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EMERGENCE OF CARROT SEEDS CV. BRASÍLIA SUBMITTED TO HYDRO-CONDITIONING

EMERGÊNCIA DE SEMENTES DE CENOURA CV. BRASÍLIA SUBMETIDAS À HIDROCONDICIONAMENTO

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**Contato principal*

Info

Recebido: 08/2018
Publicado: 11/2018
ISSN: 2595-6906

Palavras-Chave
Condicionamento fisiológico. Daucus carota L. Índice de velocidade de emergência

Keywords:
Physiological conditioning, *Daucus carota* L, Emergency speed index

Abstract

The period between the sowing and the emergence of the seedling is the most critical phase of the development of the crop. Physiological conditioning is an appropriate technique for this period. Thus, the objective of this study was to evaluate the effect of hydro-conditioning in the field emergence and in the Emergence Velocity Index (EVI) in carrot seeds, cv Brasília. The seeds were submitted to hydro-conditioning methods in wet germitest paper and immersion in aerated distilled water. The treatments were submitted to a temperature of 20ºC ± 3ºC, for periods of 24, 48 and 72 h. A completely randomized design was used, with four replications, in a 2 x 3 factorial scheme (conditioning methods x periods) and the averages compared by the Dunnett test at 5% probability. The results of the germination test do not present as significant differences between the averages of the conditionated seeds and the witnesses. Regarding EVI, there was a significant difference between witnesses and conditioning. Thus, it was concluded that the hydro-conditioning did not influence the percentage of germination of the carrot seeds, but it allowed a greater speed in the emergence of the seedlings

Resumo

O período entre a semeadura e a emergência da plântula é a fase mais crítica do desenvolvimento da cultura. O condicionamento fisiológico é uma técnica indicada para reduzir esse período. Assim, objetivou-se avaliar o efeito do hidrocondicionamento na emergência em campo e no índice de velocidade de emergência (IVE) em sementes de cenoura, cultivar Brasília. As sementes foram submetidas a métodos de hidrocondicionamento em papel germitest umedecido e imersão em água destilada aerada. Os tratamentos foram submetidos à temperatura de 20ºC ±3ºC, por períodos de 24, 48 e 72 h. Utilizou-se o delineamento inteiramente casualizado, com quatro repetições, em esquema fatorial 2 x 3 (métodos de condicionamento x períodos) e as médias comparadas pelo teste de Dunnett a 5% de probabilidade. Os resultados do teste de germinação não apresentaram diferenças significativas entre as médias das sementes condicionadas e da testemunha. Em relação ao IVE, houve diferença significativa entre a testemunha e os condicionamentos. Assim, conclui-se que o hidrocondicionamento não influenciou na porcentagem de germinação das sementes de cenoura, mas possibilitou maior velocidade na emergência das plântulas.

Agronomic Journal
Ipê

Introduction

The carrot (Daucus carota L.), belonging to the botanical family Apiaceae, is one of the most cultivated vegetables in the world, of great nutritional value, rich in vitamins and minerals, being the main edible root (Reghin e Duda, 2000). As well as several olive groves, it presents a short cycle of production and irregular germination, being the period between sowing and emergence of the seedling the most critical phase of its development (Nascimento, 2005).

Favorable environmental conditions allow the seeds to germinate and express better their physiological performance, but the ideal conditions for germination are often non-existent, and may interfere with crop development and productivity (Oliveira et al., 2005). Thus, the presence of adverse edaphoclimatic conditions, after sowing, compromises the uniformity and percentage of emergence of seedlings (Pereira, 2007), mainly for crops whose sowing is done directly in the field, as is the case with carrots.

It is noteworthy that the success of olive production depends on the establishment of seedlings in the field, a factor that is directly related to germination and seed vigor (Nascimento, 2005). The rapid and uniform establishment of seedlings is essential to obtain adequate stand, which will have a reflection on the productivity and quality of the final product (Nascimento, 1998).

During the emergency period, the seeds are exposed to various soil and climatic conditions. To reduce this period, different treatments have been developed, among them physiological conditioning (Nascimento, 1998). This technique aims to imbibe the seeds, allowing the activation of the metabolic processes of germination without the emission of the primary root (Heydecke et al., 1973). For hydration, it is possible to use only water, a technique known as hydrocondicionamento or, osmotic solutions, known as osmoconditioning (Pinedo e Ferraz, 2008).

In the process of physiological conditioning, the seeds are submitted to controlled hydration, allowing the seed to complete stages I and II of the imbibition, which are preparatory to germination, without advancing to phase III, characterized by cellular elongation and radicle emission et al., 2008). Each culture presents a specific period for the development of the germination phases, and it is important to carry out research to ensure that the seeds do not emit the radicle during the conditioning process.

Physiological conditioning has been used in several horticultural species in order to increase the rate of emergence, to improve seedling uniformity and, in some cases, to increase the percentage of germination (Nascimento, 1998). Among the techniques of conditioning, hydrocondicionamento presents advantages over the other techniques because it is simpler and cheaper, without the presence of chemical reagents (Fujikura et al., 1993).

Agronomic Journal
Ipê

The use of pre-germination techniques, such as hydro-conditioning, may favor seed germination in terms of germination speed and uniformity (Gurgel Júnior et al., 2009). Therefore, the objective of this study was to evaluate the effect of hydrocondicionamento in field twinning and the rate of emergence (IVE) in carrot seeds, cultivar Brasília.

Material e methods

The experiment was carried out in the Technological Center and in the experimental area of the Evangelical Faculty of Goianésia, from August to September 2016, in the city of Goianésia-GO, located at altitude 640 m, longitude 15 ° 18'06.2 "S and latitude 49 ° 07'10.6"W. Seed carrots Isla, cultivar Brasília with 81% of germination and 6.4% of humidity were used.

The seeds were submitted to two methods of physiological conditioning, at temperatures of 20ºC ± 3ºC (Nascimento, 2004), for periods of 24, 48 and 72 h.

The methods of conditioning used were:

I. Immersion in moistened paper: 25 g sample was divided into five gerbox® boxes, containing two sheets of germitest® paper, which were moistened with distilled water in the ratio 2.5 times the weight of the paper (Brazil, 2009) . The boxes were capped and wrapped in transparent plastic bags (Fanti e Perez, 2003) to avoid losses by evaporation and kept in a BOD incubator at a temperature of 20ºC ± 3ºC under constant light.

II. Immersion in distilled water: 25 g sample of seeds was dipped in a beaker containing 800 ml of distilled water. The conditioning was carried out in a BOD® incubator, at a temperature of 20ºC ± 3ºC under constant light, where the aeration of the system was carried out by means of an air compressor for the Boyu sc-3500 aquarium.

After the determined periods, the seeds were removed from the conditioning vessels and dried with paper towels for 15 minutes.

The seeds conditioned to the control (those that had not undergone any treatment), after drying, were submitted to the following tests:

For the field emergence test, 400 seeds per treatment were used in four replicates of 100 seeds. The sowing occurred in August 2016, in a site with the dimensions of 1.5 m in width and 5.5 m in length. The treatments were randomly distributed in 112 furrows with spacing of 5 cm and depth of approximately 1.0 cm. Twenty five seeds were distributed per groove, spacing 5 cm between plants. Thereafter, they were covered with a soil layer of about 1.0 cm. Two daily waterings were performed, keeping the soil sufficiently moist. Germination evaluations were performed seven and fourteen days after sowing, according to the Rules for Seed Analysis (Brazil, 2009). Seedlings larger than 1.0 cm were considered.

The emergence velocity index was performed in conjunction with the germination test, counting the number of seedlings emerged daily, according to Maguire's formula (1962).

Agronomic Journal
Ipê

$$IVE = \left(\frac{G1}{N1}\right) + \left(\frac{G2}{N2}\right) + \cdots + \left(\frac{Gn}{Nn}\right)$$

At where;

G1, G2, Gn = number of seedlings in the first, second and last count.

N1, N2, Nn = number of days of sowing to the first, second and last count.

The experimental design was completely randomized, with four replications arranged in a 3 x 2 factorial scheme (three times - 24 h, 48 h and 72 h, and two conditioning methods - paper and aerated) . The results were submitted to analysis of variance using the statistical software Assistat version 7.7., And the means of the treatments were compared with the control by means of the test of Dunnet to 5% of probability.

Results and Discussion

The hydrocondicionamento did not present significant effect on the percentage of germination of the carrot seeds. For the emergency speed index (IVE) a significant difference between the treatments and the control was observed.

Although there were no statistical differences between the conditioned and control treatments, higher percentages of germination of the hydrocondicionadas seeds were observed for 24 hours in distilled water with aeration at seven (14%) and fourteen days (85%) after sowing (Figure 1 and 2).

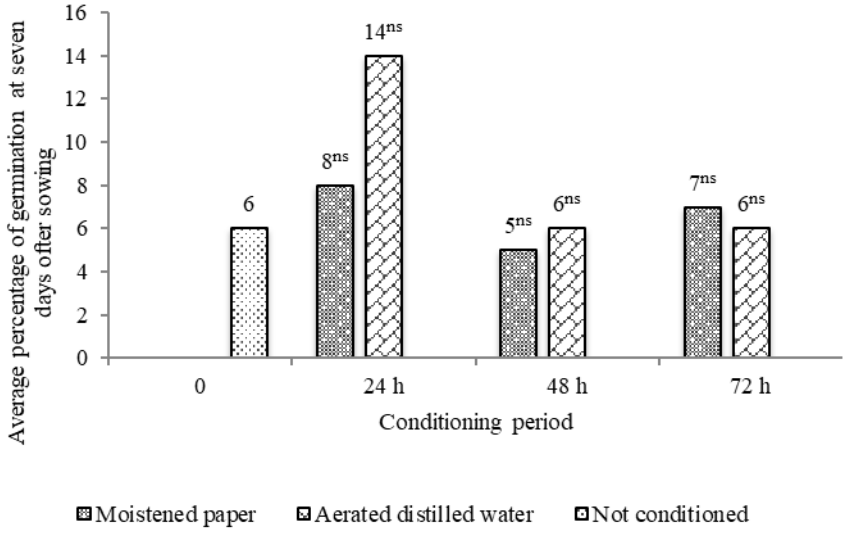

Figure 1 - Percentage means of seed germination of carrot cv. Brasília at 7 days after sowing submitted to hydrocondicionamento.
ns Not significant in relation to the control by the Dunnet test at 5% probability.

At the end of the evaluations, it was observed that the seeds that were not hydrocondicionado presented germination below the minimum standard for commercialization of agricultural seeds, which is 65% (Brazil, 1986). This lower germination may have been occasioned by

Agronomic Journal
Ipê

the short evaluation time, since the germination of carrot seeds cultivates Brasília varies from one to three weeks. The percentage germination percentage of the hydrocondicionadas seeds varied from 69 to 85%.

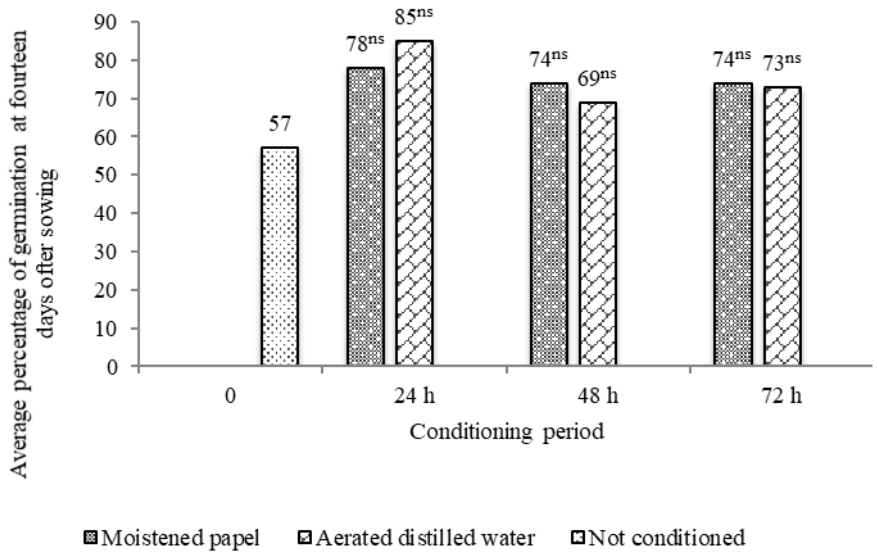

Figure 2 - Averages of germination percentage of carrot cv. Brasília at 14 days after sowing submitted to hydrocondicionamento
ns Not significant in relation to the control by the Dunnet test at 5% probability.

The rate of emergence (IVE) of the hydrocondiconated seeds in distilled water with aeration for 24h (10.55) was statistically higher than that obtained by the control, indicating that this treatment provided germination in a shorter period of time, which resulted in greater uniformity. The unconditioned seeds had the lowest rate of emergence (5.75), thus demonstrating that they took longer to germinate when compared to the hydrocondicioned seeds (Figure 3).

The hydrocondicionamento of the seeds of carrot did not influence significantly the percentage of germination. Several studies that tested the effect of physiological conditioning on the seeds demonstrated that, not always, its use promotes alteration in the percentage of germination, as Brito et al. (2011) on coriander seeds, Marcos Filho & Kikuti (2008) on cauliflower seeds and Gurgel Júnior et al. (2009) with cucumber seeds. Contrary results were found by Wheat & Wheat (1999), in eggplant seeds and Paiva et al. (2012) with melon seeds.

Agronomic Journal
Ipê

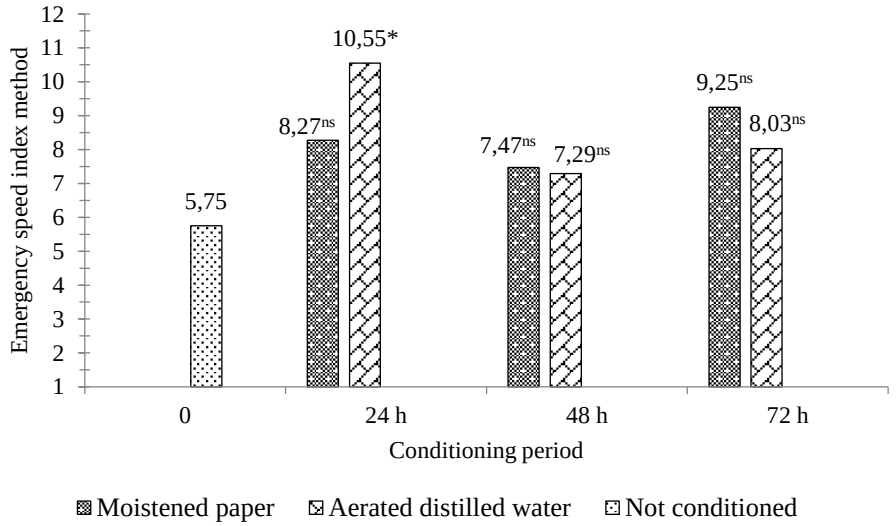

Figure 3 - Mean of the speed index of emergence (IVE) in carrot seeds cv. Brasília submitted to hydrocondicionamento.
* Statistically different from the control by the Dunnet test at 5% probability.
ns Not significant in relation to the control by the Dunnet test at 5% probability.

However, for IVE, the hydrocondicionamento presented significant effect. The distilled water treatment with aeration for 24 h provided IVE (10.55) higher than that obtained by the control. Similar results were found by Araújo et al. (2011) in maxixe seeds, Gurgel Júnior et al. (2009) on cucumber seeds and Marcos Filho & Kikuti (2008) on cauliflower seeds.

The seed submission to the hydrocondicionamento provides a faster emergency due to the advance of the imbibition process, which is the first stage of germination. This phase is characterized by the absorption of water by the tissues of the seed causing volume increase; in addition, water entry provides the activation of the metabolic processes necessary for the initiation of embryo growth (Kerbauy, 2013). Seeds not subjected to hydrocondicionamento will only begin the imbibition phase after contact with water. Thus, the hydrocondicionamento reduces the time of exposure of the seed to adverse environmental conditions after sowing (Araújo et al., 2011), which will guarantee better germination, since the chances of the seeds suffering damages will be smaller because they stay for time lower than in the soil when compared to non-water-conditioned seeds.

The hydrocondicionamento on the paper moistened during three periods (24, 48 and 72 h) did not result in significant differences of IVE in relation to the control. The immersion of the seeds in the water with oxygen supply causes greater contact of the water with the seeds when compared to the seeds placed on moistened paper. This greater contact of the seed with the water may have been responsible for a faster imbibition and,

Agronomic Journal
Ipê

consequently, for higher IVE. Andrade & Pereira (1994) observed in a study with germination of cedar seeds on different substrates that the paper roll presented lower water retention capacity when compared to the other substrates and that this may have affected the results of seed percentage and germination of cedar.

The faster germinative development is a fundamental characteristic for the establishment of the seedling (Nascimento, 1998). As one of the problems in the carrot crop is irregular germination (Nascimento, 2005), the use of pre-germination treatments promotes beneficial effects on the rate of emergence, which favors the establishment of the booth in the field (Caseiro, 2003) by providing a faster emergency and, consequently, a more uniform emergency.

Conclusions

Submission of carrot seed to 24-hour distilled water promotes beneficial effects on Emergence Velocity Index (EVI) so its use is recommended to reduce the time between sowing and seed germination in the field.

Pre-germinating treatments with water do not change the emergence percentage.

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Agronomic Journal
Ipê

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