IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
Volume 9 | Issue 2 | July, 2014 | 358-361
e ISSN-0976-593X | Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Enhancement of seed quality of chilli by seed invigoration treatments

■ K. VISHWANATH, H.M. PALLAVI, B.N. RADHA, J.B. MARUTHI AND VENKATA CHALAPATHY

SUMMARY

Loss of seed vigour and viability was said to be associated with the ageing phenomenon and results in poor stand and performance in the field, but many researchers advocated seed invigoration in promoting vigour, viability, storability and performance. Chilli cv. Byadgi seeds with initial germination of 76 per cent were invigorated with different chemicals. Significant improvement in germination, root length, shoot length, seedling dry weight, vigour index, speed of emergence and germination after accelerated gaining, was observed in invigorated seeds over the control seeds. Germination was enhanced to 88 per cent in KNO_3 (1%), hydration-dehydration alone enhances the germination from 76 to 83 per cent and field emergence from 72 to 78 per cent. The study suggests that KNO_3 (1%) could improve rapid and uniform seedling emergence.

Key Words : Vigour, Viability, Seed invigoration

How to cite this article : Vishwanath, K., Pallavi, H.M., Radha, B.N., Maruthi, J.B. and Chalapathy, Venkata (2014). Enhancement of seed quality of chilli by seed invigoration treatments. *Internat. J. Plant Sci.*, **9** (2): 358-361.

Article chronicle : Received : 04.12.2013; **Revised :** 08.05.2014; **Accepted :** 24.05.2014

Hot pepper (*Capsicum annuum* L.), commonly known as chilli, is an important vegetable as well as spice crop of India. The yield of chilli is much lower in third world countries. Rapid and uniform emergence are two essential pre requisites to increase yield, quality and ultimately profit in crops. In chilli crop its quality is a major factor which determines the economic success of the crop. One of the main causes for this poor yield is lack of a good stand establishment and reduced early growth as stressed by adverse environment. Germination and emergence of chilli seeds is often slow and non-uniform under normal as well as stress conditions (Wein, 1999; Demir and Okcu, 2004). Similarly, Andreoli and Khan (1999) found slow and erratic emergence and establishment of chili seeds, especially under cool conditions. Chilli and tomato have non-starchy endosperm and this offered a mechanical barrier to the growing embryo resulting in poor germination (Andreoli and Khan, 1999). High germination and uniform stand establishment for chili production is essential to maintaining profitable yields. Improvement in stand establishment can be obtained by advancements in seed quality and seed enhancements, genetic improvement, as well as improved seeding techniques. Seed invigoration is a technique of seed enhancement, it includes pre-soaking of seeds that improves seed performance by rapid and uniform germination, normal and vigorous seedlings, which resulted in faster and higher rate of germination and emergence in different crops (Farooq *et al.*, 2007), which also helps seedlings to grow in biotic or abiotic stress conditions (Ashraf and Foolad, 2005; Khan *et al.*, 2009a and 2009b). Such seed treatments result in synchronized emergence and uniform stand establishment leading to improved yield.

Now-a-days, various seed priming techniques have been

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
B. N. RADHA, University of Agricultural Sciences (G.K.V.K.) BENGALURU (KARNATAKA) INDIA
Email: radhabn29@gmail.com

Address of the Co-authors:
K. VISHWANATH, H.M. PALLAVI AND J.B. MARUTHI, University of Agricultural Sciences (G.K.V.K.) BENGALURU (KARNATAKA) INDIA

VENKATA CHALAPATHY, University of Hoticultural Sciences, BAGALAKOT (KARNATAKA) INDIA

developed, including hydropriming (soaking in water), halopriming (soaking in inorganic salt solutions), osmopriming (soaking in solutions of different organic osmotica), thermopriming (treatment of seed with low or high temperatures), solid matrix priming (treatment of seed with solid matrices) and biopriming (hydration using biological compounds) (Ashraf and Foolad, 2005). Each treatment has advantages and disadvantages and may have varying effects depending upon plant species, stage of plant development, concentration/dose of priming agent and incubation. Keeping in view of the above facts an experiment was designed to evaluate the impact of different chemicals on improvement of seed germination and vigour in chilli.

MATERIAL AND METHODS

Hand cleaned seeds with initial germination of 76 per cent were subjected for several seed invigoration treatments such as hydration-dehydration and soaking of seeds in aqueous solutions of KNO_3 (1%), sodium phosphate NaH_2PO_4(1%), NaCl (1.75%), potassium diphosphate KH_2PO_4 (0.5%), potassium chloride KCl (1%), calicium chloride $CaCl_2$ (1%) and PEG-6000 (-8 bars) for 6h. With a seed to solution ratio of 1:2 by volume except for polyethylene glycol in which seeds were soaked for 144 hours (6 days) and dried back to original moisture, beside a dry treatment involving hedran 3 g/kg seed and stored for 7 days was tried.

Seeds were soaked in aqueous solutions of the above chemicals and then dried under shade to the original moisture content, except hedran which was used for dry treatment of seeds control seeds did not receive any treatment. Then seeds were tested for following seed quality parameters.

Germination percentage:

It was determined as per ISTA rules for seed testing (Anonymous, 1996). The seeds were placed in rolled paper towels. Hundred seeds of four replications were tested at a constant temperature of 25^0C. The germination first and second counts were recorded on fourth and tenth day, respectively and per cent germination was expressed on normal seedling basis.

Root length, shoot length and seedling dry weight:

From the standard germination test, ten normal seedlings were selected at random in each replication on final count. The shoot length was measured from collar region to the point of attachment of cotyledons and root length from the collar region to the tip of the primary root, sum of shoot and root length constitute the seedling length and mean was calculated and expressed in centimeters. The seedlings used for seedling length measurement was used for estimating dry weight. They were dried in a hot air oven maintained at 80 ± 2^0C for 24 hours. After drying, the weight of dry seedlings was recorded and the mean seedling dry weight was calculated and expressed in milligrams.

Seedling vigour index:

It was computed by adopting the formula as suggested by Abdul-Baki and Anderson (1973) and expressed in whole number:

Seedling vigour index-I = Germination (%) x mean seedling length (cm)

Or

Seedling vigour index-II = Germination (%) x mean seedling dry weight (mg)

Seed germination test was conducted as described above daily germination counts were recorded and the only normal seedlings were considered.

Speed of germination:

It was calculated by using formula suggested by Maguire (1962).

$$\text{Speed of germination} = \frac{\text{No. of normal seedling}}{\text{Days to first count}} + \ldots + \frac{\text{No. of normal seedling}}{\text{Days to final count}}$$

Field emergence:

It was calculated by sowing one hundred seeds from each treatment in four replications in the field. The emergence counts were made on 14^{th} day after sowing and expressed in per cent.

RESULTS AND DISCUSSION

Loss of seed vigour and viability was said to be associated with the ageing phenomenon and results in poor stand and performance in the field, but many researchers advocated seed invigoration in promoting vigour, viability, storability and performance (Zhang and Maun, 1990 and Tiryaki, 2006). Pre-sowing soaking seed treatment with various chemicals is being reported for improving the physiological stamina of the seed, achieving uniform crop stand and further improving quality of seed by minimizing the variation of seed quality within the seed lots. In the present study Chilli cv. Byadgi seeds were invigorated with different chemicals besides, hydration-dehydration and PEG-6000. Germination percentage, field emergence and other seed quality parameters such as speed of emergence root length, shoot length, seedling dry weight, vigour index and germination after accelerated ageing were found to differ significantly due to invigoration treatments. Maximum germination (88%) was observed in KNO_3 (1%). Invigoration with NaH_2PO_4 (1%), KH_2PO_4 (0.5%), $CaCl_2$ (1%) and harden (3g/kg) recorded 86 per cent, NaCl (1.75%) and KCl (1%) recorded 85 per cent and PEG-6000 recorded 84 per cent germination and they did not differ among each other (Table 1). Enhancement of germination by KNO_3 was reported by Rivas *et al.* (1984), Jones and Sanders (1987) in hot pepper and Tzortzakis and Economakis (2005) in chicory. The result

Table 1: Influence of seed invigouration on seed quality parameters in chilli cv. Byadagi

Seed invigouration treatment	Germination (%)	Field emergence (%)	Speed of emergence	Root length (cm)	Shoot length (cm)	Seedling dry weight (mg)	Vigour index	Germination after 4 days of AA
Control	76	72	7.39	3.60	6.75	3.01	8.4	60
Hydration and dehydration	83	78	8.12	4.24	8.06	3.24	1020	71
PEG -6000 (-8bars)	84	80	8.40	4.65	7.75	3.36	1042	73
KNO_3 (1%)	88	85	10.00	4.32	9.46	4.00	1226	78
NaH_2PO_4 (1%)	86	83	9.77	4.23	8.79	3.81	1119	77
NaCl (1.75%)	85	81	8.63	4.36	8.18	3.55	1063	75
KH_2PO_4	86	83	9.24	4.29	8.50	3.69	1093	76
KCl (1%)	85	81	8.59	4.28	8.18	3.45	1052	74
$CaCl_2$ (1%)	86	82	9.00	4.78	8.08	3.62	1079	76
Hedran (3g/kg)	86	80	9.50	4.40	8.44	3.72	1100	77
Mean	85	80	8.87	4.31	8.22	3.55	1060	74
S.E.±	0.3	0.79	0.10	0.10	0.18	0.04	18.78	0.79
C.D. (P=0.05)	2	2	0.29	0.27	0.51	0.11	54	2

on field emergence showed the similar trend as that of germination but of slightly lower values.

Hydration-dehydration alone enhances the germination from 78 to 83 per cent and field emergence from 72 to 78 per cent. The results are in agreement with the findings of Doijode and Raturi (1987) in tomato, radish, onion, cluster bean and garden peas. Significant improvement in root length, shoot length, seedling dry weight, vigour index, speed of emergence and GAA was observed in invigorated seeds over the control seeds.

The improvement in seed quality due to invigoration treatments is due to the fact that the invigoration treatment initiate, repair and detoxification the system and also become physiologically advanced by carrying out certain initial step of germination without radical emergence. The results are in agreement with the findings of Burgrass and Powel (1984) and Smith and Cobb (1991) in paper and Dollypan and Basu (1985) in carrot seeds. Among all the seed invigoration treatments KNO_3(1%) found to be better because, it recorded the highest germination (88%) field emergence (85%) and seed vigour possibly through oxidized forms of nitrogen causing a shift in respiratory metabolism to the pentose phosphate pathway (Roberts and Smith, 1977). The next best treatments were NaH_2PO_4(1%), KH_2PO_4 (0.5%), $CaCl_2$ (1%) and hedran (3g/kg).

The present study suggests that KNO_3 (1%) improves rapid and uniform seedling germination, emergence and plant development. They are economical and can be easily adopted by nursery men in developing mass planting stocks.

REFERENCES

Abdul-Baki, A.A. and Anderson, J.D. (1973). Vigour determination by multiple criteria. *Crop Sci.*, **13** (6) : 630-637.

Andreoli, C. and Khan, A. (1999). Matriconditioning integrated with gibberellic acid to hasten seed germination and improve stand establishment of pepper and tomato. *Pesquisa Agropecuária Brasileira*, **34** (1) : 1953-1958.

Anonymous (1996). International rules for seed testing. *Seed Sci. & Technol.*, **21**: 1-288.

Ashraf, M. and Foolad, M.R. (2005). Pre-sowing seed treatment- A short-gun approach to improve germination, plant growth and crop yield under saline and non-saline conditions. *Adv. Agron.*, **88** : 333-271.

Burgrass, R.W. and Powel, A.A. (1984). Evidence for repair process in the invigoration of sees by hydration. *Ann. Bot.*, **53**:753-757.

Demir, I. and Okcu, G. (2004). Aerated hydration treatment for improved germination and seedling growth in aubergine (*Solanum melongena*) and pepper (*Capsicum annum*). *Ann. Appl. Biol.*, **144** (1) : 121-123.

Doijode, S.D. and Raturi, G.B. (1987). Effect of hydration-dehydration on the germination and vigour of certain vegetable seeds. *Seed Res.*, **15** (2): 156-159.

Dollypan and Basu R.N.(1985). Mid-storage and pres-sowing seed treatments for lettuce and carrot. *Scientia Hort.,* **33**(6): 1026-1027.

Farooq, M., Basra, S.M.A., Hussain, M., Rehman, H. and Saleem, B.A. (2007). Incorporation of polyamines in the priming media enhances the germination and early seedling growth in hybrid sunflower (*Helianthus annuus* L.). *Internat. J. Agric. & Biol.,* **9** (6) : 868-872.

Khan, H.A., Ayub, C.M., Pervez, M.A., Bilal, R.M., Shahid, M.A. and Ziaf, K. (2009a). Effect of seed priming with NaCl on salinity tolerance of hot pepper (*Capsicum annuum* L.) at seedling stage. *Soil & Environ.,* **28** (1) : 81-87.

Khan, H.A., Pervez, C.M., Ayub, K., Ziaf, R.M., Bilal, M.A., Shahid, N. and Akht, A.R. (2009b). Hormonal priming alleviates salt stress in hot pepper (*Capsicum annuum* L.). *Soil & Environ.,* **28** (2) : 130-135.

Rivas, M., Sundstorm, F.J. and Edwards, R.L. (1984). Germination and crop development of hot pepper after seed priming. *Hort. Sci.,* **19**:279-281.

Roberts, E.H. and Smith, R.D. (1977). Dormancy and the pentose phosphate pathway. In: Khan, AA (ed.) *The physiology and biochemistry of seed dormancy and germination*. North Holland Publishing, Amsterdam, pp. 385–411.

Smith, P.T. and Cobb, B.G. (1991). Physiological and enzymatic activity of pepper seeds (*Capsicum annuum*) during priming. *Physiologia Plantarum,* **82** (3) : 433–439.

Tiryaki, I. (2006). Priming and storage of amaranth seeds: Effects of plant growth regulators on germination performance at low temperature. *Seed Sci. & Technol.,* **34** (1) : 169-179.

Tzort Zakis, N.G. and Economakis, C.D. (2005). Shredded maize stems as an alternative substrate medium. Effect on growth, flowering and yield of tomato in soilless culture. *J. Veg. Sci.,* **11** (2) : 57–70.

Wein, H.C. (1999). *The physiology of vegetable crops*. CAB International, NEW YORK, USA.