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Research Paper :

Estimation of crop water requirement for irrigation planning in a semi arid region

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ABSTRACT

Historical weather data can be used to develop and modify the management practices to increase the production with the conjunctive use of rain and irrigation water as per the water needs of the crop. Regional scale crop and water resource planning needs determination of reference crop evapotranspiration (eto), probability distribution of rainfall and ETo, and estimates of magnitude and duration of water deficit and surplus which can promote crop production in both irrigated and dryland areas. Daily weather data of 16 years (from 1984 to 2001) for five locations *i.e.*, Aurangabad, Beed, Nanded, Parbhani and Osmanabad of Marathwada region was used to determine reference crop evapotranspiration (ETo). The rainfall and ETo data were analysed to ascertain their fit to various probability distributions. The goodness of fit was determined by χ^2 tests. The developed crop coefficients were used to estimate crop water requirements of 8 major crops of the region. Effective rainfall was used to determine the weeks at which the rainfall exceed or fall deficit of crop water requirement. The study indicated that normal distribution gave the closest fit to the weekly rainfall and ETo data. The seasonal water requirement of cotton, groundnut, sugarcane and banana is higher at Parbhani whereas that of *kharif* sorghum, *rabi* sorghum, wheat and soybean is higher at Osmanabad than other places in the region. the effective rainfall meets the water need of *kharif* sorghum and soybean. The rainfall values during the critical growth stages of *rabi* (sorghum and wheat) and summer crops (groundnut, banana and sugarcane) are deficit than their water requirement in the respective weeks and hence require irrigation during those periods. Among the row crops, wheat and groundnut can only be grown under irrigation. Annual excess rainfall for various crops ranges between 561 - 749 mm for *kharif* sorghum, 124 -195 mm for *rabi* sorghum, 0 - 15 mm for wheat, 624 - 808 mm for soybean, 633 - 786 mm for cotton, 453 - 609 mm for sugarcane and 526 - 703 mm for banana. If the excess rains are effectively harvested, the irrigation potential could be raised in the region.

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Scarcity and growing competition for fresh water resource will reduce its availability for irrigation and hence efficiency of its economic use will be dominant factor controlling food production. An analysis of benefits from the conjunctive use of rain and irrigation can be accomplished with crop production under rainfall conditions and potential crop production with the application of one or more irrigations (Hargreaves and Samani, 1988). Many times even with favourable climatic conditions, the crop production is very low due to absence of proper water resource planning and scientific management.

The rainfall and its distribution are important for every cultivator, both for deciding the cropping pattern and irrigation needs. The adequacy of rainfall to meet the consumptive needs of crops and other consumptive and non-consumptive water needs is a basic requirement of any region (Sikka and Soni, 1989). Since rainfall is quite erratic in both time and space, probability analysis offers a better scope for predicting the minimum assured rainfall. It is also essential to analyse the short period rainfall like weekly for planning even irrigated agriculture (Mishra *et al.*, 1999) since annual and monthly rainfall data is inadequate to evaluate the deficiencies of soil moisture occuring during different stages of crop growth.

Evapotranspiration (ET) being one of the important components of hydrological cycle requires to be estimated accurately for its reliable application for most of the current hydrologic, water management and crop growth models (Choisnel *et al.*, 1992). In view of wide applicability of potential evapotranspiration data in solving different hydrological problems, the need of computing evapotranspiration rapidly and accurately remains indisputable as direct measurements of evapotranspiration such as lysimetry are time consuming, expensive and needs to be tested on larger areas (Singh and Shukla, 1978). On the contrary, it is rather simple and practical to determine the irrigation requirements from available