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

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सार – वर्ष 1997 से 1999 के दौरान मार्च–जुलाई में किए गए परीक्षणों से प्राप्त हुए परिणामों के आधार पर बंगलुरू में भिण्डी (ओकरा) के फसल गुणांक के साथ समय को संबद्ध करने के लिए एक निदर्श विकसित किया गया है। इस दौरान बीज बोने के पश्चात् 9वें सप्ताह में फसल गुणांक का चरम मान 1.16 पाया गया। औसत रूप से, फसल की बढ़ोतरी के दौरान भिण्डी (ओकरा) की फसल ने लगभग 547 मि. मी. जलग्रहण किया है। फसल गुणांकों के माध्य मान फसल की पौध, फली के विकास और फसल की परिपक्व्ता की अवस्थाओं के दौरान क्रमशः 0.46, 1.29 और 0.66 पाए गए हैं।

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 co-efficient 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 Escelentus 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) is necessary to determine water requirement of the crop during various growth stages. Doorenbas and Pruitt (1977) showed the significance of K_c for assessment of crop water requirement for irrigation scheduling. Prediction of Crop coefficient as a function of crop stage is important for determining crop water consumption and scheduling irrigation. Chaudhuri *et al*., (1999) have reported K_c values for major crops of Gujarat region.

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) vales were calculated by using Penman's modified formulae.

The Crop coefficient (K_c) was calculated by using the following relationship
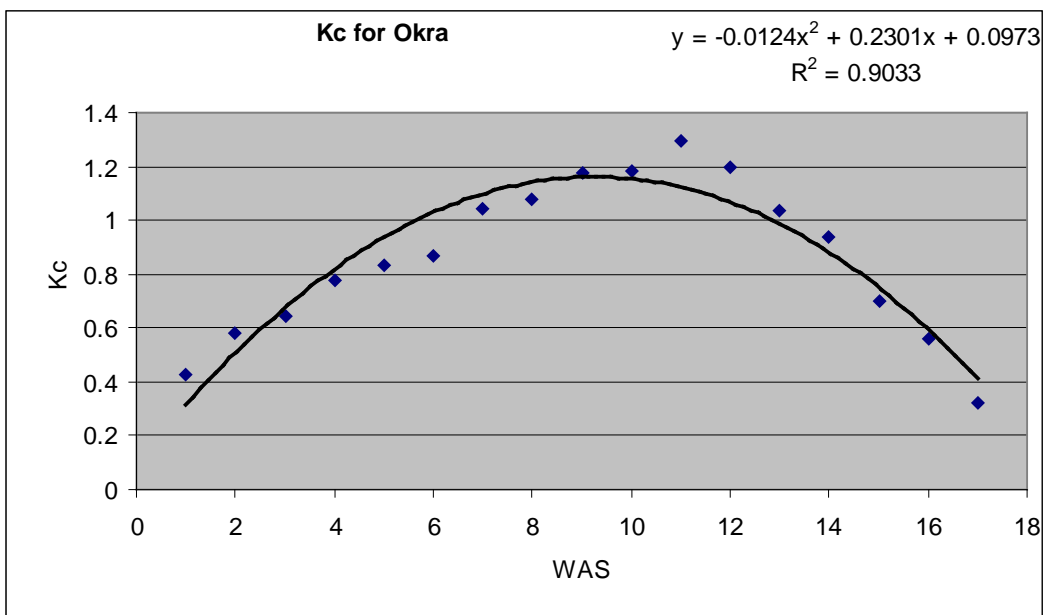
$$K_c = AET/PET$$

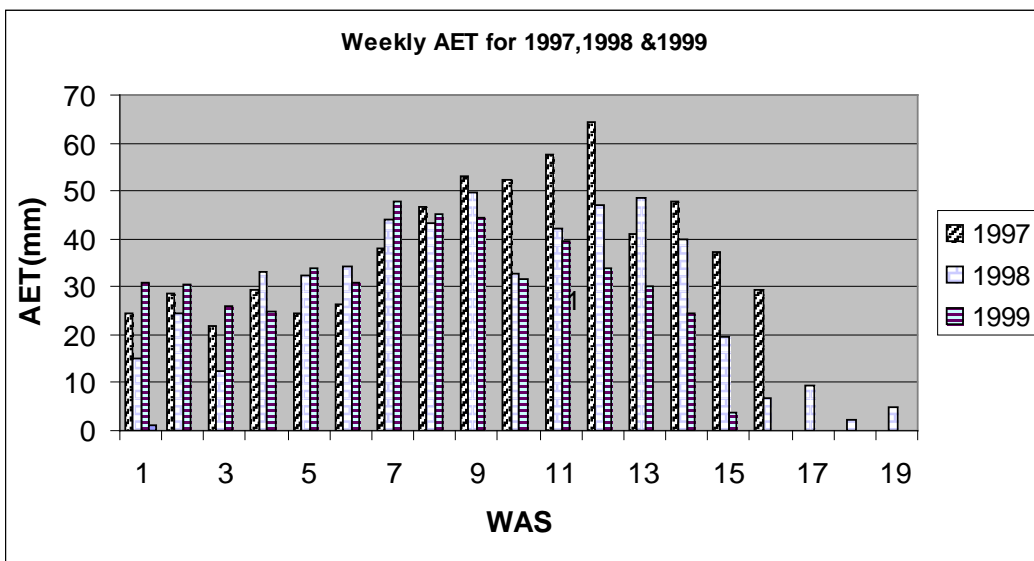**Fig. 1.** Crop coefficient (K_c) for okra during 1997-1999

Fig. 2. Weekly AET (mm) for okra during 1997, 1998 and 1999

3.   **Results and discussion**

3.1. *Crop coefficient*

Fig. 1 shows variation in crop coefficient   (K_c) with time, in weeks after sowing (WAS), during the growth of okra. When K_c values were fitted to time, in weeks after sowing (WAS), the following nonlinear relationship ($R^2 = 0.90$) was obtained.

$$K_c = 0.0973 + 0.2301 \, X \, (WAS) - 0.0124 \, X \, (WAS)^2$$

TABLE 1

Crop yield and evapotranspiration

Year	Date of sowing	AET (mm)	Pod yield (kg/ha)	WUE (kg/ha/mm)
1997	01 Mar 1997	622.9	12581	20.2
1998	09 Mar 1998	541.9	3312	6.1
1999	01 Mar 1999	477.6	13314	27.9

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.

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