



COWPEA CROP COEFFICIENT IN TERESINA, PIAUI STATE, BRAZIL

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ABSTRACT: Determining the cowpea crop coefficient (Kc) is fundamental in order to establish its water needs during the stages of its development. The objective of this research was to determine the cowpea (*Vigna unguiculata* L. Walp.) Kc values, BR-17 Gurguéia variety, in its diverse crop development stages, by using a weighing lysimeter. The test was carried out in the experimental area of Embrapa Middle-North, in Teresina, PI (05°05' S; 42°48' W and 74.4 m) aiming a rational planning and management of irrigation. The evapotranspiration reference was estimated by the Penman-Monteith method using climatic data obtained from an automatic weather station located in the experimental area. The Kc values were: 0.7, in the initial phase; 0.7 to 0.8, in the growing phase; 0.8 to 1.06 in the reproductive phase and 0.6 in the final phase.

KEYWORDS: weighing lysimeter, evapotranspiration, irrigation.

INTRODUCTION: The cowpea (*Vigna unguiculata* (L.) Walp.) is one main legume cultivated in Brazil, predominantly in the Northeastern and Northern regions, where it is used as a basic food by the population. In these regions, the cowpea represents about 95% of all cultivated beans. Brazil is the major producer and consumer of the cowpea in the world (IBGE, 2006). Although the State of Piauí has the potential for high grain yield under irrigation, there is little information about the cowpea water needs. Determining the cowpea crop coefficient (Kc) is basic for finding out its water needs during the phases of its development. Some factors may influence the Kc values such as: variety characteristics, soil water content and climatic conditions. Therefore, the Kc must be determined within local conditions. Some studies about the cowpea Kc were carried out in the Northeastern Region (LIMA & SILVA, 1988; ANDRADE et al., 1993; FERREIRA et al., 2006; SOUZA et al., 2005) and the Northern Region (AGUIAR et al., 1992). However, there is no research about cowpea Kc for the local conditions of Teresina, PI. The objective of this research is to determine the Kc values of cowpea crop during its developmental phases in the soil and climatic conditions of Teresina.

METHODOLOGY: This trial was carried out in the experimental area of Embrapa Middle-North, in Teresina, PI (05°05' S; 42°48' W and 74.4m). The soil of the experimental area is a Red-Yellow Latosol, whose chemical characteristics are presented in Table 1. The climate, according to Koppen classification is Aw' (tropical rainy). The cowpea (*Vigna unguiculata* (L.) Walp), "BR-17 Gurguéia" variety was evaluated during all its developmental phases.



TABLE 1. Chemical characteristics of the soil of the experimental area. Teresina, PI, 2005

| Sample | pH | P | K | Ca | Mg | Na | H + Al | CTC | V |
|-----------------------|---------|---------------------|---|------|------|------|--------|------|-------|
| | (water) | mg dm ⁻³ | -----cmol _c dm ⁻³ ----- | | | | | | % |
| Lysimeter 0 – 0.2 m | 5.49 | 14.40 | 0.17 | 1.28 | 0.82 | 0.25 | 1.44 | 3.96 | 63.73 |
| Lysimeter 0.2 – 0.4 m | 5.30 | 22.68 | 0.10 | 0.71 | 0.48 | 0.02 | 2.00 | 3.31 | 39.61 |
| Border 0 – 0.2 m | 5.94 | 25.34 | 0.30 | 1.65 | 0.94 | 0.01 | 1.39 | 4.29 | 67.66 |
| Border 0.2 – 0.4 m | 5.71 | 14.83 | 0.22 | 1.17 | 1.05 | 0.01 | 1.65 | 4.10 | 59.75 |

The crop was sowed on August, 5, 2005 and the plants were spaced at 0.8 m x 0.2 m in an area of 1.2 ha (border). During the planting, 40 kg of P₂O₅ ha⁻¹ and 30 kg of K₂O ha⁻¹ were applied. Chemical products for the aphid control were used. Irrigation was supplied at night by sprinklers spaced at 12 m x 12 m with a water flow of 400 L.h⁻¹. The soil water tension was monitored by tensiometers. Four weighing lysimeters were used for measuring the crop evapotranspiration (ET_c). Each lysimeter was made up of a box (1.5 m by 1.5 m of width and 1.0 m of depth), constructed of glass fiber 9 mm thick and supported on a precision balance. A cable was used for connecting the electronic balance of each lysimeter to the weather station. A datalogger was used to store the meteorological and lysimeter data. The reference evapotranspiration (ET_o) was estimated by the Penman – Monteith method. The K_c was determined by the relation between crop evapotranspiration (ET_c) and the reference evapotranspiration (ET_o). The harvest occurred around 70 days after planting. In order to estimate the grain yield all plants in the lysimeter were harvested and ten plots measuring 1.5 m x 1.5 m each, were evaluated, in the border area.

RESULTS AND DISCUSSION: The variations of the K_c during the whole cycle of the cowpea is shown in Figure 1. The K_c presented a minimum value of 0.66 during the first 15 days after planting, because a small fraction of the soil was covered by the crop and the roots presented a superficial growth. The K_c increased reaching a maximum value of 1.06, 45 days after sowing, coinciding with the beginning of the reproductive cycle and grain filling stage. After this phase, the K_c values decreased, in accordance with the plant physiology. In Alvorada do Gurguéia, Piauí State, FERREIRA et al. (2006), evaluating the cowpea crop, obtained higher K_c levels in the grain formation phase (1.20). Other researchers obtained higher levels of cowpea K_c in other regions. ANDRADE et al (1993), evaluating the “BR - 12 Canindé”, in Parnaíba, Piauí State of obtained K_c equal to 1.16 as the maximum level, at 42 days after sowing, coinciding with the flowering phase. In Bragança, Pará State, similar levels of K_c were observed (1.04), during the same phase (AGUIAR et al., 1992). In Ceará State, SOUZA et al. (2005) obtained 0.78 as the minimum K_c, in the vegetative phase, and 1.27 as maximum K_c in the reproductive phase for the cowpea crop cv. “Setentão”. These differences can be explained by the genetic characteristics of the crop and the different soil (water content) and climatic conditions (relative humidity and air temperature) during the experiment. The grain yield, in the border area, was 2,159 kg ha⁻¹ and, in the lysimeter area, 2,216 kg ha⁻¹. These similar and high levels of grain yield indicates that the crop was developed under adequate soil and climatic conditions and, therefore, the K_c levels are representative of the Teresina region.

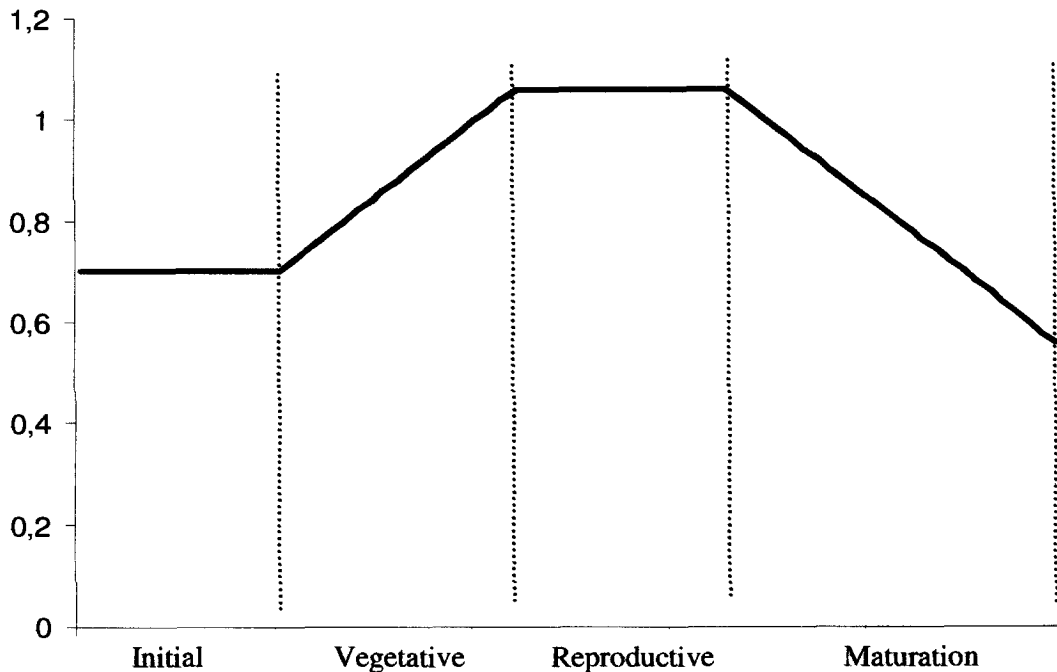


FIGURE 1 – Cowpea crop coefficient (K_c) measured in Teresina conty, Piauí State, 2005.

CONCLUSIONS: The cowpea crop coefficient measured in the soil and climatic conditions of Teresina, Piauí State, ranged from 0.66 to 1.06 during the initial and reproductive phase, respectively.

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