RESEARCH PAPER:

Crop coefficients (K_C) of soybean [*Glycine max* (L.) Merrill]

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SUMMARY

In the Marathwada region, soybean [*Glycine max* (L.) Merrill] is grown as a rainfed crop, which is exposed to varying sets of weather conditions in general and rainfall distribution is particular. The acute need of water at critical growth stages, through lysimetric observations and its comparison with different approaches may provide information for decision making in irrigation scheduling the measurement of AET by means of lysimeter and it is essential to establish a relationship between the measured value of AET by in lysimeter and the estimated PET by different empirical formulae. Keeping these points in mind, a research project was planned on estimation of crop evapotranspiration in soybean crop through lysimeter. From the field study it was seen that the Blaney and Criddle, Thornthwaite and pan evaporation methods did not give correct prediction of PET, due to estimated K_C values and did not give correct estimation at various phenophases. For estimation of PET under Marathwada region at Parbhani condition, the modified Penman method is the most suitable. The total seasonal Actual evapotranspiration (AET) for soybean was found to be 353.59 mm. This again necessitied the application of protective irrigation to soybean during pod formation to grain formation stage by the modified Penman method.

Crop evapotranspiration can be estimated by direct measurements of the water loss from a soil (using lysimeters) and vegetation samples or can be estimated by the reference crop evapotranspiration (ETo) and crop coefficient (K_C) by Doorenbos and Pruit, 1977; Kang, 1986 and Kerr *et al.*, 1993. Crop evapotranspiration is not easy to measure since specific devices and measurements of various physical parameters or the soil water balance in lysimeters are required. These methods are often expensive, demanding in terms of accuracy of measurement and can only be fully exploited by well-trained research personal.

The crop coefficient represents crop specific water need and is essential for accurate estimation of irrigation requirement of different crops in the command area (CSSRI, 2000). Crop co-efficient also serves as an aggregation of the physical and physiological differences between crops (Allen, 1994). Although crop coefficients, in general, are suggested by various researchers for a number of crops grown under different climatic conditions (Doorenbos and Pruitt, 1977), these values are general estimates and can only be used at

locations where local data are not available. Crop coefficients need to be derived empirically for each crop based on lysimetric data and local climatic conditions (Allen *et al.*, 1998). Therefore, there is an acute need for local calibration of crop coefficient under given climatic conditions since such studies on crop coefficients are very limited and are not well documented for semi-arid region of Marathwada.

Keeping these points in mind, a research project was planned on estimation of crop evapotranspiration in soybean crop through lysimeter and its comparison with the different approaches.

MATERIALS AND METHODS

The present investigation was carried out by laying out experiment on soybean with objectives to study the measurement of AET in soybean and estimation of PET by various methods and its comparison with AET. The daily data of all weather parameters *viz.*, maximum and minimum air temperature, maximum and minimum relative humidity, wind speed, actual sunshine hours and rainfall for