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Soil Matric Potential for the Biquinho Pepper Submitted to Irrigation Levels and Biofertilizer Doses

Jorge Alves de Sousa[1], Caetano Claudio Pereira Junior[2], and Hugo Orlando Carvallo Guerra[1]

1. Federal University of Campina Grande, Campina Grande, Brazil

2. Federal Institute of Pernambuco, Barreiros, Brazil

Abstract: The control of the hydric status of the soil allows the knowledge of the soil available water for the plants, essential information for the decisions with respect to the rational management of the irrigation and crop production. This control can be performed throughout the direct determination of the soil water content or measuring the energy by which this water is retained by the soil, called matric potential. The objective of the present work was to relate the soil water content with the matric potentials monitored throughout the use of tensiometers. For this, an experiment was conducted with the biquinho pepper submitted to 5 levels of irrigation. With the exception of the treatment with the lowest irrigation level (L4) the matric potentials observed for the levels L1 and L2 were always greater than the -8kPa, furnishing to the biquinho pepper an adequate water supplement. The L3 treatment produced matric potentials close to the -8kPa recommended and considered adequate for the irrigation of pepper, theoretically not producing a water deficit. The monitoring of the soil matric potentials to obtain the soil water content is an excellent and useful tool for an adequate irrigation management.

Key words: capsicum chinense, capillary potential, soil water content

1. Introduction

The great acceptance of pepper fruits and the wish of the consumer market for good quality products stimulates this sector to gain more expressiveness through the most diverse research related to the growth and production of peppers in a healthy environment. Despite the importance of crops in protected environments for Brazilian olericulture, research results are still insufficient to support the potential use of this technology in the different climatic regions of the Brazil, especially those necessary for the proper management of irrigation. To analyze the reduction of water content in the plant is one of the ways to study the responses of a plant submitted to different water availability in the soil, being thus the monitoring of water stress is essential to determine the impact on the productivity of the species [1]. Pepper is a plant very sensitive to water availability and soil mineral nutrition, essential factors to increase productivity and improve production quality.

The control of the soil water status allows to know the amount of water available to the plants, essential information for making decisions regarding the rational management of irrigation and production. This control can be done by directly determining the soil water content or by measuring the energy by which water is retained by the soil, called matric potential [2].

The objective of this experiment was to analyze the soil water content on the biquinho pepper expressed in matrix potential values, measured through the use of tensiometers.

2. Material and Methods

The experiment was conducted in a protected environment in the experimental area of the

Corresponding author: Jorge Alves de Sousa, Doctor; research areas/interests: irrigation and drainage. E-mail: jorgeasousa@yahoo.com.br.

Olericulture Sector, of the Federal Institute of Education Science and Technology of Pernambuco campus Barreiros (IFPE-Campus Barreiros). The Barreiros Campus is located in the municipality of Barreiros, 110 km from the state capital of Pernambuco, Recife, Brazil, in the Mesoregion of Mata Sul Pernambucana, whose geographic coordinates are: Latitude: 08°49'06" S; Longitude: 35°11'11" and Altitude: 22 m. The substrate for the plant consisted of a mixture based on coconut powder, earthworm humus and soil of the experiment site in the proportions 1:2:3, respectively. Soil textural characteristics were: 29.94% clay, 12.29% silt and 57.77% sand, being classified as a sandy clay loam soil.

A randomized block design was used, in a factorial scheme (4×5) + 1, composed of four irrigation depths, five doses of biofertilizer, plus four additional treatments with conventional mineral fertilization instead of biofertilization distributed in four blocks, resulting in ninetysix experimental units.

The irrigation depths were: L1 - 125% of the control level applied by an automatic trigger, AAI; L2 - 100% of the control level applied by the AAI; L3 - 75% of the control level applied by the AAI; and L4 - 50% of the control level applied by the AAI. The biofertilizer doses were: 0, 5, 10, 15 and 20 m^3 ha^{-1}, applied every 15 days, from the thirtieth day after transplanting the seedlings; corresponding to 0, 200, 400, 600 and 800 ml per plant (D5, D4, D3, D2 and D1, respectively), resulting in a total of eight applications throughout the cultivation period. The reference dose was 10 m^3 ha $^{-1}$ based on the recommendation of Schiedeck [3].

The matric potential of the substrate reached during the experiment was monitored by puncture tensiometers installed at 0.15 m depth (Fig. 1).

Fig. 1 Puncture tensiometers installed in the pots and digital tensiometer to obtain the tension readings.

3. Results and Discussion

There was no significant effect of the irrigation levels on the fresh and dry mass of the biquinho pepper, having significant effect ($p < 0.01$) only the biofertilizer doses. Although there was significant effect of the biofertilizer doses, the análयses of the matríc potentials was conducted with the means of these doses, not analysing their effect on the plant, focusing the work only to the matric potentials.

Fig. 2 shows the matric potentials of the substrate monitored during the phenological period of the crop.

It is observed that the L4 treatment, with the smallest irrigation depth (127.50 mm) produced mean potentials of -24.51 kPa (Fig. 2), much smaller than the -8.0 kPa, considered adequate for irrigation in substrates as recommended by Medici (2010) [4] and used in the present experiment to turn on automatic trigger. Thus, theoretically, the treatment L4 would have produced the effect of the planned treatment (50% of the L2 control irrigation level) and a water deficit.

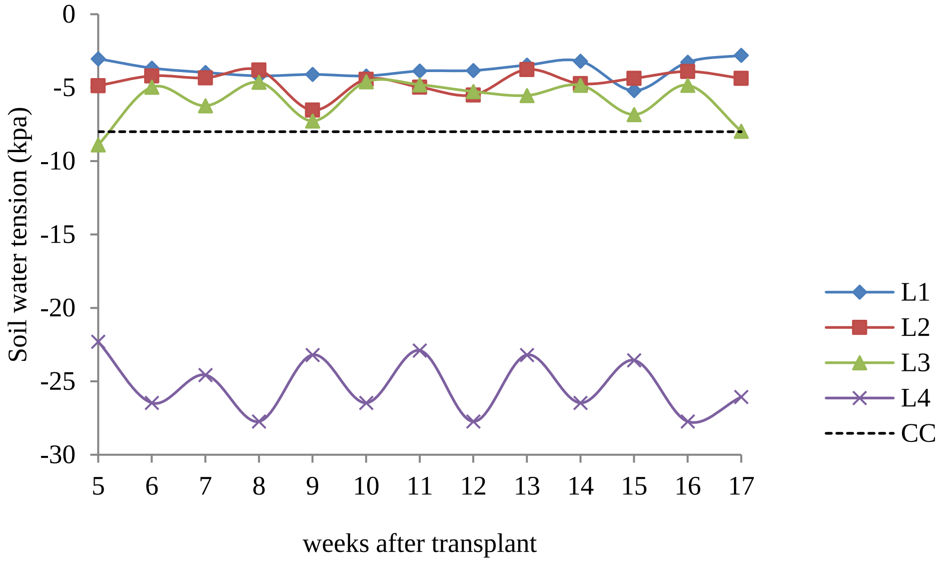

Fig. 2 Matric potentials observed during the course of the experiment for the irrigation depths: L1 - 125% of the control level applied by the automatic trigger, AAI; L2 - 100% of the control level; L3 - 75% of the control level and L4 - 50% of the control level.

The L3 treatment with a depth of 190.63 mm produced an average matric potential of -7.01 kPa, close to the -8 kPa, considered adequated for irrigation in substrates, theoretically not producing a water deficit for the plant. Treatments L2 and L1 produced mean matric potentials of -4.81 and -3.65 kPa, respectively, stresses well below the -8.0 kPa stipulated by water treatments and thus without water deficits. The water depths applied by treatments L2 and L1 were 253.76 and 317.25 mm, respectively.

With the exception of the treatment with the smallest irrigation depth (L4), the matric potentials established by the irrigation treatments L1, L2 and L3 were always higher than the 8kPa, recommended by Medici et al. (2010) [4], thus providing an adequate supply water for the pepper.

4. Conclusions

The matric potentials observed with the treatments L1, L2 and L3 were always higher than the -80 kPa considered adequate for the pepper irrigation.

The measurement of soil matric potentials to infer soil water content data is an excellent and useful tool for an adequate management of pepper irrigation.

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