Journal of Agrometeorology 19 (3) : 292-293 (September 2017)

Short Comminucation

Crop evapotranspiration and crop coefficient of soybean (Glycine max L. Merrill) in Bengaluru, Karnataka

C. S. PATIL[1] and RAJAVEL MANICKAM[2]

[1]India Meteorological Department, Chennai

[2]India Meteorological Department, Raipur

E-mail:cspatilmet@rediffmail.com

Evaluation of evapotranspiration in different locations and seasons is essential for developing more efficient and sustainable water management techniques (Attarod *et al.* 2005). There are about 50 methods available for estimating reference evapotranspiration (Grismer *et al.* 2002). Doorenbos and Pruitt (1977) provided guidelines for predicting crop water requirements for irrigation scheduling. Soybean (Glycine max L. Merrill) is very high nutritional crop containing about 20 % oil and 40 % protein. The knowledge of crop coefficient (the ratio of crop evapotranspiration and reference evapotranspiration) is useful to plan agricultural operations like protective irrigation. The main aim of the present investigation is to find out crop coefficient of soybean in different weeks.

For the present study, a field experiment was conducted at Agrometeorological Research Unit of IMD, Gandhi Krishi Vigyan Kendra campus, Bangalore (12^0 58'N, $77^0$35'E, 930 m a.s.l) in Karnataka State. Soil of the field is red sandy loam. Experiment was conducted during *kharif* season of 2000, 2001 and 2003. The crop was not raised during 2002 due to drought. The soybean crop was grown following the recommended package of practices of University of Agricultural Sciences, Bangalore. Two gravimetric lysimeters having dimension of 1.3 x 1.3 x 0.9 m and consisting of a sensitive type of weighing machine of 2000 kg capacity were installed in the field to measure actual evapotranspiration (AET). The sensitivity of the system was ±0.2 kg which is equivalent to 0.12 mm of evapotranspiration or rainfall. The daily AET was measured by recording weight loss and taking the rainfall into account. Potential evapotranspiration (PET) values were calculated using modified Penman's formulae. The meteorological data from the adjacent agrometeorological observatory was used to calculate PET. Crop coefficient (K_c) was calculated as the ratio of AET to PET at different weeks.

Table 1: Crop evapotranspiration and soybean yield

Date of sowing	Date of physiological maturity	AET (mm)	Yield (qha^{-1})
7th Aug.2000	6th Nov. 2000	339.5	14.48
30th Jul. 2001	2nd Nov. 2001	361.9	17.58
25th Jul. 2003	17th Oct. 2003	306.6	7.99

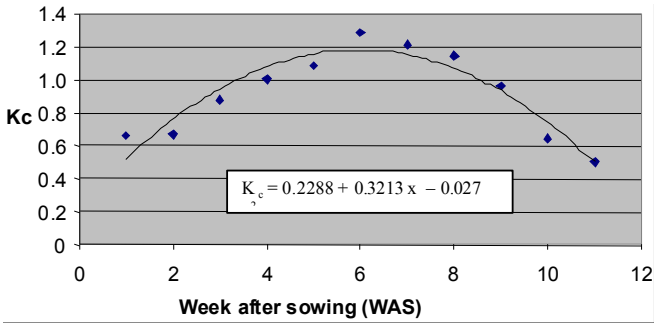

Fig. 1: Crop coefficient (K_c) of soybean at Bengaluru

Actual evapotranspiration (AET)

The actual evapotranspiration values for three years are shown in Table 1. The average actual evapotranspiration of three years was 336mm. Kamble *et al* (2010) found that the total seasonal actual evapotranspiration of soybean was 350mm in Solapur (Maharashtra). The yield of soybean varied from 7.99 qha^{-1} during 2003 (lowest yield) to 17.58 qha^{-1} (highest yield) during 2001. Low water consumption (306.6mm) and leaf roller/leaf miner which affected the crop may caused low yield in 2003. Kashyapi and Bahot (2012) reported the yield of soyabean as 13.8 qha^{-1} and total actual evapotranspiration of 437.9mm. In the present study, positive correlation between amount of actual evapotranspiration and yield of soybean was found. This variation may be due to weather conditions prevailing during the growth period in different years.

Crop coefficient

Crop coefficient (K_c) values at different weeks after sowing (WAS) (Fig. 1) shows that peak value of crop coefficient (1.18) was found on 6th WAS which corresponds to flowering stage. Verma *et al* (2007) reported that the crop coefficient values determined by Penman's modified formulae in Bhopal varied in the range of 0.30 – 0.45, 0.55 – 0.90, 1.00 – 1.15, 0.85 – 0.70 and 0.55 – 0.40 during seeding, vegetative, flowering, pod development and maturity stage respectively. Kashyapi and Bahot (2012) reported the K_c values of soybean at Bangalore as 1.19, 1.44, 1.25 during active vegetative, flowering and pod maturity respectively. Das (2003) reported that the values of the ratio of evapotranspiration and evaporation were maximum during flowering phase. The K_c of soybean at any particular week can be calculated using following regression equation.

$K_c = 0.2288 + 0.3213\ x - 0.027\ x^2$; Where x is week after sowing (WAS)

REFERENCES

Attarod, P., Komori, D., Hayashi, K., Aoki, M., Ishida, T., Fukumura, K., Boonyawat S., Polsan, P., Tongdeenok, P., Samboon, P and Punkngum, S.(2005). Comparison of the evapotranspiration among a Paddy Field, Cassava Plantation and Teak Plantation in Thailand. *J. Agri. Meterol.,* 60 (5): 789-792.

Das, H.P.(2003). Water use efficiency of soybean and its yield response to evapotranspiration and rainfall. *J. Agric. Physics* 3(1&2): 35-39.

Doorenbos, J and Pruitt, W.O.(1977). "Guidelines for predicting crop water requirements". Irrigation and Drainage Paper No.24, FAO Rome, 35-41.

Grismer, M.E., Orang, M., Synder, R. and Matyac, R.(2002). Pan evaporation to reference evapotranspiration conversation methods. *J. Irrig. Drain. Eng.,* 128: 180-184.

Kamble, P.S., Maniyar, V.G. and Jadhav, J.D.(2010). Crop coefficient (Kc) of soybean (*Glycine max* (L.) Merr.)". *Asian J. Envir. Sci.,* 5(2): 131-135.

Kashyapi, A. and Bahot, A. S. (2012). Phenophase wise study of parameters controlling water requirement of soybean crop (*Glycine max* (L.) Merr.) at various agroclimatic zones. *Mausam*, 63(2): 239-246.

Verma, I.J., Das, H.P. and Jadav V.N.(2007). Water and heat unit requirement in different growth stages of soybean (*Glycine Max* L.Merril) at Bhopal. *Mausam,* 58(4): 537-542.

Received : April 2017; Accepted: June 2017