Himachal Journal of Agricultural Research Vol. 32(2) : 142-145, 2006

Short Note

Effect of priming on quality of bell-pepper (*Capsicum annuum* L.) seeds

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Seed is the basic and critical input. Its availability in time and at affordable prices, though has always been question tag, yet makes vegetable cultivation a profitable venture. Vegetable productivity has gone up to 150 per cent in 2002-03 as compared to 1991-92 (Rai *et al.*, 2004), where the seed has played a pivotal role. Capsicums are grown over an area of 1650 hectares in Himachal Pradesh and bell-pepper ranks as third commercial crop of the state (Anonymous, 2004). To cover this area, a minimum of 660 kg seed is required, with minimum seed germination capacity of 60 per cent. Seed multiplication as such is erratic every year under fluctuating weather conditions. Hence the seed multiplying agencies often fail to achieve the state seed requirement and feel unable to meet the requisite seed demand. The other option left with the researchers is to improve the germination capacity of the seed, so that the seed rate per unit area may be reduced, as is the case of hybrids. Moreover pre sowing treatment also provides opportunity for low vigour seeds to cope with the more vigorous one's. For the purpose, seed primers offer good opportunity for improving the seed quality and hence the present study was framed to enhance the seed germination.

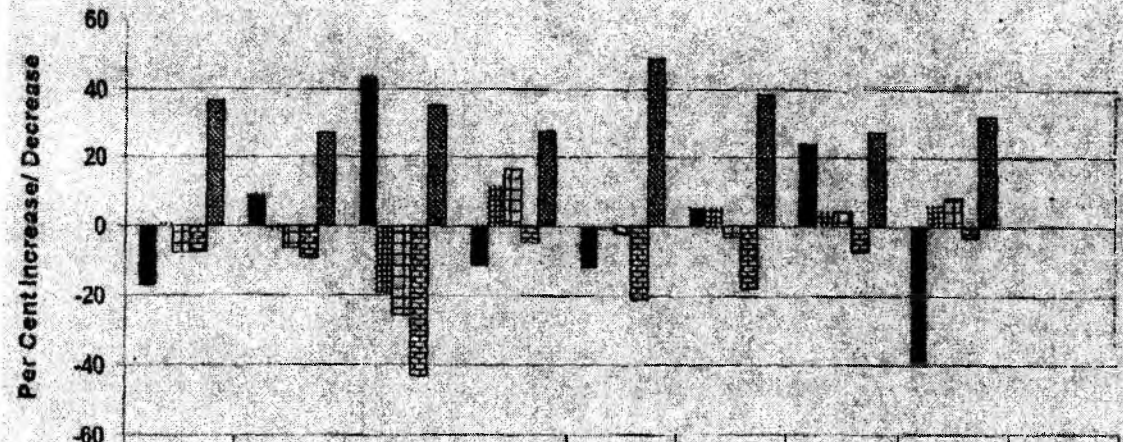
Seeds of bell-pepper cv. Califonia Wonder were extracted from ripe red fruits and treated with the primers after three months during 2002 and 2003. The primers were: polyethylene glycol-6000 (PEG) @ (-1.0, -1.5 & -2.0 MPa), KNO_3 (150 ppm), disodium and dipotassium hydrogen orthophosphate (0.001 M each), sodium sulphate (0.001 M) and potassium hydrogen phosphate (200 ppm). PEG solution of -1.0 MPa (30%) concentration was prepared by dissolving 300g PEG-6000 in one litre of water. Similarly, PEG solution of -1.5 MPa (37%) concentrations *i.e.* 370 g per litre of water and -2.0 MPa (42.5%) concentration *i.e.*425 g per litre of water were prepared, following the graphical methodology prepared by Zur (1966). Seeds were soaked in 1:10 primer solution and water soaking for control for three hours. Then the seeds were dried in shade. The experimental results were analyzed as per the protocol of completely randomised block design with three replications and nine treatments. The Bartlett Test of homogeniety was found significant. Observations were recorded on moisture content (%), seed germination (%), seed vigour index-I based on seedling length x germination (Abdul-Baki and Anderson, 1973) and seed vigor index-II (Dahiya, 1997) based on seedling dry weight x seed germination and electrical conductivity measured in dSm^{-1} using digital conductivity meter. The EC was recorded after soaking the seeds in 1.5 times de-ionised water for one hour.

Mean data for 2002 and 2003 in (Table-1) extrapolated significant differences among the primer treatments on seed viability and vigour of bell-pepper. Pepper seeds have normal moisture content around 6.0-7.0 per cent (Harrington, 1960), which was observed in the control (6.7%). The seed moisture content was significantly low in potassium hydrogen orthophosphate treated seeds (4.08%) and was found maximum in polyethylene glycol -2.0MPa (9.59%). However, in other treatments, except sodium sulphate and dipotassium hydrogen orthophosphate, the moisture content was at par with each other. The priming treatments of PEG (-1.0 MPa to 17.3%), KNO_3 (11.3%), Na_2SO_4 (12.2%) and KH_2PO_4 (39.1%) showed decrease in moisture content over control (The graphics and data in Fig 1.). Maximum seed germination was found in potassium nitrate (83.48%) followed by potassium hydrogen phosphate (79.30%). Figure-1 has clearly shown improvement in seed germination with PEG (-1.0 MPa), KNO_3, K_2HPO_4, Na_2SO_4 and KH_2PO_4 over the control. It has been reported by Giulianini *et al.*, (1992), that pepper seed germinate well at a constant temperature of 25 to 35° C and are inhibited below 20° C, which can be

Table 1. Effect of different primers on seed germination and vigour of bell-pepper seeds

Treatments	Moisture content (%)			Germination (%)			Seed vigour index-I			Seed vigour index-II			Electrical conductivity (dSm^{-1})		
	2002	2003	Mean	2002	2003	Mean	2002	2003	Mean	2002	2003	Mean	2002	2003	Mean
Polyethylene Glycol (-1.0 MPa)	6.0	5.08	5.54	67.33	83.60	75.46	316.45	698.33	507.39	1272.5	1839.2	1555.9	0.246	1.132	0.689
Polyethylene Glycol (-1.5 MPa)	6.0	8.62	7.31	73.33	73.00	73.16	379.89	649.45	514.64	1569.3	1474.4	1521.8	0.298	1.288	0.793
Polyethylene Glycol (-2.0 MPa)	10.5	8.69	9.59	42.66	77.60	60.13	136.93	679.00	407.96	449.2	1460.0	954.5	0.284	1.120	0.702
Potassium nitrate (150 ppm)	6.0	5.88	5.94	80.66	86.30	83.48	559.78	721.75	640.76	1551.1	1639.7	1595.4	0.320	1.254	0.787
Disodium hydrogen orthophosphate (0.001 M)	6.0	5.76	5.88	62.33	85.30	73.81	347.80	723.91	535.85	1007.3	1620.7	1314.0	0.094	1.018	0.556
Dipotassium hydrogen orthophosphate (0.001 M)	6.0	8.10	7.05	59.33	84.30	78.81	301.39	763.47	532.43	800.9	1938.90	1369.9	0.072	1.260	0.666
Sodium sulphate (0.001 M)	8.0	8.62	8.31	77.33	78.60	77.96	469.39	674.91	572.15	1690.4	1414.80	1552.6	0.320	1.252	0.786
Potassium hydrogen phosphate (0.001M)	4.0	4.16	4.08	80.00	78.60	79.30	531.20	660.24	595.72	1852.8	1393.40	1623.1	0.334	1.142	0.738
Control (water soaking)	6.0	7.40	6.70	77.00	72.30	74.65	558.25	540.70	549.47	1786.4	1563.7	1675.0	1.514	0.660	1.087
CD (P=0.05)	1.17	0.92	-	8.01	2.47	-	89.34	28.60	-	152.38	107.48	-	0.28	0.200	-

Fig.1: Effect of Primers on Seed Quality of Bell-Pepper



	1	2	3	4	5	6	7	8	9
MC	-17.3	9.1	43.1	-11.3	-12.2	5.22	24	-39.1	0
Germ.	1.1	-1.2	-19.4	11.8	-1.1	5.6	4.4	6.2	0
SV-I	-7.6	-6.3	-25.7	16.6	-2.5	-3.1	4.1	8.4	0
SV-II	-7.1	-9.1	-43	-4.7	-21.6	-18.2	-7.3	-3.1	0
EC	36.6	27	35.4	27.5	48.8	38.7	27.4	32.1	0

Primers

1. PEG(-1.0 MPa), 2. PEG(-1.5 MPa), 3. PEG(-2.0 MPa), 4. KNO_3, 5. Na_2HPO_4 6. K_2HPO_4 7. Na_2SO_4 8. KH_2PO_4 9. Control

overcome by seed priming with PEG 6000 or KNO_3 + potassium orthophosphate. Moreover, KNO_3 has been the most widely used chemical for promoting seed germination (Smith and Cobb, 1991, and Thakur *et al.*, 1997), whose efficacy was dependent upon osmotic potential (-1.0 MPa) of the solution, duration of priming, aeration, light, temperature, seed dehydration and storage (Parera and Cantliffe, 1994). The differences in germination might have arisen due to genetic variation within capsicum species of the varieties (Khan, 1992 and Thakur *et al.*, 1997). In contrast to osmo conditioning with salts, Loberson and Fedder (1987) as well as Yaklick and Orzolek (1977) found improved germination with osmoticums like PEG in California Wonder and Yolo Wonder. In the present investigations, the failure of PEG concentrations to improve germination could be the non removal of the osmotica from seeds before they were dried (Parera and Cantliffe, 1994). Seed vigour index-I was found statistically higher in potassium nitrate treated seeds (640.76). Seed vigor index-I was improved with the application of KNO_3, Na_2SO_4 and KH_2PO_4 over the control (Fig-1). Improved vigour could be the result of increase in radical, hypocotyl or the seedling length when preconditioned with KNO_3 or PEG. Seed vigour index-II was found highest in the control (1675.0) followed by potassium hydrogen phosphate (1623.1) and potassium nitrate (1595.4). However decrease in seed vigour index-II was noticed with the application of any of the primers over control (Fig. 1). The electrical conductivity of the seed leachates was lowest in disodium hydroden orthophosphate (0.556) and maximum in the control (1.087). Other primers were intermediated in checking the losses due to solute leakage, irrespective of the initial moisture content of the seed, which was in contrast to early findings (Simon and Wiebe, 1975). Electrical conductivity was improved with all the primers as revealed by the positive values over the control (Fig.-1). Moreover unprimed seeds may exhibit higher water soak conductivity indicating the loss of amino acids and organic acids from the seeds (Doijode, 2002). In contrast, improved seed quality with potassium dihydrogen phosphate to four year seeds has been reported earlier by Solanki and Joshi (1985).

Conclusively, seed priming with potassium nitrate (150 ppm) helped in improving seed germination by 11.8%, seed vigor-I by 16.6% and electrical conductivity by 27.6% of bell-pepper seeds

because of below normal (5.94%) moisture content. However it remains elusive, how exactly preconditioned treatments bring out the significant improvement in the germination and seedling vigour. Thakur *et al.* (1997) hypothesized this improvement to the maintenance of controlled but sufficient hydration of the seeds to a level that permits pre-germination metabolic activity to proceed, but prevents the actual radical emergence. It could be due to enhancement of protein synthesis during osmo conditioning and/or during subsequent germination of pepper seeds (Khan, 1992).

References

Abdul-Baki, A. A. and Anderson J.D. 1973. Vigour determination in soybean by multiple criteria. *Crop Science* 13: 630-637.

Anonymous. 2004. *Statistics on Vegetable Production and Productivity*. Directorate of Agriculture, Shimla, Himachal Pradesh.

Cochran, W.G. and Cox, G..M. 1967. *Experimental Designs*. John Wiley & Sons, Inc. New York. pp 136-139.

Dahiya, O.S. 1997. Seed vigour tests for seed quality assessment. *In*: Manual on Seed Quality Assuarance, Academy of Agricultural Research & Education Management, CCS HAU, Hisar. pp 196-205.

Doijode, S.D. 2002. *Seed storage of Horticultural Crops*. The Haworth Press, Inc. USA, p. 150-174.

Giulianini, D., Nuvoli, S., Pardossi, A. and Tognoni, F. 1992. Pregermination treatment of tomato and pepper seeds. *Colture Prottette* 21: 73-79.

Harrington, J.F. 1960. Drying, storing and packaging of seed to maintain germination, vigour. *Seedsmen's Digest* 11(1):16.

Khan, A.A. 1992. Preplant physiological seed conditioning. *Horticultural Review* 14: 131-181.

Loberson, D. and Feder, Z. 1987. The effect of seed priming and fluid drilling on germination, emergence and growth of vegetables at unfavourable temperatures. *Acta Horticulture* 198: 15-21.

Parera, C.A. and Cantliffe, D.L. 1994. Presowing seed priming. *Horticultural Review* 16: 109-141.

Rai, M., Singh, P.M. and Rao, R.G.S. 2004. Vegetable seed production in India: an overall scenario. *In:* National Conference on Seed: A global perspective, ISST and ICAR, New Delhi, 26-28 March, p. 62-66.

Simon, E.W. and Wiebe, H.H. 1975. Leakage during imbibtion, resistance to damage at low temperature and the water content of the peas. *New Phytology* 74: 407-411.

Smith, P.T. and Cobb, B.G. 1991. Accelerated germination of pepper seed by priming with salt solution and water. *Horticulture Science* 26 (4): 417-419.

Solanki, S.S. and Joshi, R.P. 1985. Effect of different chemicals on invigoration in seed germination of cucumber and capsicum. *Progressive Horticulture* 17:122-124.

Stofella, P.J., Paola, M.L.D., Paradossi, A. and Tognoni, F. 1992. Seedling root morphology and shoot growth after priming or pre-germination of bell pepper. *Horticulture Science* 27 (3): 214-215.

Sundstrom, F.J. and Edwards, R.L. 1989. Pepper seed respiration germination and seedling development following seed priming. *Horticulture Science* 24 (2): 343-345.

Thakur, A. and Thakur, P.S. and Bhardwaj, J. 1997. Influence of seed osmo-conditioning on germination potential and seedling performance of bell pepper. *Seed Research* 25 (1):25-30.

Yaklick, R.W. and Orzolek, M.D. 1977. Effect of polyethylene glycol-6000 on pepper seed. *Horticulture Science* 12: 263-264.

Zur, B. 1966. Osmotic control of the matric soil water potential: Soil water system. *Soil Science* 102 (6): 394-398.

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