

The Effects of Seed Priming with L-glutamine and L-arginine Amino Acids in Pepper Seeds

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Abstract

Seed-priming is a physiological technique of seed hydration and drying to enhance the germination. Seed priming treatments can be used to achieve even and earlier sprouts. A popular seed-priming practice which helps the seeds germinate faster is hydro-priming. Other studies have shown that seed priming with α -arginine promotes growth in sunflower. Pepper seeds germinate slowly and the aim of this study was to assess the effects of seed priming with α -glutamine and α -arginine amino acids in pepper seeds grown in different fertilization scheme. During the evaluation it can be concluded that seed-priming treatment with α -arginine and double distilled water speeds up the sprouting. At some variants, it was proven that α -glutamine seed-priming was inefficient. It was also found that fertilization schemes influence the germination and root growth in the following year.

Keywords: *Capsicum annuum*, fertilization scheme, sprouting

Introduction

Capsicum annuum L. seeds are one of the vegetable species from *Solanaceae* family that germinates slowly. Seed-priming is a physiological technique of seed hydration and drying to enhance the pregerminative metabolic process for a good germination. Taylor *et al.* (1998) states that this prevents the seeds from absorbing enough water for radicle protrusion, thus suspending the seeds in the lag phase. Seed priming has been commonly used to reduce the time between seed sowing and seedling emergence and to synchronize emergence (Parera and Cantliffe, 1994). A popular seed-priming practice which helps the seeds germinate faster is hydro-priming. This technique helps the seed to imbibe water and go through the first phase of germination in which pre-germination metabolic activities are started

while the latter two phases of germination are inhibited (Pill and Necker, 2001). Other studies have shown that seed priming with α -arginine promotes growth in sunflower (Nejadalimoradi *et al.*, 2014) or bean plants (Zeid, 2009). Liu *et al.* (2006) state that α -arginine is one of the most functionally diverse amino acids and a precursor for polyamine biosynthesis. Polyamines modulate several biological processes in plants, including cell division, differentiation, and senescence and it has been suggested that they participate in cellular defense against oxidative damage through the inhibition of lipid peroxidation and scavenge of free radicals (Velikova *et al.*, 2000). L-glutamine is good nitrogen source, which cells need to grow well and quickly. Some studies (Pop *et al.*, 2014) suggests that the use of A.D. type bio-phyto-

modulators accelerates the plant sprouting in to-mato and peppers seeds.

Materials and methods

In this study, the biological material used was represented by two new cultivars of peppers obtained at Vegetable Research Development Station Buzau ('Regal', 'Cantemir' noted with L3 and L70) grown in five fertilization schemes. The experimental variants used are presented in Table1.

The seeds obtained were conditioned, analyzed and were subjected to seed-priming treatments. For seed-priming it was used: (V1) solution of 1 mM of α -arginine, (V2) 1 mM of α -glutamine, (V3) a mix of 1 mM of α -arginine with

1 mM α -glutamine and (V4) a control variant with double distilled water. The seeds were primed for 24 hours. After priming, the seed were grown in Petri dishes, with added 10 ml of water every time needed, in a control temperature room at 25°C. The samples were made in triplicate. To preserve a sterile environment, all samples were process in a biological safety hood Telstar Bio II with UV filter.

Results and discussions

Throughout the research, it was observed that in the experiment with α -arginine, the seeds have begun to sprout first at L70V4, followed by L70V2, but at the end of the sprouting process, the best result with 100% germinated seeds were recorded by variants L3V3 and L70V3. The

Table 1. List of fertilizers used in the experiment

Variant	Fertilizer	Compositions
V1	Organic – a mix of two types of fertilizers	Organic matter (1.5%), Diuresis (0.04%) N (17%), K (1.5%), Organic matter (3.2%), Diuresis (0.26%)
V2	Organic	Organic matter (70%), N total (3%), N organic (2.8%), P ₂ O ₅ (3%), K ₂ O (6%), Mg (1%), S (0.7%), CaO (2.3%)
V3	Organic	N total (8%), K (1.3%), Ca(26%), Na(0.2%)
V4	Chemical	N (6%) P ₂ O ₅ (12%) K ₂ O (24%), B, Cu, Fe, Mn, Zn, Mo
V5	Control variant	No fertilizers used

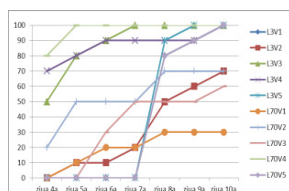


Figure 1. Germination percentage using α -arginine solution

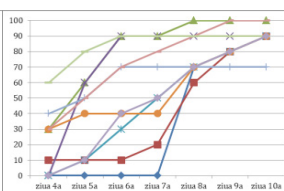


Figure 2. Germination percentage using α -glutamine solution

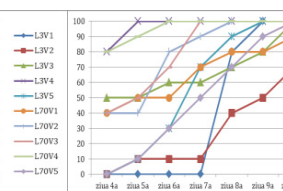


Figure 3. Germination percentage using α -glutamine and α -arginine solution

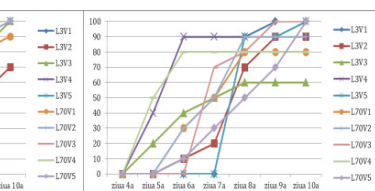


Figure 4. Germination percentage using double distilled water

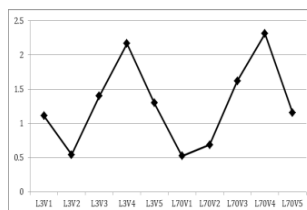


Figure 5. Variation of radicle length using α -arginine solution

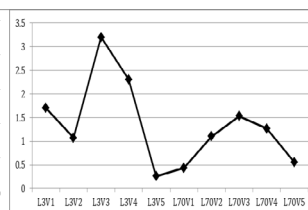


Figure 6. Variation of radicle length using α -glutamine solution

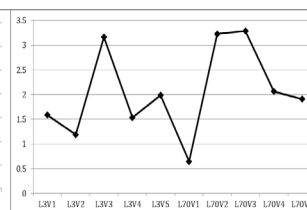


Figure 7. Variation of radicle length using α -glutamine and α -arginine solution

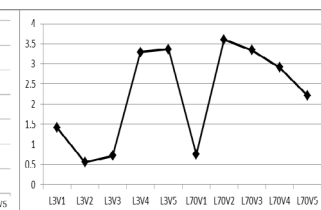


Figure 8. Variation of radicle length using double distilled water

variants L3V4 and L70V4 with double distilled water have sprouted completely after six days, with a germination percentage of 100%. After ten days, just variants L3V2 and L70V1 had a germination of 70% and the rest of variants sprouted 100%. The germination percentage and variation of radicle length is presented in Figures 1-8.

The experimental variants with α -glutamine and mix of α -arginine and α -glutamine solution emerged after 5 days from sowing, and after 10 days, only five variants (L3V3, L3V4, L3V5, L70V4, L70V5) germinated over 90% , respectively six variants (L3V1, L3V4, L70V1, L70V3, L70V4) in the case of α -arginine and α -glutamine solution. The root had weak growths, managing only in the case of L3V4 to be over 2 cm long. As a summary, in some variants the seed-priming treatment is efficient, while with others it proves to be fruitless.

It can be concluded, that the experimental variants with sprouting percentage of over 90%, but also with the highest root growth (over 3 cm) were recorded by the solution with α -arginine and double distilled water.

The percentage of sprouting differed depending on the fertilization scheme, the best result being recorded by L70V3 and L3V4. At the opposite pole, the fertilization variants with the weakest radicle growths were the control variants, L3V5 and L70V5, but also L70V1. In the essence, the fertilization scheme has an influence on the germination process in the following year and the choice of a balanced fertilization scheme is important for the future crop.

Other studies suggests that seeds physiological quality is influenced by pre-harvesting conditions, by the harvesting and post-harvesting practices, as well by the storage conditions (de Mattos and de Carvalho, 2016; Sano *et al.*, 2016; Singkaew *et al.*, 2017). In order to establish a good germination of further crops it is important to have a balanced fertilization scheme during the vegetation period, an optimal time for seed harvesting, good pre-harvesting and post-harvesting practice, an adequate storage conditions and a suitable seed-priming technique, followed, of course, by a flawless growing room.

Conclusions

In the present work, it was shown that seed-priming with α -arginine and double distilled water speeds up the sprouting process and promo-

tes root development in early stages of vegetation. At some variants, it was proven that α -glutamine seed-priming was inefficient. It was also found that fertilization schemes influence the germination and root growth in the following year.

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