aug.	1.	.28	.19	.23	.16	.09	.03	.02	-	-
		2.	.28	.32	.09	.07	.07	.14	.03	-	-
		3.	.28	.23	.21	.16	.05	.05	-	.02	-
9.	Sep.	1.	.51	.23	.14	.07	.03	.02	-	-	-
		2.	.67	.23	.07	.03	-	-	-	-	-
		3.	.63	.28	.07	.02	-	-	-	-	
10.	Oct.	1.	.79	.16	.05	-	-	-	-	-	-
		2.	.86	.12	.02	-	-	-	-	-	-
		3.	.86	.14	-	-	-	-	-	-	-
11.	Nov	1.	.88	.07	.05	-	-	-	-	-	-
		2.	.84	.12	.02	.02	-	-	-	-	-
		3.	.75	.23	.02	-	-	-	-	-	-
12.	Dec.	1.	.77	.16	.05	-	.02	-	-	-	-
		2.	.74	.21	.05	-	-	-	-	-	-
		3.	.65	.30	.05	-	-	-	-	-	-

HOW TO READ THE TABLES 2 AND 3

In Table 2, the number of rainy days are along horizontal axis or in the top row while the months are along vertical direction with three decades of each month. For instance we want to see what is the probability of the 2 rainy days in the second decade of January. We shall see under third column (i.e 2 rainy days) and row of January 2nd decade where the two coincide that would be the required probability. In this case the probability will be 0.09 or 9 percent and similarly Table 3 can be read easily.

The probabilities of the number of rainy days have been found because these are of immense importance for the agricultural purposes. We can forecast for the number of rainy days in any decade, if the probabilities of two number of rainy days in certain decade is eighty percent and it rains for the first two days of the decade, we can aver that there is only a little, twenty percent probability of any further rainfall in the said decade. In this way we can issue forecast for the benefit of local farmers to do their necessary jobs in order to get better and reliable results of the crop sowing and harvesting respectively, as the rainfall additional during the period of about one month prior to sowing and during the period of germination is in general beneficial to the crop, where as more rainfall during the tillering phase is detrimental (1).

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