Annals of Arid Zone 33(3) 229—231 1994

Determination of Crop Growing Period in Arid and Semi-arid Regions of Rajasthan

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Abstract Simple criteria has been used for determination of Crop Growing Period (CGP) in arid/semi-arid regions of Rajasthan, based on information about soils, crop water requirement and assured rainfall of the region. Through the soil-water budgeting of long term rainfall in relation to crop water requirement, the assured CGP at selected locations of Rajasthan was worked out using a computer programme. The assured CGP thus analysed varied from 3 to 13 weeks under shallow soils and from 5 to 15 weeks under deep soils. A test analysis of CGP- pearl millet grain yield relationship for the arid region of Jodhpur district is also presented.

Key words Crop growing period, climatic analysis, arid regions

Sustainable agricultural systems in arid/semi-arid regions mainly depend upon the assured amount of rainfall that can meet the crop water requirement during its growth and development. Assured rainfall is the most probable rainfall occurring at least in 2/3rd of the years (67% probability) satisfying the water requirement at different growth stages of the major crops of the region. Thus, the duration of crop growing period (CGP) depends upon the rainfall-crop water requirements and is highly influenced by the quantum and distribution of monsoon rainfall.

Studies were made on the influence of water availability on the yields of arid zone crops. In case of mung bean and cowpea, the moisture availability conditions during 6th to 9th week coinciding with pod formation and developmental stages have strongly influenced the yields (Ramana Rao *et al.* 1984a & b). So also water availability conditions during 7th to 11th week and 6th to 10th week have profound influence on grain yields of pearl millet and sesame, respectively. Keeping in view the water availability as the key factor determining the yield level, the CGP analysis using simple criteria for some selected locations of Rajasthan were carried out.

Materials and Methods

To identify the CGP, weekly rainfall data of the stations for a period of 30 years were collected. The major soil type of the area was identified to find out soil depth and water holding capacity. The normal cropping pattern and the main crops growing in the area were identified. Sowing week was considered to be one in which rainfall received was greater than 25 mm.

The weekly water requirements taken were 25 mm week^{-1} for pearl millet, sorghum, short duration pulses, 40 mm week^{-1} for maize and pigeonpea, 50 mm week^{-1} for rice. If the rainfall in a week was greater than the weekly water requirement of the crop in the region, it was assumed that 3/4th of the excess water recharged the soil and 1/4th was lost as runoff.

In a week when rainfall was less than the crop water requirement, the difference was met from the available soil moisture. The soil moisture recharge can occur till the soil attained field capacity (e.g., 150 mm for deep loamy sand soils, 100 mm for shallow soils). Any additional water beyond this is lost as deep drainage.

A computer programme was developed to work out the frequency of CGP in different cropping weeks and the length of assured CGP. The programme takes weekly rainfall, weekly crop water requirement and available water holding capacity of the soil as inputs.

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In the present study, areas experiencing 33% (3 out of 10 years being drought years) and 50% (5 out of 10 being drought years) drought conditions were identified as drought prone and chronic drought prone areas, respectively. For this purpose, the preceding 10 year data were subjected to the CGP (that satisfies the major/ suitable crops of the region) analysis on yearly basis to identify drought prone and chronically drought prone areas.

Results and Discussion

The CGP analysis, taking pearl millet as the test crop, was done for Jodhpur. At 60% probability, the CGP, with a crop water need of 25 mm week^{-1} under the arid conditions at Jodhpur, are 7 weeks for shallow and 11 weeks for deep soils. At 75% probability, the CGP is only 2 weeks under both shallow and deep soil conditions indicating that the area is not suitable for pearl millet.

Under semi-arid conditions at Jaipur, the CGP at 60% probability with a crop water requirement of 25 mm week^{-1} is 12 weeks under shallow soils and 14 weeks under deep soils which is adequate for crop like pearl millet. At 75% probability, it is 9 weeks for shallow soils and 12 weeks for deep soils indicating that the area does not support long duration crops and crops are prone to drought in at least 25 per cent years in this region.

Another semi-arid station, viz., Udaipur, with a crop water need of 25 mm week^{-1}, supports a CGP of 13 weeks under shallow soils and 15 weeks in deep soils at 60% probability. This shows that the area can support pearl millet and sorghum in 60% of the years without drought conditions. But the CGP with a crop water requirement of 40 mm week^{-1} at 60 % probability is only 10 weeks in shallow soils and 11 weeks in deep soils, indicating that the area does not support high water requirement crop like maize.

The CGP for some of arid and semi-arid locations of Rajasthan varied between 3 to 13 weeks under shallow soil conditions and 5 to 15 weeks under deep soils (Table 1). The lowest CGP of 3 to 5 weeks was at Jaisalmer in the extreme part of west Rajasthan and highest CGP of 13 to 15 weeks was at Udaipur in a semi-arid location.

Studies on CGP-pearl millet grain yield relationship for Jodhpur region indicate that the

Table 1 Mean annual rainfall and Crop Growing Period (CGR) at some arid/semi-arid locations of Rajasthan

Station	Mean annual rainfall (mm)	Major crop	CGP (in weeks)		
			Shallow soils	Deep soils	Highest
Barmer	259.7	Pearl millet	5	6	12
Bikaner	297.4	Pearl millet	5	7	14
Churu	368.1	Pearl millet	8	10	15
Ganganagar	247.9	Pearl millet	6	7	14
Jaisalmer	188.9	Pearl millet	3	5	12
Jaipur	631.2	Pearl millet & sorghum	12	14	18
Jalor	387.6	Pearl millet	9	11	19
Jhunjhunu	397.2	Pearl millet	10	12	17
Jodhpur	368.0	Pearl millet	7	11	20
Kota	757.8	Rice	9	10	16
Nagaur	332.6	Pearl millet	9	10	16
Pali	424.6	Pearl millet	10	12	20
Sikar	469.9	Pearl millet	9	10	17
Udaipur	616.5	Pearl millet & sorghum	13	15	19
		Maize	10	11	16

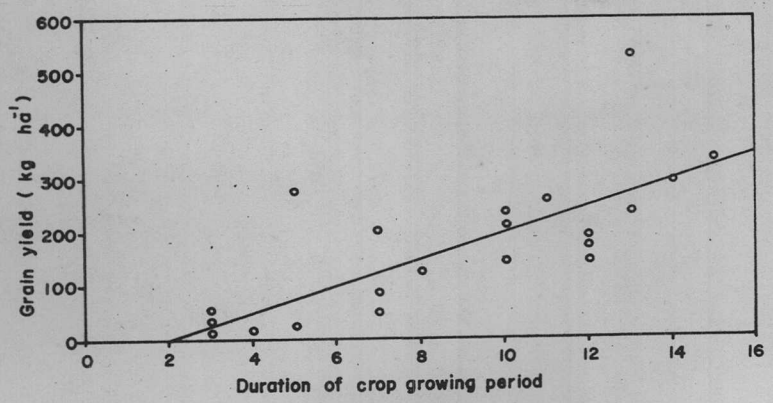

Fig 1 Relationship between CGP and productivity of pearl millet in Jodhpur

Table 2 *Frequency of occurrence of CGP>10 weeks at different locations in Rajasthan*

Station	Climatic type	years (%) with CGP > 10 weeks
Barmer	Extreme arid	17**
Bikaner	Extreme arid	17**
Churu	Arid	38**
Ganganagar	Extreme arid	17**
Jaisalmer	Extreme arid	8**
Jaipur	Semi-arid	89
Jalor	Arid	46**
Jhunjhunu	Arid	46**
Jodhpur	Arid	42**
Kota	Semi-arid	76
Nagaur	Arid	54*
Pali	Arid	46**
Sikar	Arid	46**
Udaipur	Semi-arid	86

* Drought prone ** Chronically drought prone

duration of the rainfall above a certain thre-shold value of crop water requirement determines the yield level (Fig.1). For example, the pearl millet grain yield in Jodhpur region reduced from 335 kg ha^{-1}, when CGP was 15 weeks in 1975, to 12 kg ha^{-1}, when CGP was 3 weeks in the drought year of 1968.

The CGP exceeding 10 weeks occur only in 8 to 46% of the years (i.e., drought conditions prevail in more than 50% of the years) at Barmer, Bikaner, Churu, Ganganagar, Jaisalmer, Jalor, Jhunjhunu, Jodhpur, Pali and Sikar and hence these areas are chronically drought prone (Table 2). CGP exceeding 10 weeks prevails for 54% of the years at Nagaur (i.e., drought conditions prevail for more than 33% but for less than 50 % of the years) and hence it falls under drought prone area, whereas CGP was favourable in 76 to 89 % of the years at Jaipur, Kota and Udaipur indicating drought prevail at these locations in 11 to 24% of the years.

Similar studies can be made for other regions and such an analysis, in addition to rainfall characteristics, keeping in view the major crops of the region will help in delineating the drought prone and chronic drought prone areas more effectively.

References

Ramana Rao BV, Ramakrishna YS & Daulay HS 1984a Influence of water availability on yield of cowpea under rainfed conditions. *Annals of Arid Zone* **23**(1) 63-66

Ramana Rao BV, Ramakrisna YS & Daulay HS 1984b Influence of water availability on yield of green gram. *Mausam* **35** 265- 266