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CROP MODELING BASED ON RAINFALL DISTRIBUTION PATTERN FOR KOKRAJHAR DISTRICT OF ASSAM

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ABSTRACT

Rain water plays a pivotal role in agriculture and holds the key for success in rainfed agriculture. The Kokrajhar district has only 4.8% of agricultural land under irrigation and crop production greatly depends on rain water. The erratic and unpredictable distribution of rainfall in the region are responsible for moisture stress and flash-flood resulting in crop failure. The mean annual rainfall of Kokrajhar is 3444.65 mm and the standard deviation is 714.04. June is the wettest month receiving on an average 757.33 mm rainfall with low variation (CV=39.7). The wet months June, July and August are highly stable with low variation, August having the lowest variation (CV=36.29). December was found to be driest month with average rainfall of 5.44 mm. Months from November to February are having low rainfall with very high co-efficient of variation indicating an erratic pattern of rainfall. More than 70% of the years had 3 or more drought months.

INTRODUCTION

The Kokrajhar district of Assam, is situated in the lower Brahmaputra valley between 26°18′N – 26°54′ N latitude and 89°48′ E - 90°57′ E longitudes. The climate is hot summer followed by the monsoon of heavy rainfall and relatively cool winter with scanty rainfall. The mean annual maximum temperature lies between 31° C and 35.5° C and minimum varying from 9° C to 14° C. The district has only 4.8% of agricultural land under irrigation and crop production greatly depends on rain water. The rainfall is high but its distribution over time and space is not uniform. Normally 70% rainfall occurs during the monsoon period of which, crop uses only small amount and its large portion finds its way as surface runoff (Table 1). The erratic and unpredictable distribution of rainfall in the region are responsible for moisture stress and flush-flood resulting in crop failure. Therefore, it is apparent that detailed knowledge of rainfall, its intensity and distribution helps in planning crop calendar and designing of different structures for flood control (Ray et al, 1987).

MATERIALS AND METHODS

The daily rainfall data of ten years (1992-2001) were collected from meteorological observatory under District Agricultural Office, Kokrajhar. Classification of monthly and yearly rainfall events were done according to following criteria (Sharma et. Al., 1979). If monthly 'm' is the mean rainfall, then a month receiving rainfall less than A1 and A2 is normal and above A2 is surplus month, where A1=m/2 and A2=2m. Also, if 'Y' is the mean annual rainfall then a year is said to be drought, normal and surplus it receives rainfall less than Y-S, in the interval (Y-S, Y+S) and more than Y-S, where 'S' is the standard deviation of the yearly rainfall.

RESULTS AND DISCUSSION

Analysis of daily rainfall data for the period 1992-2001revealed that the mean annual rainfall of Kokrajhar was 3444.65mm and the standard deviation was 714.04. Further, it was observed that 70% of the years were normal years receiving rainfall between 2530.61mm and 3958.69mm. 20% of the years were drought years receiving rainfall less then 2530.61mm. The year 1998 was only surplus year with rainfall receiving more then 3958.69mm.

June was the wettest month receiving on an average 757.33mm rainfall with low variation (CV=39.7), followed by July and August being wet months with average 739.94mm and 538.99mm rainfall respectively with low variation. Of the wet months June, July and August were highly stable with low variation, August having the lowest variation (CV=36.29).

December was found to be driest month with average rainfall of 5.44mm. In a period of 10 years it was revealed that only 27.5% to total months were dry, 63.3% normal and 9.16% surplus months. This implies that in any year, expected number of drought, normal and surplus months would be 3.3, 7.6 and 1.1 respectively. Months from November to February were having low rainfall with very high co-efficient of variation indicating an erratic pattern of rainfall. Total annual rainfall data for ten years show the highest value (4424.7mm) in 1998 and lowest (2006.7mm) in 1992. Year 1992 was the driest year having the longest span of 5 drought months (Table 2).

Out of total ten years, more than 70% of the years had 3 or more drought months though these years also suffered problem of flood during the rain concentric months July and August. Maximum number of normal months in a year was found to be 9 which accounted 10% of the total years. But 60% of the years received at least eight normal months (Table 3). Most of the drought months occurred in post monsoon period, highest frequency being for January Frequency of occurrence of normality was highest in the months of June to September.

During the months the percentage distribution of drought months was April, May, June and October with 33%. At the same time these months were also having 33% in the percentage distribution of normal months. June, July and August were the months where percentage distribution of surplus months was 50%. So there is a chance of flood or excess water during during these months causing crop failure. Although April, May and October are having similar percentage but with low rainfall, therefore chance of flood is less. An inverse relationship was observed between co-efficient of variation and mean monthly rainfall. This indicates that the co-efficient of variation decreases as the monthly becomes wet and increases for months having erratic rainfall. January, February, November and December are deficient in the overall rain but have maximum uncertainty.

Soil suitability in relation to rainfall characteristics for different crops

Micro climate developed by rainfall and soil texture restricts the choice of crops and governs their growth and yield. The climate of Kokrajhar is hot summer and cool winter. Major amount of rainfall is received during summer and it is higher during May-Sept. The soils are acidic in relation and sandy to loam in texture and water holding capacity is medium to low. Considering the specific climatic and land situation, careful selection of crops is very much essential to get sustained production.

Kharif season crops

During June-August, there is heavy (>400mm) and almost stable rainfall. Thus sali rice can be transplanted easily in this period and low lying area can be covered with Bao paddy. Kharif pulses and oilseeds can also be grown easily during late September since the possibility of rotting of seed is very less due to scanty rainfall in the next month. Delay in sowing of these crops may results severe moisture stress during peak vegetable growth.

Summer season crops

March is optimum time for summer rice but it can be grown early in February due to premonsoon shower. But if the crop fails in February sowing, mesta can be successfully raised by taking the advantage of season. Mesta (*Hibiscus sp*) is grown more popularly than jute in this region because the growth and yield of jute is highly unpredictable. This might be due to microclimate developed by rainfall and soil texture. Summer green gram in this region could be grown successfully in February deviating from its normal June-July sowing which otherwise shows poor germination and growth due to very high rainfall during this period. For summer vegetables, February could be right time for raising since there remains sufficient soil moisture

due to premonsoon shower which may result good seed germination.

Rabi season crops

Niger and buckwheat is very popular crop in the area and sowing of these two crops is best suited during the month of November. Other rabi crops like blackgram, linseed, lentil, winter vegetables etc. may be raised within October by avoiding excess rainfall during early part of September. Pointed gourd could be planted during November with good soil residual moisture which helps in early rooting of vine. In medium to low land, wheat can be successfully grown if residual moisture exists in soil, otherwise sowing should be extended upto November. In case of potato, October planting is suitable time and in some parts of this region December planting is also practiced.

Other crops

Normally most of the fruits and plantation crops are planted during March-April and if planting is done in September-October, crop growth will be very poor which may be due to severe moisture stress during this period. Sugarcane do not perform well in this region which may be due to heavy moisture stress because of sandy loam nature of soil and low rainfall during October-February.

REFERENCES

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Table 1. Basic information of the district

Geographical area	3,12,900 ha
No. of inhabited village	922
No. of un-inhabitate villaga	06
Population (as per 2001 census)	930404
a) Male	478242
b) Female	452162
No. of farming families	56466
No. of big farming families	8778
No. of small farming families	19217
No. of marginal farming families	28471
Irrigation available till 2001	8768 ha
Agricultural land	180668 ha
a) Kharif land	67914 ha
b) Rabi land	57852 ha
Cropping intensity	162 %
Forest land	123866 ha
Degraded forest	3468 ha
Waste land	2494 ha

Table 2. Monthly rainfall distribution statistics of Kokrajhar from 1992-200

Monthly	Mean	SD	CV	A1	A2	DM	PD	NM	PN	SM	PS
Jan	7.95	14.16	178.11	3.97	15.90	7	70	1	10	2	20
Feb	15.00	14.89	99.26	7.50	30.00	3	30	5	50	2	20
March	34.02	23.85	70.10	17.01	68.04	3	30	6	60	1	10
April	196.03	110.50	56.36	98.01	392.06	2	20	8	80	0	0
May	435.53	175.60	38.71	217.76	871.06	2	20	8	80	0	0
June	757.33	300.8	39.71	378.66	1514.66	0	0	10	10	0	0
July	739.94	298.05	40.28	369.97	1479.88	2	20	8	80	0	0
Aug	538.99	195.62	36.29	269.49	1077.98	1	10	9	90	0	0
Sept	311.47	162.31	52.11	155.73	622.94	0	0	9	90	1	1
Oct	183.70	112.0	60.96	91.85	367.40	2	20	8	80	0	0
Nov	19.32	26.38	136.54	9.66	38.64	5	50	2	20	3	30
Dec	5.44	10.32	189.70	2.72	10.88	6	60	2	20	2	20
Annual	3244.65	714.04	22.00	1351.88	5406.00						

SD=Standard deviation; CV=Co-efficient of variation; DM=Dry months; PD=Percentage of years having drought months; NM=Normal months; PN=Percentage of years having normal months; SM=Surplus months; PS=Percentage of years having surplus months.

Table 3. Probability distribution of drought, normal and surplus months

No of drought month	Probability	% of years having drought months	No of normal months	Probability	% of years having normal months	No of surplus months	Probability	% of years having surplus months
5	0.09	10	9	0.09	10	2	0.18	30
4	0.27	30	8	0.40	60	1	0.54	50
3	0.59	40	7	0.77	20	0	0.86	20
2	0.86	20	5	0.90	10			