English Version

Use of different doses of Hidrogel for sweet pepper seedling production

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Abstract

Sweet pepper (*Capsicum annuum*) is a vegetable of great socioeconomic importance in Brazil. One of the main stages of the production system is the production of quality seedlingsand, for this, it is required a substrate with good water retention and porosity. The technique of adding hydrogel as soil conditioner aims to increase the capacity of water retention on substrates for seedlings. The objective of this study was the analysis of the sweet pepper seedlings development using four doses of hydrogel Hydroplan-EB added to the Bioterra substrate, using 0, 1.0, 1.5 and 2.0 g kg^{-1} of substrate. The test was conducted during March-April 2007, at a seedling nursery of Unoeste, Presidente Prudente, São Paulo State, Brazil. It was used sweet pepper variety Cascadura Ikeda. The measured variables were plant height, root length, leaf number, dry mass of aerial part and of roots. The use of hydrogel did not influence the root system of the seedling peppers. There was no effect of hydrogel in the shoot length, but the hidrogel doses affected the aerial part dry weight because when we increased the dose of the hydrogel was observed in response to developing leaves and not the height growth. This fact promoted a significant positive linear adjustment of the aerial part mass dry with increasing dose of hydrogel, providing a change of better quality.

Key words: *Capsicum annuum*; water retention; soil conditioner

Introduction

Sweet paper, *Capsicum annuum* (Solanaceae), is a vegetable of great socioeconomic importance in Brazil, and it is sold as green, red, yellow, orange, cream and purple fruit. Its nutritive value, for consumption as a meal itself, is mainly due to the presence of vitamins, especially vitamin C. Its origin is tropical, developing and producing better under relatively high or mild temperatures, being intolerant to low temperatures and frost. The adult plant is more resistant to cold weather (FILGUEIRA, 2000).

One of the main stages of the productive system of sweet pepper is the production of seedlings of quality, since the final development of plants in the production field depends on them (ANDRIOLO, 2000). In order to obtain seedlings of quality, it is necessary the use of a good technique of seedling formation and, among the important factors, it is noteworthy the substrate properties. The best substrates must present, among other important characteristics, good water retention, porosity, availability of acquisition and transport, absence of pathogens, richness in essential nutrients, appropriated pH, texture and structure (SILVA et al., 2001).

A technique that is still little studied is the addition of water retentive polymers as water conditioners in soil, aiming to increase the capacity of retention of water in substrates for seedlings, providing better quality. The water retentive polymer, or hydrogel, is characterized by the capacity of absorbing and releasing water and soluble nutrients. The nature of the arrangement of the molecules gives this material a granular form, when dry, and when hydrated, the granules expand, transforming themselves into particles of gel (PREVEDELLO and BALENA, 2000; AKHTER et al., 2004).

According to AKHTER et al. (2004) and VALE et al. (2006) a water retentive polymer may guarantee the supply of water to plants in regions which presented water deficit supplying the needs of water of the plants in an increasing way. These materials may minimize the effects of possible veranicos[3] in the phase of implantation, and the problem with the degraded and sandy soils, making it possible the development of agriculture in more arid regions. The authors still complete that with

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3 'Veranico' is a Brazilian word to define dry periods during the wet season.

the emergence of a new generation of polymers, their application have intensified lately, mainly in landscape projects, sportive grass, fruit-growing, reforestation, planting of crops and seedling nursery, considering that some nursery farmers already use these polymers in mixtures with the substrate, obtaining satisfactory results.

HAFLE et al. (2008) commented that a limiting factor to the use of these polymers is their cost, still high; however, positive results may be obtained with very low dose; these doses may bring the improvement of the conditions of water and nutrient retention in the substrate, providing one more alternative in the production of seedlings from this species, with lower costs.

Literature presents several works that show the benefits of hydrogel in the physical-chemical properties of the porous media. PREVEDELLO and BALENA (2000) verified that the increase in the dose of the polymer reduced the values of the water conductivity in the saturated mean. AL-DARBY (1996) found similar results with the addition of the polymers in a sandy soil. According to this author, the reduction of the water conductivity was due to the reduction of the mean ratio of the porous due to the expansion of the polymers. In this work, it was also verified an increase in the water availability in function of the increasing doses of the polymer. DEMARTELAERE et al. (2009) observed that the use of the hydrogel polymer reduced in 25% the quantity of water used in irrigation of melon.

According to OLIVEIRA et al. (2004), as there is an increase in the concentration of the polymer in soil, there is larger water retention, mainly in the highest matric potentials. Still according to the same authors, the use of hydrogel polymer contributes to increase the water retention in soils with sandy clay loam and clay textures, until the matric potential of -1.0 MPa.

It literature it can be found several works of research using hydrogel for the production of coffee seedlings (VALLONE et al., 2004; VALE et al., 2006; ZONTA et al., 2009). In horticultural crops there are a few works with the use of hydrogel. LOPED et al. (2009) studied the effect of addition of hydrogel in broccoli obtaining the best results with the dose of 2 g L^{-1}. DEMARTELAERE et al. (2009) tested the use of water retentive polymer in melon associated to irrigation depths and observed higher yield and number of fruits per linear meter in function of the application of the soil conditioner. The mean fruit weight and the content of total soluble solids were not influenced by the application of the soil conditioner. LOPES et al. (2010), evaluating the use of hydrogel in the survival of *Eucalyptus urograndis* seedlings in clay soil, observed that hydrogel had its late symptoms of lack of water, guaranteeing 37 days without additional irrigation.

ALBUQUERQUE FILHO et al. (2009) verified in coriander satisfactory results, even being submitted to an irrigation management which provided water deficit, using doses of the hydrogel polymer 'hidratassolo'. HAFLER et al. (2008) in their study with addition of hydrogel to the substrate maintained passion fruit cuttings irrigated near to the field capacity and observed effects of the use of hydrogel, since, even under irrigation the cuttings presented an increase in the survival and a larger rooting, caused by a larger retention of water and nutrient availability due to the addition of hydrogel.

The objective of this work was to analyze the development of the root and shoot system of sweet pepper seedlings with the use of different doses of the hydrogel polymer Hydroplan added to the substrate in the region of Presidente Prudente, São Paulo.

Material and methods

The experiment was conducted during the period from March to April 2007, in screened nursery of the Campus II of the University of the West of São Paulo, in Presitente Prudente, São Paulo. Latitude: 22º 07'04" and longitude: 51º 22'05" W of GRW. The climate is classified by Köeppen as Aw mesothermal with hot summer and dry winter.

It was used seeds of sweet pepper variety Cascadura Ikeda of the brand "Blue Line", presenting purity of 99%, guarantee of minimum germination of 91% lot 20068; hydrogel based on polyacrylamide insoluble in water commercially known as Hydroplan-EB/HyC-S and substrate Bioterra. The experiment was completely randomized with 4 treatments and 8 replications, considering that each replication had 50 cells of new polystyrene trays in order to avoid interference of contaminants or other conditioners previously used.

Treatments were divided in four doses of Hydroplan, being: 0 (control); 1.0 g (0.1%); 1.5 g (0.15%) and 2.0 g kg^{-1} of substrate. (0.2%). The quantities of Hydroplan used in the experiment were mixed with 2.5 kg of the substrate needed to fill the polystyrene trays, proving an homogeneous mixture in order to guarantee a good distribution of the polymer in the substrate.

Seeding was performed on March 15th 2007. In each cell it was manually placed three seeds in the depth of 1 cm. After 10 days it began the emergence. Fifteen days after the emergence it was performed the thinning removing the less vigorous plants, leaving one plant per cell. The irrigation was divided in three times a day due to the high temperatures which characterize this period of the year.

After the thirtieth day of the beginning of the emergence, it began the collection of 10 plants randomly by replication, from which the following variables were evaluated: shoot length (SL), measured from the neck to the plant apex with ruler graded in centimeters; - root length (RL) with ruler grade in centimeters and number of leaves per plant (NL). Next, shoot and root were separated and dried in oven with forced circulation at 70 °C, for 48 hours to later determination of the value of the dry matter of shoot (DMS), expressed in grams and of the dry matter of the root, (DMR), express in grams.

The analysis of variance was made by F test; the mean comparison by the Scott-Knott test, both with significance of 5%. For the analysis it was used the software SISVAR 4.6. For the characteristics in which the regression was possible, the curves were adjusted trough the software Origin® 6.0 considering all the replications.

Results and discussion

With the results obtained from the statistic analysis (Table 1), it was verified that only the variables number of leaves (NL) and dry matter of shoot (DMS) presented significant differences between treatments with doses of hydrogel. In other words, the use of hydrogel did not provide differences in the root system of the sweet pepper seedling. In relation to the shoot there was no effect of hydrogel in the length of the shoot, but hydrogel interfered in the dry matter of shoot since it provided higher number of leaves.

For the variable analyzed number of leaves it can be seen that even with the daily irrigation of sweet pepper seedlings it was observed a positive linear adjustment of the number of leaves with the increase of the dose of hydrogel (Figure 1). Thus, when there is an increase in the dose of Hydroplan the shoot responds with leaf development and not in the increase in height. HAFLER et al. (2008) commented that the effects of hydrogel added to the substrate are due to a higher retention of water and availability of the nutrients due to the characteristics of the hydrogel of absorbing water and allowing this water to be used in a gradual way by plants as it was explained by PREVEDELLO and BALENA (2000); OLIVEIRA et al. (2004); AKHTER et al. (2004) and VALE et al. (2006).

This increase in the water retention was also observed by VIEIRA and PAULETOO (2009) which evaluated the effect of a water absorbent conditioner polymer increased the total porosity, reduced the shoot space, did not affect the water availability and provided increase on the volume

Table 1. Summary of the analysis of variance for shoot lenght (SL), root lenght (RL), number of leaves (NL), dry matter of shoot (DMS) and dry matter of root (DMR) produced in different doses of hydrogel. Presidente Prudente, 2007.

F.V.	G.L.	SL	RL	NL	DMS	DMR
		cm			g $plant^{-1}$	
Treat	3	5.44n.s.(1)	7.24n.s.	2.758*	3.286*	n.s.
Residuous	28					
C.V.		12.2	11.21	15.4	19.31	24.5

*(1) F values of the analysis of variance; * = significant at 5% of probability and n.s. = non significant.*

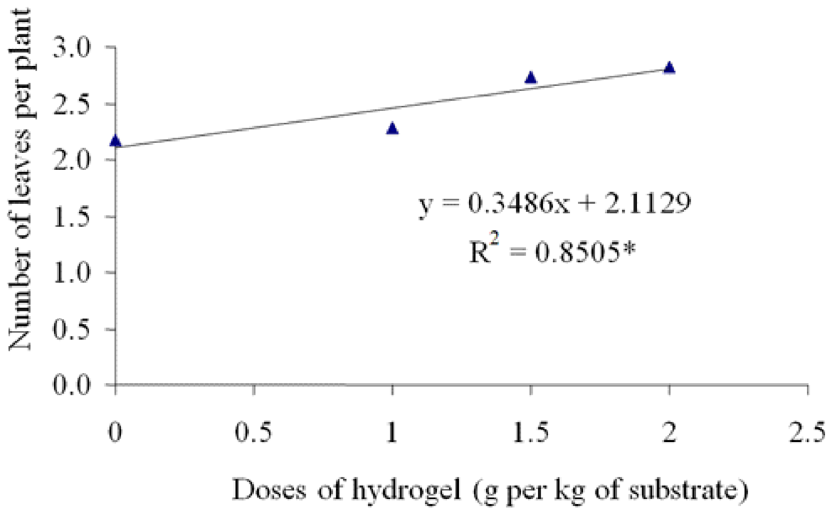

Figure 1. Number of leaves per plant to the changes of sweet pepper for the doses of hydrogel tested 30 days after the beginning of the emergence. Presidente Prudente, 2007.

of reserve water of the substrate. The authors still complete that this in practice, in nursery of plant production during periods of water deficit, may contribute to water economy and higher survival of plants.

The result of the increase of the number of leaves is seen in the dry matter of shoot (DMS) in Figure 2, which also presents a significant positive linear adjustment with the increase of the dose of hydrogel. These results are in accordance with AZEVEDO et al. (2002) and PETERSON (2006), who concluded that the addition of hydrogel to soil optimize the availability of water, reduces the loss by nutrient percolation and leaching and improves the soil aeration and drainage, accelerating the shoot development of plants. ZONTA et al. (2009) commented that the increase of the water absorption and retention by hydrogel will make the water more

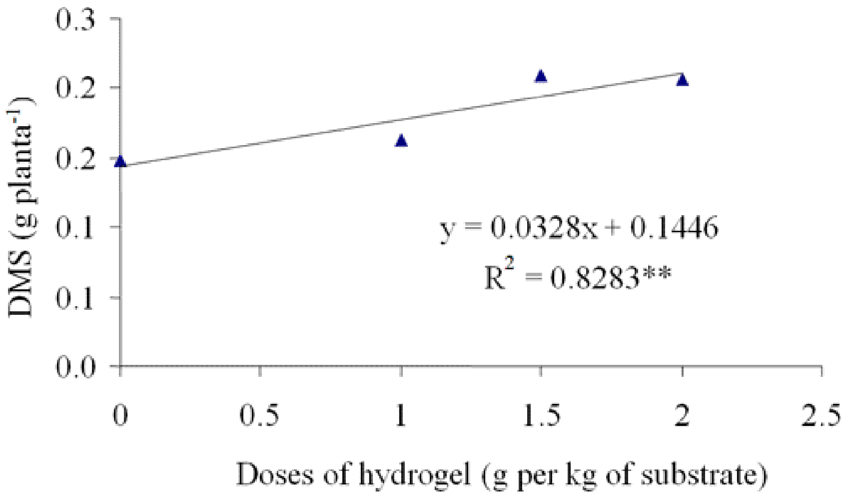

Figure 2. Dry matter of the shoot of sweet pepper seedlings per plant 30 days after the beginning of the emergence. Presidente Prudente, 2007.

easily available to plants, improving their initial development.

Conclusion

From the obtained results it was concluded that the use of hydrogel Hydroplan provided a better development of sweet pepper seedlings, trough the increase of the shoot and a higher number of leaves providing a seedling of better quality with better exploitation of water to the irrigation.

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