http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 11 (11): 1502-1505, 2008
ISSN 1028-8880

Determination of the Best Temperature and Dry Condition in Carrot Primed-Seeds

M.A. Aazami and S. Mohammadi
Department of Horticulture, Maragheh Higher Education Complex,
University of Tabriz, Tabriz-5166616471, Iran

Abstract: Seed priming and drying condition effects were investigated immediately after seed-priming and 9 week after the storage. In this experiment, carrot seeds of 'Forto C.V.' were used. These seeds were individually primed for 10 days at 20°C and in PEG (6000) (273 g L^{-1}) and KNO_3 (200 mmol) solutions. Then they were dried for 1 and 2 h at 15, 25 and 30°C, respectively. One part of the seeds was stored at 5°C in RH/45% For 9 week. Chemical priming effects, drying temperature as well as germination temperature on different traits especially germination percentage were significant. However, drying time had no significant effect on germination percentage after storage period. PEG priming and drying at 25°C for 2 h provided the best condition for germination percentage. Using the best material for pre-priming, along with suitable drying management with appropriate quality and good conditions of the storage is important.

Key words: Priming, carrot, seeds, PEG, KNO_3

INTRODUCTION

Normal carrot production requires uniform and quick germination. This would be feasible not only by seed quality, but also through especial pre-primings. Priming application especially under stress condition is very important (Bradford, 1986). Salinity resistance has especial importance in plant germination and growth periods. Studies on drought effects on germination are done in osmotic active solutions (Bradford and Haigh, 1994; Caseiro *et al.*, 2004; Demir Kaya *et al.*, 2006). There has been continuous flow of information for using pre-planting priming to improve germination and its speed in farm (Bradford and Haigh, 1994; Murungu *et al.*, 2004). To do so, some researchers as such Heydecker and Coolbear (1977) and Bradford *et al.* (1988) have investigated different primings. One of these treatments is putting seeds into an osmotic solution. This method is done according to seed watering control in priming time and beginning of metabolite activity after observable germination; however, it prevents root exit (Nascimento and West, 2000). Some successful results on PEG application have been reported in different plant species as onion, maize, celery, carrot, radish, parsley, lettuce and tomato (Brocklehurst and Dearman, 1983a; Cantliffe *et al.*, 1981). Studies show that priming duration and osmotic potential of applied solutions are important. Nowadays, priming of some species and their commercial usage are considered as a commercial technique of seed production (Goobkin, 1989; Maiti *et al.*, 2006; Young and Pathi, 2007). Seeds drying are essential for storage. To commercialize primed seeds, drying seeds without decreasing their germination strength is important. To store primed seeds successfully drying usually necessitated, so that reduction of humidity depends on the species and storage condition (Nascimento and West, 2000).

In different species, the time and temperature of priming, time and temperature of environment and germination temperature are varied. This has been proved about watermelon and melon (Nascimento and West, 2000). So, the present investigating was therefore undertaken to determine the best temperature as well as drying condition on carrot.

MATERIALS AND METHODS

A study was conducted to evaluate the best temperature and dry condition in carrot primed-seeds in the Department of Horticulture, Faculty of Agriculture, Maragheh Higher Education Complex, University of Tabriz, during the year 2006.

Priming: The primed seed applied in this study was of carrot Forto cv. Four gram of the seeds was soaked in PEG (6000) solution with a concentration of 273 g L^{-1} (osmotic potential of -1.0 MPa) and inside KNO_3 solution (200 mmol). The solutions were incubated at 20°C in an incubator. Priming time was 10 days.

Corresponding Author: M.A. Aazami, Department of Horticulture, Maragheh Higher Education Complex, University of Tabriz, Tabriz-5166616471, Iran

Drying: After priming, seeds were individually dried for 1 and 2 h at 15, 25 and 30°C. After drying half of the seeds from each treatment were stored at 5°C and 45% humidity for 9 week. Reaming of the treated seeds was planted in Petri dishes.

Germination test: The above mentioned seeds were planted individually in 4 replications in 96 Petri dishes (10 cm dia). Fifty seeds were sterilized in 0.002 of Tiram solution and planted in each Petri plate. Four replications of each treatment, containing 2 pre-priming solutions, 3 drying temperatures and 2 drying times, were put in 2 separate incubators in front of light and at 15 and 20°C.

Data handling: Data time required for germination (by the use of formula, $\Sigma(nxt)/\Sigma.n$; where: n = No. of germinated seeds per day, t = No. of days germination taken place, Σn = Sum of germinated seeds in general) and T_{50} values were investigated. Fourteen days after incubation radicle length, dry weight of radicle and plumule dry were measured for each sample. To measure radicle and plumule dry weight were calculated by using an over at 68°C for 48 h and then all the samples were weighed in an electronic balance (0.0001 scales).

Post-storage period: Dried seeds that stored for 9 week at 5-7°C, were planted in 96 Petri dishes after sterilization as described earlier and then were incubated at 15 and 20°C. Observations were performed and samples were analyzed according to the first method. The data were analyzed with MSTATC and SPSS softwares. The experiment design was split factorial with 4 factors. Mean comparison was done by Duncan's test (p = 0.01).

RESULTS

After priming: After priming, the seeds were kept at 15 and 20°C in order to germinating and all the data were observed for 14 days to achieve germination percentage, T_{50} and mean time required for germination (Table 1). Germination percentage was more observable with PEG 6000 compare to KNO_3. All factors like chemicals (C), drying temperature (T), drying time (D) and their interactions were significant, except the interaction effects of TD (drying time×drying temperature). PEG 6000 treatments dried at 25°C for 2 h and germinated at 20°C showed the better results comparers other treatments in the case of percentage germination.

The mean of dried radicle and plumule among different treatments had no significant difference. Germination at 20°C showed the best result among other

Table 1: Effect chemical treatments, temperature and time drying on different traits (pre-storage)

Chemical material	Drying temperature	Drying times	Germination times	PG	T_{50}	RL	DWR	DWP
PEG	15	1	15	48	8	1.70	0.001	0.0001
			20	14	8	1.55	0.001	0.002
		2	15	64	22	7.81	0.005	0.003
			20	80	64	10.41	0.006	0.002
	25	1	15	22	12	8.62	0.006	0.003
			20	78	60	9.55	0.007	0.003
		2	15	222	12	10.42	0.006	0.004
			20	90	56	10.67	0.007	0.003
	30	1	15	78	64	9.99	0.007	0.003
			20	62	56	8.08	0.006	0.002
		2	15	74	56	8.92	0.006	0.004
			20	74	56	9.15	0.007	0.002
KNO_3	15	1	15	72	54	8.81	0.005	0.002
			20	74	58	8.70	0.001	0.001
		2	15	14	8	1.04	0.001	0.0001
			20	22	8	1.96	0.007	0.003
	25	1	15	22	12	2.56	0.002	0.0001
			20	30	16	3.08	0.001	0.001
		2	15	22	12	2.35	0.001	0.0001
			20	30	16	3.13	0.002	0.001
	30	1	15	38	16	2.78	0.002	0.001
			20	22	16	2.54	0.001	0.001
		2	15	14	8	1.50	0.001	0.0001
			20	38	8	2.54	0.002	0.001
C				**	**	**	**	**
T				**	**	**	**	NS
CT				**	**	**	**	**
D				**	**	**	**	NS
CD				**	**	**	**	**
TD				NS	**	**	**	**
CTD				**	**	**	**	NS

PG: Percentage Germination; LR: Radicle Length; DWR: Dry Weight of Radicle; DWP: Dry Weight of Plumule, NS, *, **Non significant, significant at p = 0.05 or 0.01, respectively

Table 2: Effect chemical treatments, temperature and time drying on different traits (post-storage)

Chemical material	Drying temperature	Drying times	Germination times	PG	T_{50}	RL	DWR	DWP
PEG	15	1	15	58	54	8.09	0.007	0.003
			20	78	62	7.72	0.005	0.002
		2	15	58	45	8.17	0.006	0.003
			20	66	58	8.23	0.006	0.002
	25	1	15	58	45	6.20	0.007	0.003
			20	66	58	7.08	0.008	0.002
		2	15	66	45	7.83	0.008	0.004
			20	62	54	7.21	0.005	0.002
	30	1	15	62	28	7.70	0.006	0.004
			20	70	62	7.66	0.007	0.003
		2	15	86	56	7.60	0.009	0.005
			20	58	50	6.72	0.004	0.002
KNO_3	15	1	15	22	16	5.01	0.002	0.001
			20	18	14	4.05	0.0001	0.0001
		2	15	14	8	3.15	0.001	0.0001
			20	26	18	3.25	0.001	0.0001
	25	1	15	18	8	3.33	0.001	0.001
			20	14	12	1.82	0.0001	0.0001
		2	15	22	20	8.06	0.002	0.001
			20	22	18	8.22	0.001	0.0001
	30	1	15	14	12	5.10	0.001	0.0001
			20	18	12	4.08	0.001	0.0001
		2	15	14	12	4.24	0.001	0.0001
			20	10	4	2.42	0.0001	0.0001
C				**	**	**	**	**
T				NS	**	**	**	**
CT				**	**	**	**	**
D				NS	NS	**	NS	NS
CD				NS	NS	**	NS	**
TD				**	**	**	NS	**
CTD				**	**	**	**	**

PG: Percentage Germination; LR: Radicle Length; DWR: Dry Weight of Radicle; DWP: Dry Weight of Plumule, NS, *, **Non significant, significant at $p = 0.05$ or 0.01, respectively

treatments. The least germination time in the case of PEG was at 15°C and the highest speed of germination with KNO_3 was also at 15°C.

After storage: after priming, the seeds were kept in storage for 9 week in order to investigate the storage effect on germination and other seed traits germination percentage, T_{50} value and mean of the germination time decreased after storing that after priming. Drying temperature was not significant on germination percentage, but in other features the opposite case was occurred, however, drying time had no significant effect on other traits (Table 2).

Seeds, primed with PEG (dried at 30°C for 2 h). Showed the highest percentage of germination at 15°C, but there was no difference significant between radicle and plumule dry weight. As a matte of fact, all the characters during the storing period showed a relative decrease after priming.

DISCUSSION

Drying temperature of primed seeds before storage is effective in germination percentage increase, but unstored seeds have higher germination percentage than stored ones. Drying temperature in string conditions has significant effect on germination percentage in other traits. The primed seeds in lettuce, dried at 27°C, had higher germination percentage than drying at 32°C (Guedes and Cantliffe, 1980). These was due to, probably, shield cracking at high drying temperature, this temperature (60°C) after seed soaking period, increased seed spoilage of radish in the storing period (Mude *et al*., 1994; Bekendam *et al*., 1987), showed that the storing conditions significantly affect on the shrubs growth whose seeds were under priming. Carpenter and Eoucher (1991) observed that primed pansies seeds were to aerated to drying only and germination of all the dehydrated seeds (9%) after 6 week of storage was decreased. Meanwhile germination in unprimed seeds were similar at 12-20% of humidity. As a result, seeds high humidity is effective on seeds strength maintenance and its survive in storage conditions.

Carrot seeds soaking in PEG increases germination percentage and decreases average germination time. Also, seed soaking in PEG increases significantly germination speed, unless the seeds are dried in lower temperatures. These results match with many reports. Most of then shows positive effects of some chemicals salts and PEG on many traits like germination percentage, germination speed and better settlements of shrubs in farm in onion and radish (Akers *et al*., 1987; Goobkin, 1989), lettuce (Cantliffe *et al*., 1981), carrot and celery (Brocklehurst and Dearman, 1983b). However, Cayuela *et al.* (2007) and Dahal *et al.* (2007) on tomato and Ellis and Butcher (2007) on onion confirmed the previous findings. Hence appropriate management of drying condition in carrot primed seeds with suitable chemicals and good germination temper true, along with good quality of seeds and appropriate condition in storage can provide good condition for germination and better growth.

REFERENCES

Akers, S.W., G.A. Bekowitz and J. Rabin, 1987. Germination of parsley seed primed in aerated solutions of polyethylene glycol. HortScience, 22: 250-258.

Bekendam, J., J.G. Van Pijlen and H.L. Kraak, 1987. The effect of priming on the rate and uniformity of germination of endive seed. Acta Hortic., 215: 209-218.

Bradford, K.J., 1986. Manipulation of seed water relations via osmotic priming to improve germination under stress conditions. HortScience, 21: 1105-1112.

Bradford, K.J., D.M. May, B.J. Hoyle, S. Sibinski, S.J. Scott and K.B. Tyler, 1988. Seed and soil treatments to improve emergence of muskmelon from cold or crusted soils. Crop Sci., 28: 1001-1005.

Bradford, K.J. and A.M. Haigh, 1994. Relationship between accumulated hydrothermal time during seed priming and subsequent seed germination rates. Seed Sci., 4: 63-69.

Brocklehurst, P.A. and J. Dearman, 1983a. Interaction between seed priming treatments and nine seed lots of carrot, celery and onion. I. Laboratory germination. Ann. Applied Biol., 102: 577-585.

Brocklehurst, P.A. and J. Dearman, 1983b. Interaction between seed priming treatments and nine seed lots of carrot, celery and onion. II. Seedling emergence and plant growth. Ann. Applied Biol., 102: 585-593.

Cantliffe, D.J., K.D. Shuler and A.C. Guedes, 1981. Overcoming seed thermodormancy in a heat sensitive romaine lettuce by seed priming. HortScience, 16: 196-198.

Carpenter, W.J. and J.E. Eoucher, 1991. Proper environment improves the storage of primed pansy seed. HortScience, 26: 1483-1485.

Caseiro, R., M.A. Bennett and J. Marcos-Filho, 2004. Comparison of three priming techniques for onion seed lots differing in initial seed quality. Seed Sci. Technol., 32 (11): 365-375.

Cayuela, E., A. Munoz-Mayor, F. Vicente-Agullo, E. Moyano, J. Carica-Abellan, M.T. Estan and M.C. Bolarin, 2007. Drought pretreatment increase the salinity resistance of tomato plants. J. Plant Nutr. Soil Sci., 170 (4): 479-784.

Dahal, P., N. Su Kim and K.J. Bradford, 2007. Respiration and germination rates of tomato seeds at suboptimal temperatures and reduced water potentials. J. Exp. Bot., 47 (7): 941-947.

Demir Kaya, M., G. Okgu, M. Atak, Y. Gikili and O. Kolsarici, 2006. Seed treatments to overcome salt and drought stress during germination in sunflower (*Helianthus annuus* L.). Eur. J. Agron., 24 (4): 291-295.

Ellis, R.H. and P.D. Butcher, 2007. The effect of priming and natural differences in quality amongst onion seed lots on the response of the rate of germination to temperature and the identification of the characteristics under genotypic control. J. Exp. Bot., 39 (7): 935-950.

Goobkin, V.N., 1989. Methods of vegetable seed germination improvement. Acta Hortic., 253: 273-276.

Guedes, A.C. and D.J. Cantliffe, 1980. Germination of lettuce seeds at high temperature after seed priming. J. Am. Soc. HortSci., 105: 777-781.

Heydecker, W. and H. Coolbear, 1977. Seed treatments for improved performance-survey and attempted prognosis. Seed Sci. Technol., 5: 353-423.

Maiti, R., P. Vidyasagar, S. Shahapur and S. Ghosh, 2006. Development and standardization of a simple technique for breaking seed dormancy in sunflower (*Helianthus annuus* L.) genotypes. Peer Rev., 29: 117-126.

Mude, R.B., R.L.K. Drew, D. Gray, W. Bujalski and A.W. Nienow, 1994. The effect of storage on the germination and seedling abnormalities of leek seeds primed and dried by different methods. Seed Sci. Technol., 22: 299-311.

Murungu, F.S., C. Chiduza, P. Nymugafata, L.J. Clark, W.R. Whalley and W.E. Finch-Savage, 2004. Effects of on-farm seed priming on consecutive daily sowing occasions on the emergence and growth of maize in semi-arid Zimbabwe. Field Crops Res., 89: 49-57.

Nascimento, W.M. and S.H. West, 2000. During muskmelon (*Cucumis melo* L.) seed priming and its effects on seed germination and deterioration. Seed Sci. Technol., 28: 211-215.

Young, D. and V. Pathi, 2007. Effects of gelatine and medium molecular weight starch as priming fluid in cardiopulmonary bypass-a randomised controlled trial. Sage J., 22 (1): 57-61.