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STUDY OF CLIMATIC WATER BALANCE OF BHUBANESWAR FOR CROP PLANNING

1. The availability of water for crop growth both in its amount and period can be estimated through water balance method. From water balance studies one could easily work out the assured or safe period of crop growth and thus structure the crop planning accordingly. A number of research papers have been published relating to water balance and its application to crop cultivation by different authors, namely; Raman and Murthy (1971), Krishnan (1972), Subrahmanyam (1982), Rammohan and Subrahmanyam (1983), Swaminathan and Shantha Kumari (1983), Ramkrishna *et al.* (1985) and Ramachandran and Rajegowda (1987). Much of the work done in this field is based on either annual or monthly rainfall data. Such study may not be very helpful from efficient crop production point of view because, a dry spell of considerable length may damage the crop even if a particular year or month gets normal rainfall. So, week is considered here as an unit which may be nearer to the optimum length of time.

2. Weekly rainfall data for a period of 16 years (1977-92) of Bhubaneswar having sandy loam soil with field capacity of 200 mm have been used for the study. Weekly potential evapotranspiration (PET) values have been taken from the computation of

Biswas and Khambete (1992). Climatic water balance for 52 standard meteorological weeks of the year have been worked out employing the water budgeting procedure of Thornthwaite and Mather (1955).

3. Weekly climatic water balance of Bhubaneswar for different crop seasons namely — kharif, rabi and pre-kharif is presented in Table 1. The analysis of the table indicates that during kharif season precipitation is 1239.5 mm, both potential and actual evapotranspiration are same, *i.e.*, 541.8 mm and water surplus is 500.4 mm. During this period there is no water deficiency. It is also obvious that from 23rd to 28th week, there is no water surplus though rainfall exceeds PET. The excess rainfall during this time is used for replenishing the soil which helps the land preparation and planting of kharif crops. As the trend continues, the soil attains field capacity on 29th week. This condition persists till the end of the season indicating thereby that during the said period water availability is at potential rate to meet up the demand of kharif crops. This is also the period of water surplus. The highest surplus in the order of 79.3 mm occurs on 30th week due to the influence of southwest monsoon. So, various kharif crops may be grown safely as rainfed during the period.

3.1. A careful observation of the water balance parameters indicates that except the last two weeks of post-monsoon season (October-December),

TABLE 1

Climatic water balance of Bhubaneswar (All values are in mm)

Climatic element	Rabi season (Meteorological weeks)								Total (Season)	Pre-kharif season (Meteorological weeks)				
	1	2	3	4	5	6	7	8		9	10	11	12	13
P	4.0	2.0	2.8	1.9	1.3	6.2	7.9	9.3	220.2	3.3	6.4	3.2	3.8	8.6
PET	21.7	22.4	22.4	23.1	25.9	28.0	30.1	32.9	513.1	35.7	37.8	40.6	43.4	46.9
P-PET	-17.7	-20.4	-19.6	-21.2	-24.6	-22.2	-22.2	-23.6	—	-32.4	-31.4	-37.4	-39.6	-38.3
S	82.7	74.7	67.9	60.9	53.8	48.2	43.1	38.3	—	32.6	27.9	23.1	18.9	15.6
ΔS	-7.7	-8.0	-6.8	-7.0	-7.1	-5.6	-5.1	-4.8	—	-5.7	-4.7	-4.8	-4.2	-3.3
AET	11.7	10.0	9.6	8.9	8.4	11.8	13.0	14.1	344.8	9.0	11.1	8.0	8.0	11.9
WD	10.0	12.4	12.8	14.2	17.5	16.2	17.1	18.8	168.3	26.7	26.7	32.6	35.4	35.0
WS	—	—	—	—	—	—	—	—	—	—	—	—	—	—

P = Precipitation (Rainfall)
 S = Soil moisture storage
 AET = Actual evapotranspiration
 WS = Water surplus

PET = Potential evapotranspiration
 ΔS = Change in soil moisture storage
 WD = Water deficit

inspite of water deficiency due to less rainfall than the water need, rabi crops will not suffer from moisture stress as stored moisture is sufficient to meet up the demand. This is mainly the seedling and early vegetative stage of rabi crops. For the remaining period of the season, stored moisture is less than half of the field capacity. Therefore, supplemental irrigation is needed depending on the crops and the respective varieties to save the crop from moisture stress.

3.2. During pre-monsoon (March-May) season rainfall is not only less than PET but the stored soil moisture is also very less for the crops to survive. This is a period of high moisture stress and crop cultivation is not remunerative without supplemental irrigation.

3.3. Based on the study of water balance of Bhubaneswar it is seen that water surplus is from mid July to first week of October and there is a surplus water of 500.4 mm at the end of the kharif season while rabi crops around Bhubaneswar suffers from moisture stress from the mid of vegetative stage as water deficiency starts from end of December. So, better production may be obtained by advancing the sowing dates of rabi crops. Besides, there is a lot of scope for rain water harvesting, conservation and recycling during the stress period.

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