Crop coefficient and water requirement of Okra
(*Abelmoschus Esculentus L. Moench*)

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ABSTRACT. Based on the result of an experiment conducted from 1997 to 1999 during March-July, a model has been developed for relating crop coefficient of okra with time at Bangalore. The peak value of crop coefficient was found to be 1.16 on the 9th week after sowing. On an average okra crop consumed about 547 mm of water during the growth. The mean values of crop coefficients are found to be 0.46, 1.29 and 0.66 during seedling, pod development and maturity stages respectively.

Key words – Okra, Actual evapotranspiration, Crop-coefficient.

1. Introduction

Okra (*Abelmoschus Esculentus L. Moench*) Lady’s finger is an important vegetable in India. It is grown extensively in Karnataka State.

The water resources of India are limited. Irrigation acreage in India is increasing at a rapid rate. Therefore in the present energy crisis, judicious and efficient use of irrigation is very important where water supply and water need are not in balance. One of the method to improve irrigation efficiency is through the understanding of requirement of water during various growth stages of a plant. A knowledge of crop coefficient 

\[ K_c = \frac{AET}{PET} \]

The objective of the present study is to compute crop coefficient in different stages of growth in relation to potential evapotranspiration (PET) and the water consumption in various growth stages.

2. Data and methodology

In the present study data on okra of variety Arka Anamika grown at GKVK campus Bangalore (12° 58' N, 77° 35' E, 930 m asl) in Karnataka State for three years during pre-monsoon season between 1997-1999 were used.

The actual evapotranspiration (AET) was measured daily by using gravimetric lysimeter. Potential evapotranspiration (PET) values were calculated by using Penman’s modified formulae.

The Crop coefficient \( K_c \) was calculated by using the following relationship

\[ K_c = \frac{AET}{PET} \]
3. Results and discussion

3.1. Crop coefficient

Fig. 1 shows variation in crop coefficient (Kc) with time, in weeks after sowing (WAS), during the growth of okra. When Kc values were fitted to time, in weeks after sowing (WAS), the following nonlinear relationship (R² = 0.90) was obtained.

\[ K_c = 0.0973 + 0.2301 \times (WAS) - 0.0124 \times (WAS)^2 \]

Fig. 1. Crop coefficient (Kc) for okra during 1997-1999

Fig. 2. Weekly AET (mm) for okra during 1997, 1998 and 1999
Using this equation, it is possible to estimate $K_c$ values, any time in WAS during different stages of crop growth.

The crop coefficient values were lower during seedling stage, gradually increased with advancement of crop age, attained the maximum values at pod development stage and declined towards maturity. There was variation in the $K_c$ values of three seasons due to difference in the seasonal climate conditions. The average $K_c$ value was low during seedling stage due to low canopy cover, indicating that major loss may constitute evaporation from bare soil, attained maximum value at flowering to pod development stage due to maximum water loss by greater transpiring surface as a consequence of rapid leaf development. During maturity period the values drastically reduced due to leaf senescence and loss of photosynthetic capacity. The $K_c$ values of 0.32, 1.16 and 0.42 were found to be during seedling, pod development and maturity stages respectively. Bhanu Rekha et al., (2006) determined the $K_c$ values for Okra as 0.43, 0.97 and 0.40 during seedling, pod development and maturity stages respectively using modified penman’s method. The difference is attributed to local conditions.

3.2. Consumptive use of water (AET)

Fig. 2 shows the weekly variation of AET for the years 1997, 1998 and 1999. The AET varied between 622.9 to 477.6 mm (Table 1). On an average the crop needs about 547.4 mm of water during the growth. This variation is primarily due to weather conditions. Doorenbos and Kassam (1979) recognized climate as one of the important factors determining crop water requirement for unrestricted optimum growth and yield. The level of evapotranspiration is related to the evaporative demand of the air.

The pod yield varied from a low yield value of 3312 kg/ha during 1998 to high yield of 13314 kg/ha during 1999. The poor yield during 1998 was due to the pod borer observed on 21st May 1998 and it had spread to 30% of the crops on 28th May 1998. After that preventive measures had taken. The average yield of the crop was 9735.6 kg/ha, and the average water use efficiency (WUE) was 18.0 kg/ha/mm.

4. Conclusion

(i) On an average okra crop consumed about 547.4 mm of water during the growth.

(ii) Water use efficiency does not depend only on the total amount of water consumed by the crop but also on its distribution during the various growth stages of the crop.

(iii) The peak values of crop coefficient are found to be 1.16 on the 9th WAS.

(iv) The crop coefficients are found to be 0.32, 1.16 and 0.42 during seedling, pod development and maturity stages respectively.

References

