INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 5, No. 1, p. 359-364, 2014

RESEARCH PAPER OPEN ACCESS

Effect of osmopriming on the germination of tomato seeds

Mohammad R. Asgharipour[1*], Reza Pasandi[2], Hasanali Pooresmail[3]

[1]*Department of Agronomy, College of Agriculture, University of Zabol, Zabol, Iran.*

[2]*Department of Agronomy, Payame Noor University*

[3]*University member, College of Agriculture, University of Zabol, Zabol, Iran*

Key words: Osmotic solution, germination, tomato, osmopriming.

http://dx.doi.org/10.12692/ijb/5.1.359-364 Article published on July 12, 2014

Abstract

Tomatoes (*Lycopersicum esculentum*) is one of the most important horticultural plants from Solanaceae which has various applications in the food industry. Abiotic stresses such as drought, salinity and cold stress, are the most important factor in reducing the rate of tomato seed germination. Osmopriming are able reduce the adverse effects of stress on seed germination through changes in the rate of seed germination. In this study different osmotic potential was used to evaluate the effects of osmopriming on the germination and related traits in tomato. Six tomato seeds were placed in each Petri dish and 6 ml of the solution was added to each Petri dish. After 7 days of the priming seeds were placed in a growth chamber with 16 h light and 8 h dark at 25 ° C. Counting of germinated seeds was lasted 12 days. In this experiment the percentage and rate of germination, length of root and shoot were measured. Results showed that the effect of priming on germination rate and root length was significant at 1% level and the impact of osmotic potential was significant at the 5% level, while other traits were not influenced by the treatments. Results suggested that the germination percentage and other characteristics significantly different compared with the control.

* **Corresponding Author:** R. Mohammad Asgharipour ✉ m_asgharipour@uoz.ac.ir

Introduction

Tomato (*lycopersicon esculentum*) is one of the most horticultural plants in Iran and other countries. Tomato plant with wide adaptability to different soil and climatic conditions is considered to be part of the summer crops that require a long growing season (Asgharipour and Armin, 2010). Cultivation area of this plant in 1999 was 5.3 million hectares of land and 97 million tons has been harvested, which accounted for the largest production of vegetables (FAO, 1999). Improved varieties with high viability is wide spread all over the world, but these varieties are planted when the physical stresses such as high temperature, or increase water scarcity, salinity, soil crusting or biological stresses such as disease. In addition, pests and weeds encountered seedling emergence problems they will face, and the percentage will be reduced, or even in difficult conditions, these factors can hinder the emergence of the plants smooth and uniform to produce maximum performance and enhance recovery efficiency seems necessary (Asgharipour and Rafiei, 2011).

Increase in seed size due to an increase in plant breeding and the genetic potential for improving seed does not seem enough, so other strategies are emphasized that can raise seed quality (Asgharipour *et al.,* 2011; Asgharipour and Rafiei, 2011). Early planting to increase germination and pre-treatments are used as hydropriming and Osmopriming. Osmopriming method is important among which includes the water in a controlled manner and using materials such as PEG And KNO_3 etc. are being provided so that seed germination is triggered metabolic activity but actually prevents the emergence of root and shoot (Asgharipour *et al.,* 2011; Asgharipour and Rafiei, 2011). In other words, in this method, the amount of water available for plants is limited to only the initial stages of germination, shoot and root should be done before departure and seeds for germination at a later stage ready (Artala, 2003).

Primed seeds compared with control at a wide range of temperatures and less sensitive to changes in oxygen sprout germination medium (Smok, 1993). Priming of tomato seeds 2% potassium nitrate for five days at 20 degrees and increase seed germination but had no effect on germination (Levent and Yeliz Kiyak, 2003). Also primed pepper seeds for 6 days at 20 ° C and osmotic potential MPa 5.1 improve germination (Armin *et al.*, 2010).

Priming of tomato seeds in osmotic potential of -1, -1.5 and -2 MPa increase the germination rate but had no effect on transcription DNA No (Ozbingol, 1999). The solution Osmopriming -8 MPa and 72 h increased germination in seeds was oxtongue (Makizadeh and Tafti, 2004). Osmopriming is somebar also limitations such as lack of oxygen in a very negative osmotic potential or osmotic absorb more water when washing the material from the seeds and decrease in the life of the seed priming, which can be selected by applying methods such as osmotic potential fit after washing and drying the seeds after priming treatments such as heat stress and maintain in the circumstances of this technic to be resolved (Atkin, 1999).

The aim of this study was to determine the best time and method of priming and evaluate its effects on related traits of seeds germination in tomato and determination the best possible treatment for osmopriming in tomato.

Materials and methods

Study layout

In this experiment, the effect of priming on germination of tomato was examined in factorial experiment as completely randomized design in three replications. Treatments included osmotic potential of polyethylene glycol 6000 (PEG) in four levels (-4, -8 and -12 bar) and duration of priming with three levels (24, 48 and 72 h). To calculate the amount necessary PEG to prepare the desired osmotic solution Van Hoff equation was used. In accordingly for preparation of -4, -8, and -12 bar solutions at 20 °, respectively, 169, 251 and 314 g PEG Kg of water was used.

Treatment

Before priming seed viability test was performed and results indicated that 93% of seed is viable. Seed viability was determined by MTT test, it was found that 7% of the remaining is non-life. At any petri dish 30 seeds of tomato PS (Peto Seed), Cultivar, were placed in each Petri dish cc 6 of these solutions were added to the Petri dish so that the seeds were suspended. Upon completion Osmopriming time with levels 24, 48 and 72 hours of seed dishes out with water and then dry them with moisture content Using Technology to about 6 to 7% was reduced. Then new seeds each group separately in the Petri dish was placed on filter paper, and the bar distilled water was added to each Petri Dish.

Sampling and data analysis

To prevent fungal diseases, fungicides seed sterilization was performed using the Petri dish and placed inside a transparent nylon bag for germination and transferred to growth chamber for 16 hours light and 8 hours dark and the temperature was set at 25 ° C and relative humidity of 70%. Counting started from seed germination to seed germination test was performed 12 days coleoptile growth of 2 ml, after the end of germination traits such as shoot length, root length and germination, seedling weight were measured, and the results will be measured not so normal to normal Data were converted to the type of reverse angle was used.

Data analysis carried out using SPSS and EXCEL software.

Results and discussion

Seedling germination

Statistical analysis of the experimental results showed that the main factors that influence levels of osmotic potential on germination and root length was significant at the 5% level (Table 1) and the effect on the duration of priming plumule interaction was significant at the 5% level × duration of osmotic potential on seed shoot length was significant at the 1%.

Table 1. Statistical analysis of priming effects on germination characteristics.

		Mean Square			
Treatment	Degrees freedom	of Root length	Shoot length	Germination rate	Germination percentage
During the period	2	12.378 *	082.1 ns	42.311 *	378.9 ns
Osmotic potential P	2	13.871 *	496.1 ns	0.711 ns	46.1 ns
P × D	4	5.464 ns	875.3 *	0.692 ns	55.8 ns

ns Not significant, ** Significant at 1% level and * significant at the 5% level.

Seedling vigour

The comparison showed that the control and duration of effect observed for all traits except germination percentage was significantly different (Table 2). Comparison mean duration of the root length priming, shoot length and germination rate, duration did not show a significant difference between 24 and 48 hours, whereas the adjectives significantly over the course of 72 hours can be reduced. at the duration of the germination priming There were no significant differences, which results in Arin (2003) and Duman (1999) Were reported were consistent.

Table 2. The effects of duration of priming on germination components.

	Root length	Shoot length	Germination rate	Germination percentage
Control	a	c	c	c
24 hours	a	a	a	a
48 hours	a	a	a	a
72 hours	a	b	b	b

Values followed by the same letter within the same columns do not differ significantly at p =1% according to DMRT.

Table 3. The effects of different priming solutions on germination components.

Treatment	Root length	Shoot length	Germination rate	Germination percentage
Control	c	c	c	a
-4 hour	a	a	a	a
-8 hour	b	a	a	a
-12 hour	b	a	a	a

Values followed by the same letter within the same columns do not differ significantly at p =1% according to DMRT.

Comparison of mean levels of osmotic potential effects on traits showed that applied at three levels of osmotic potential on germination percentage and germination rate and shoot length was not significantly different from each other, the effect of osmotic potential of the -8 and -12 the root length was significantly different Not together but significantly less than the effect of osmotic potential -4.

Table 4. The effects of different priming duration and priming solutions on germination components.

	Root length	Shoot length	Germination rate	Germination percentage
Control	c	c	d	a
-4 and 24-hour time	a	a	bc	a
-4 and 48-hour time	a	b	c	a
-4 and 72-hour time	a	b	c	a
-8 and 24-hour time	a	b	c	a
-8 and 48-hour time	a	b	b	a
-8 and 72-hour time	a	b	ab	a
-12 and 24-hour time	b	b	a	a
-12 and 48-hour time	b	ab	c	a
-12 and 72-hour time	b	b	d	a

Values followed by the same letter within the same columns do not differ significantly at p =1% according to DMRT.

Discussion

Mean comparison of interaction various levels of osmotic potential of priming duration (combined treatment) showed that the character of germination, the seeds of the osmotic potential of -12 were primed for germination rate was less than the other treatments and other treatments were significantly different from each did not. As well as the longest root in a number of treatments (-4 and 24-hour time) and eight treatments (-12 and 48-hour time) were obtained from the other treatments did not differ from each other significantly con. During the shoot length treatments during the six (-8 and 72-hour time) and seven treatments (-12 and 24-hour time) obtained germination and seed treatments were not significantly different from each other.

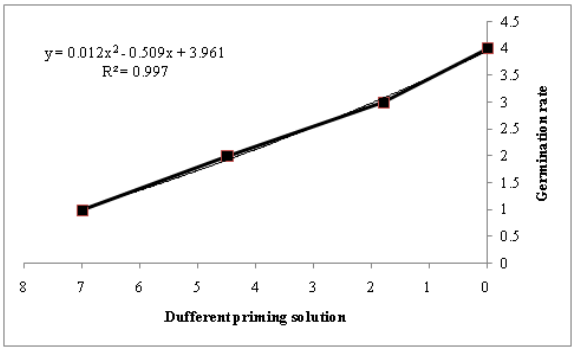

Fig. 1. The effects of different priming solutions on germination rate.

The green weight and dry weight of seedlings obtained by Azbzvr priming significantly higher than the control plants (data not shown), which results

Arin (2003) However, the opposite results were consistent Cantliffe (1994). Line chart germination and priming period with respect to y =-2.085x + 9.5103 and linear regression R = 0.924 Shows that increasing the duration of priming germination rate decreases. The germination rate of change of Rayleigh & osmosis showed that the germination rate with increasing osmotic potential linearly increases as the equation y = 0.281x + 4.776 and linear regression 1. Dohal(1990) reported that the main effect of priming on tomato seeds by shortening the deadline for final awakening endosperm (activation) and increasing the ability of the fetus in the water is done Khan (1998) The report showed the presence of nitrate in water absorption to cause protein synthesis during priming caused decreasing seed germination components this can enhance germination. Cayuela (1996) announced that it causes some physiological changes, such as priming sugar and organic compounds and ions are concentrated in the seeds and roots and leaves will eventually cause more rapid germination and greater resistance to unfavorable conditions.

Conclusion

The overall results showed that the best results in a short period of priming and the average potential is obtained according to the results of this test and according to previous reports, the importance of priming Asmv to raise the seed germination and other attributes of germination and emergence, resulting in a steady increase in the removal efficiency is verified.

References

Arin LE, Kiyak DY. 2003. The effect of pre_sowing treatments on emergnce and seedling growth of tomato seed *(Liycopersicon esculentum* Mill.) Under several stress conditions. Pakistan Journal of Biological Siciences **6(11),** 990-994. http://dx.doi.org/10.3923/pjbs.2003.990.994

Alvarado AD, Bradford KJ, Hewitt JD. 1987. Osmotic priming of tomato seed: Effect on germination, field emergence, seedling growth and fruit yield. Journal of American Society of Horticultural Sciences **112,** 427-432. http://dx.doi.org/10.1007/s10725-006-0008-4

Asgharipour MR, Rafiei M. 2011. Effect of Salinity on Germination and Seedling Growth of Lentils. Journal of Applied Sciences Research **7(11),** 142-150. http://dx.doi.org/10.3923/pjbs.2008.1268.1272

Asgharipour MR, Khatamipour M, Razavi-Omrani M. 2011. Phytotoxicity of cadmium on seed germination, early growth, proline and carbohydrate content in two wheat varieties. Advances in Environmental Biology **5(4),** 559-565. http://dx.doi.org/10.1016/j.crvi.2010.12.006

Armin M, Asgharipour M, Razavi-Omrani M. 2010. The effect of seed priming on germination and seedling growth of watermelon (*Citrullus Lanatus*). Advances in Environmental Biology **4(3),** 501-505. http://dx.doi.org/10.1016/j.scienta.2004.04.012

Asgharipour MR, Rafiei M. 2011. Effect of seed size on seed germination behavior of wheat cultivars. Australian Journal of Basic and Applied Sciences **5(12),** 614-616.

Asgharipour MR, Armin M. 2010. Growth and Elemental Accumulation of Tomato Seedlings Grown in Composted Solid Waste Soil Amended. American-Eurasian Journal of Sustainable Agriculture **4(1),** 124-129. http://dx.doi.org/10.1007/s10668-007-9100-9

Cavallaro V, Mauromicale G, Vincenzo GD. 1994. Effect of seed osmoconditioning on emergence characteristics of the tomato *(Lycopersicon* escolentum Mill.). Acta horticultrae **36,** 213-220. http://dx.doi.org/10.7763/ijet.2009.v1.64

Bray CM. 1995. Biochemical processes during the osmopriming of seeds. In Kigel J, Galili G, eds. Seed development and germination. New York: Marccel Dekker, 767-789. http://dx.doi.org/10.1017/s0960258500002907

Yamaguchi M. 1993. World vegetables. Van Nostrand Reinhold, New York, 415 P.

Muhyaddin T, Wiebe HJ. 1989. Effect of seed treatments with polyetylenglycol (PEG) on emergence of vegetable crops. Seed Sciences and Technology **17,** 49-56. http://dx.doi.org/10.1016/0378-4290(84)90027-3.

Parera CA, Cantliffe DJ. 1994. Presowing seed priming. Horticultural Review **16,** 109-139. http://dx.doi.org/10.1016/0378-4290(84)90027-3

Penalosa APS, Eira MTS. 1993. Hydration-dehydration treatments on tomato seeds *(Lycopersicon esculentum Mill*). Seed Science and Technology **21,** 309-316. http://dx.doi.org/10.1017/s0960258500003032