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# **RESEARCH ARTICLE**

**Determination of Crop Coefficient Value for Brinjal (scientific name) Using Tensiometer Under Different Mulching Condition**

## ***ABSTRACT***

The present study aimed to determine the crop coefficient value for brinjal using tensiometer under different mulching condition. The study was conducted at Central Farm (C-block) of Agricultural Engineering College and Research Institute, Kumulur, Tamil Nadu during November 2018 to March 2019. Brinjal F1 hybrid Dhruva was transplanted and the study was conducted in three different conditions viz black colour, white colour and without mulch. Actual ETC was estimated using water balance method and ET0 was used to estimate crop coefficient values for different crop growing stages for all three mulching conditions. The brinjal crop growing periods was ere divided into the initial stage, development stage, mid-season stage and end stages. The ETo calculator was used to calculate the reference evapotranspiration from the 25 years meteorological date and the 25 years average reference evapotranspiration were taken for this study purpose. Soil water balance method was used to determine the crop evapotranspiration. Kc value for drip irrigation with black coloured mulch condition and different growth stages was 0.57, 0.78, 1.03 and 0.79, KC value for drip irrigation with white coloured mulch condition and different growth stages was 0.56, 0.77, 1.02 and 0.74 and KC for drip irrigation without mulch 0.57, 0.83, 1.03 and 0.84.Keywords:Keywords should immediately follow the abstract.

**Keywords:** Mulching, crop coefficient, Tensiometer, ET0 calculator, drip irrigation.

## ***INTRODUCTION***

## Water management is a key factor in agricultural production. India shares 17 per cent of global production with 2.4 per cent land and 4.0 per cent of world water resource. Efficient utilization of available water resource is mandatory in India. Around 90 per cent of water resources are utilized for agriculture and allied activities in India. Out of these only 50 per cent of water is used by plants and remaining is wasted through either evaporation or deep percolation. This is because of traditional methods are practiced for irrigation. Widely known best water saving irrigation technique is drip irrigation system. Under drip method, irrigation water is directly applied to the plant root zone, which minimizes the evaporation, percolation and other water losses (Suryavanshi *et al*., 2015). Brinjal (Solenum melongena) belongs to the family Solanaceae, considered native to India and is a widely grown vegetable in Asian countries. It is a worldwide important vegetable and grown in more than 1.7 million hectares area. Mulching is used to cover surface of soil for creating congenial environment for plant growth. Different types of mulches available starts from organic to polythene material. Polythene sheets are commonly used to cultivate vegetables crops. Commonly used plastic sheet mulching is based on LLDPE (Linear low-density polyethylene) because it is economic and durable in use. Studies have revealed that combination of drip fertigation with plastic mulching results higher performance in plant growth and production. Realizing the real benefits of use of drip system with plastic mulching, farmers starts to use this one. Very limited research work has been carried out in the field of crop water. With this background the following objectives are set to determine crop coefficient value for brinjal.

## ***MATERIAL AND METHODS***

## The study was conducted at Central Farm of Agricultural Engineering College and Research Institute, Kumulur, Tamil Nadu (Latitude: 10ᵒ92’ N; Longitude: 78ᵒ82’ E; 62m above the Mean Sea Level). The average annual precipitation is about 881.412 mm (Vaidheki and Arulanandu 2017).

## Soil samples were collected from the experimental field at different depths. By using international Robinson pipette method, the soil texture was found to be an average value of 74% sand, 14% silt, and 12% clay, which belongs to sandy loam soil. By using double ring infiltrometer test, the infiltration rate was determined as 1.71 cm h-1 (Mashayekhi *et al*., 2016). The field capacity and wilting point for the soil were estimated by using pressure plate apparatus such as 22.26% and 9.52%. Bulk density of the soil sample was 1.413 g/cc it was determined by core cutter method. Similarly (Zhang *et al.,* 2012) and (Laulina *et al*., 2019) also obtained field capacity of sandy loam soil was in the range of 21-23%. The Eggplant (Solanum melongena L.) variety Dhruva F1 selected for the experiment. The study was conducted for the season November 2018 to March 2019, on one side of the each furrow by keeping row-to-row and plant-to-plant distance 90 cm and 45 cm respectively. The layout of the experiment was three treatments tested, black mulched drip irrigation (BM+DI), white mulched drip irrigation (WM+DI) and drip irrigation without mulching as shows in Fig. 1.

## J:\field layout.JPG

## **Figure 1. Layout of eggplant experiment and irrigation system at AEC&RI kumulur, Trichy**

## **Figure 2. Plant height (cm) of brinjal under three mulching condition**

## **Figure 3. Number of leaves of brinjal under three mulching condition**

## **Figure 4. Stem diameter of brinjal under three mulching condition**

## **Figure 5. Plant spread in North-South direction under three mulching condition**

## The plant height was measured once in a week under each mulching condition at shown in Fig. 2. Height was measured in centimeter from ground level to tip of the main shoot with the help of meter scale. Fig. 3. Shown that after transplanting, the number of matured leaves was counted manually, once in two weeks. Diameter of the stem was measured at 2 cm above the ground level, using thread and meter scale at shown in Fig. 4. Plant spread was measured in North-South and East-West direction by using meter scale once in two week for each mulching condition separately (Fig. 5.).

## Reference evapotranspiration and crop coefficient taken different mulching conditions values and the canopy factor value equal to 1 (Sravanthi A. *et al.,* 2015). Crop coefficient (KC) is the ratio of reference evapotranspiration (ET0) and crop evapotranspiration (ETc ) as followed by equation 1.

## KC = ET0 / ETC (1)

## Crop coefficient for brinjal at different growth stages given in FAO 56 paper (Allen *et al.,* 1998) was used for calculating the crop evapotranspiration (ETC). The crop coefficient value of the brinjal crop was 0.6, 0.825, 1.05 and 0.9 during initial stage, development stage, mid stage and end stage.

## ***Results and discussion***

## The crop coefficient values were estimated on a daily basis from the initial stage to the end stage of the cropping period from actual ETc and ETo. The brinjal growing periods were divided into the initial stage, development stage, mid-season stage and end stages. The initial stage was from transplanting to plant growing period. The development stage was from growing period to the flowering phase and the middle period was selected from the flowering phase to yielding phase, whereas the final stage was selected from yielding up to the harvesting period. The Kc value for the four different growth stages and the three different mulching conditions are graphically depicted in the Figure 6, 7 and 8. Soil water balance method was used to determine the actual crop evapotranspiration (Abdollahi *et al.,* 2018) and FAO Penman-Monteith equation was used to calculate reference crop evapotranspiration. The actual crop evapotranspiration calculated for initial, vegetative, mid-season and end stages under black coloured condition were found to be 60.40 117.41 mm, 186.35 mm and 91.81 mm. Kc values estimated under drip irrigation with black coloured mulching conditions for different crop growing stages are 0.57, 0.78, 1.03 and 0.79. Water from soil was lost only through transpiration under plastic mulching. Estimated crop coefficient values were compared with FAO guideline Kc values. From the table it can be seen that the estimated crop coefficients were lesser than the FAO guideline Kc values.

## Kc values estimated under drip irrigation with white coloured mulching conditions for different crop growing stages are 0.56, 0,77, 1.02 and 0.74. These values were lesser than other two mulching conditions. Water used by the crop was lesser in this condition due to the reason that higher reflection characteristics of white coloured mulch retains higher moisture. It was observed in white coloured mulching condition that crop growth was lesser due to poor development of soil micro-organism in the soil. The estimated Kc values were lesser than the FAO guideline Kc values. Similar results were also found by other researchers study (Ted Van der Gulik 2001), (Daniel *et al.,* 2012), (Ehab Fahkree Hikamat and Almasraf 2014), (Daniel *et al.,* 2012).

## **Figure 6. Crop coefficient (Kc) for drip irrigation with black coloured mulch condition**

## **Figure 7. Crop coefficient (Kc) for drip irrigation with white coloured mulch condition**

## **Figure 8. Crop coefficient (Kc) for drip irrigation without mulch condition**

## ***Summary and conclusion***

## At the initial crop growth stage soil water content was lesser in the root zone. Amount of water present in the soil was higher in drip irrigation with white coloured mulching than with black coloured mulching due to reflection property of white coloured mulching. Increasing root growth from initial to end stage reflected in the water uptake by plants. Crop coefficient value of brinjal was calculated for different crop growing stages for all three mulching conditions by taking ratio of actual crop ET and reference crop ET. Computed Kc values at initial, development, mid and end stage of the brinjal is were drip irrigation with 0.57, 0.78, 1.03, 0.79 for drip irrigation with black coloured mulching 0.56, 0.77, 1.02, 0.74 for drip irrigation white coloured mulching and 0.57, 0.83, 1.03 and 0.84 for without mulching.

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