International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 2186-2189

Received: 07-05-2019
Accepted: 09-06-2019

Manuswamy MR
Department of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka, India

NM Shakuntala
Department of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka, India

Vijay Kumar K
Department of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka, India

SR Doddagoudar
Department of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka, India

MG Patil
Department of Horticulture, University of Agricultural Sciences, Raichur, Karnataka, India

Correspondence
Manuswamy MR
Department of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka, India

Seed quality enhancement of aged and fresh seeds of chilli (*Capsicum annumm* L.) with plant extracts, antioxidants and chemicals

Manuswamy MR, NM Shakuntala, Vijay Kumar K, SR Doddagoudar and MG Patil

Abstract
A laboratory experiment was conducted to study the effect of seed priming with plant extracts and antioxidants on seed quality of chilli in the Department of Seed Science and Technology, Raichur, during 2018-19. The experiment consisted of twenty treatments which includes organic and inorganic solutions were imposed at different concentrations. The experiment was laid out in CRD design with four replications. The results revealed that, among the various priming treatments studied, seeds primed with KNO_3 @ 5%, moringa leaf extract @ 10% and salicylic acid @ 1 mM recorded significantly highest in terms of all seed quality parameters *viz*., field emergence, seed germination, speed of germination, shoot length, root length, seedling dry weight, seedling vigour index, electrical conductivity and dehydrogenase enzyme activity compared to control and other treatments in both aged and fresh seed lot.

Keywords: Chilli, KNO_3, Moringa leaf extract, salicylic acid, priming, seed germination

Introduction
Chilli (*Capsicum annuum* L.) is one of the most important edible and nutritious vegetable crop in the world. Poor germination, low seedling emergence and also the availability of quality seeds are serious problems limiting the production of chilli. The use of seeds of low physiological quality is a common practice under tropical and sub-tropical conditions leads to in adequate plant population in the field. Poor quality and carry over seeds generally exhibit poor germinability, less vigour and decline in their ability to germinate and emerge into vigorous seedlings leading to problems in successful crop production. Hence proper seed treatments are needed which enhance germination even in stressful environment conditions like low temperature, moisture stress and saline soil beds. The term seed priming, seed enhancement or seed invigouration represents a series of treatments applied to a given seed lot in order to improve its germination, uniform germination of seedlings and yield potentiality. It has been reported that seed priming is one of the most important techniques to help uniform germination, seedlings emergence and it do increases seed tolerance to adverse climatic conditions in field condition (Heydecker *et al*. 1975) [9].

In this experiment for priming of chili seeds, five plant extracts (marigold flower extract, waste tea extract, *Acacia nilotica* leaf extract, periwinkle leaf extract and moringa leaf extract), four antioxidants (ascorbic acid, salicylic acid and alpha tocopherol) and chemicals (GA_3 and KNO_3) are used as priming agents.

Acacia species is one of the richest sources of bioactive flavonoids, alkaloids, phenolics, saponins, polysaccharides, tannins and terpenoids (Rafi *et al.* 2015) [10]. Some of these substances act as allelochemicals and influence germination and seedling growth. Essential oils obtained from marigold have been used as an insecticide, fungicide, bactericide and nematocide and have got positive results for pest control (Kazim Mavi, 2014) [14]. Gallic acid, one of these substances, is an antioxidant agent that helps to protect cells against oxidative damage. Leaves of *Vinca rosea* are also high in alkaloids and phenolic compounds (Prabha *et al.*, 2016) [6]. Alkaloids, phnenolic and saponins compounds protect the plants against pathogens and also produce antioxidant activity. Waste tea is rich in potent antioxidants, such as catechins and saponins which are the active fraction of extract having fungicidal and insecticidal property and furthermore chances of hormonal effects (Kazim and Mehmet, 2017). Moringa leaves are very good source of zeatin, cytokinin, potassium, calcium, protein, ascorbate, vitamin A and C. Vitamin A and other micronutrients and their deficiencies can be

overcome by moringa application (Shakeel Imran *et al.* 2014) [18]. It is also having polyphenolic effect on seed germination.

Ascorbic acid is the only antioxidant that can completely prevent initiation of lipid peroxidation, scavenges ROS (reactive oxygen species) such as superoxide, hydroperoxy radicals, single oxygen, peroxy nitrite and nitrogen dioxide and also effectively protects other substrates from oxidative damage (Govindraj *et al.* 2017) [8]. Addition of vitamin E (tocopherols) has improved the germinability of parsley, onion and chilli seeds and loss of tocopherol is one of the manifestations of seed deterioration (Govindraj *et al.* 2017) [8].

Salicylic acid (SA) is a phytohormone of phenolic nature. It can improve plant resistance to various abiotic stresses including ultraviolet light, drought, salt and temperature extremes and also enhances the activity of antioxidant enzymes (Afzal *et al*. 2010) [1].

The objectives of this study were to (i) determine germination and emergence traits; and (ii) compare the effects of organic priming, antioxidants and chemicals on emergence percentage and seedling performance for aged and fresh seed lot of chilli separately.

Material and Methods

A two year old and five months old chilli seed of variety Guntur super 10 were used as aged and fresh seeds lot respectively. The laboratory experiment was carried out in the Department of Seed Science and Technology, College of Agriculture, Raichur. The treatment details includes twenty treatments *viz.*, T_0: Absolute control (unprimed seeds), T_1: Seeds are soaked in 5% marigold extract, T_2: Seeds are soaked in 10% marigold extract, T_3: Seeds are soaked in 5% waste tea extract, T_4: Seeds are soaked in 10% waste tea extract, T_5: Seeds are soaked in 5% *Acacia* extract, T_6: Seeds are soaked in 10% *Acacia* extract, T_7: Seeds are soaked in 5% periwinkle leaf extract, T_8: Seeds are soaked in 10% periwinkle leaf extract, T_9: Seeds are soaked in 5% moringa leaf extract, T_{10}: Seeds are soaked in 10% moringa leaf extract, T_{11}: Seeds soaked in 50 ppm ascorbic acid solution, T_{12}: Seeds soaked in 100 ppm ascorbic acid solution, T_{13}: Seeds soaked in 1.0 mM salicylic acid solution, T_{14}: Seeds soaked in 2.0 mM salicylic acid solution, T_{15}: Seeds soaked in 0.1% alpha-tocopherol solution, T_{16}: Seeds soaked in 0.3% alpha-tocopherol solution, T_{17}: Seeds soaked in 40 mM of quercitin solution, T_{18}: Seed soaked in 5% KNO_3 solution, T_{19}: Seed soaked in 40 ppm GA_3 solution. The experiment was laid out in CRD (Completely Randomised Design) with four replications.

The plant extracts solutions were prepared by adding dried leaf or flower powder of a plant in water to get known concentrations of plant extracts solution. Seed to solution ratio of 1:2 were made and soaked for twenty four hours. Then, the seeds were air dried under shade and used to assess the seed quality parameters. For antioxidants like alpha tocopherol and quercitin, initially 1 ml of ethanol is added to dissolve them as they are directly insoluble in water.

Germination test was conducted using 100 seeds by between paper method where seeds were placed between germination papers and incubated in the walk in seed germination room. Germination percentage was calculated on 14th day and expressed in percentage (ISTA, 2013) [11]. Seedling emergence was calculated in by sowing seeds in protrays and observation recorded after 35 days.

Electrical conductivity of the seed leachate was measured in the digital conductivity bridge (WENSAR) with a cell constant 1.0 and the mean values were expressed in deci siemens per meter (dSm^{-1}) (Milosevic *et al*. 2010) [17]. The OD value of dehydrogenase enzyme activity was obtained as reported by Kittock and Law (1968) [16].

Results and Discussion

In aged seed lot seeds primed with KNO_3 (5%) recorded significantly highest germination (85.50%), seedling emergence (79.00%), shoot length (7.54 cm), root length (8.30 cm), seedling dry weight (39.00 mg), seedling vigour index (1354), dehydrogenase enzyme activity (1.314 OD value) and lowest electrical conductivity (0.616 dSm^{-1}), as compared to control and followed by 10 per cent moringa leaf extract (85.25%, 78.00%, 7.32 cm, 8.30 cm, 38.75 mg, 1331, 1.314 OD value and 0.628 dSm^{-1} respectively). However, control recorded significantly lowest values for seed quality parameters (73.00%, 67.00%, 5.38 cm, 6.59 cm, 33.00 mg, 873, 1.127 OD value and 0.795 dSm^{-1} respectively) (Table 1).

In fresh seed lot seeds primed with KNO_3 (5%) recorded significantly highest germination (92.13%), seedling emergence (86.00%), shoot length (7.69 cm), root length (9.30 cm), seedling dry weight (42.00 mg), seedling vigour index (1520), dehydrogenase enzyme activity (1.314 OD value) and lower electrical conductivity (0.616 dSm^{-1}), and as compared to control and other treatments which is followed by 10 per cent moring leaf extract (91.75%, 85.00%, 7.63 cm, 9.30 cm, 40.50 mg, 1511, 1.337 OD value and 0.318 dSm^{-1} respectively). However, control recorded significantly lowest values for seed quality parameters (82.75%, 78.00%, 6.98 cm, 7.59 cm, 34.00 mg, 1121, 1.258 OD value and 0.496 dSm^{-1} respectively) (Table 2).

The increase in germination and seedling emergence might be due to increased cell division within the apical meristem of the seedling root, which caused an increase in seedling growth (Khan and shah 2011) [15]. Trigo *et al.* (1999) [19] comment that the advantage of priming with KNO_3 may be related to the fact that this may act as an additional source of potassium and nitrogen during seed germination. Other researchers claim that the nitrate combined with some environmental factors, like temperature and light, may stimulate the synthesis of gibberellins and promote germination. Use of moringa leaf extract which is rich in cytokinin and potassium can be a natural and cheaper alternative priming agent to enhance plant growth (Foidl *et al.* 2001) [7]. Moringa leaf extract is rich in nutrients and vitamins which might transfer to the growing embryo during priming lag phase (Farooq *et al.* 2010) [6], ultimately giving enhanced seed germination and subsequent growth of chilli seedlings upon exposure to field conditions. This also enhances amylase activity which might increase starch metabolism as indicated by high soluble sugars in moringa primed seeds. This research is inclined with Basra *et al*. (2011) [3].

Salicylic acid increased the root dry weight by expanding root system. Increase in its concentration may affect the seed quality as it decreased the germination percentage and increased fresh ungerminated seed. Salicylic acid fasten emergence (Farooq *et al.* 2008) [5] regulates cell growth by cell division, expansion and protecting the cell structure (Kang *et al*. 2007) [12]. Quercitin is also an antioxidant and it also recorded the maximum seed physiological quality parameters as it acts as antioxidant and also as a flavanoids which will enhance the growth and influence the endogenous GA_3 effect (Amalesh *et al*. 2011) in aged and fresh seed lot.

Table 1: Effect of plant extracts, antioxidants and chemicals on germination (%), seedling emergence (%), shoot length (cm), root length (cm), seedling dry weight (mg), seedling vigour index, dehydrogenase enzyme activity (OD value) and electrical conductivity (dSm^{-1}) in aged seed lot of chilli

Treatments	Germination (%)	Seedling emergence (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	Seedling vigour index	Dehydrogenase enzyme activity (OD value)	Electrical conductivity (dSm^{-1})
T_0	73.00	67.00	5.38	6.59	33.00	873	1.127	0.795
T_1	82.75	77.00	6.81	7.46	36.50	1180	1.307	0.684
T_2	80.25	71.00	5.78	6.99	35.25	1024	1.295	0.688
T_3	80.00	73.00	5.56	6.75	35.75	985	1.290	0.698
T_4	81.75	76.00	6.42	7.31	36.50	1122	1.303	0.678
T_5	81.50	74.00	6.77	7.61	36.50	1171	1.304	0.677
T_6	76.25	70.00	5.56	6.73	33.50	937	1.258	0.756
T_7	82.00	76.00	6.75	7.38	36.50	1158	1.304	0.678
T_8	76.25	69.00	5.94	6.79	33.50	970	1.258	0.758
T_9	81.75	75.00	6.49	7.28	36.50	1125	1.304	0.678
T_{10}	85.25	78.00	7.32	8.30	38.75	1331	1.314	0.628
T_{11}	79.25	73.00	6.46	7.82	35.50	1131	1.289	0.703
T_{12}	82.50	77.00	7.10	7.86	37.25	1246	1.305	0.667
T_{13}	83.00	74.00	7.18	7.98	37.75	1228	1.295	0.687
T_{14}	70.00	63.00	6.26	7.21	32.50	943	1.027	0.831
T_{15}	81.00	75.00	6.78	7.80	36.00	1181	1.295	0.691
T_{16}	70.25	64.00	6.02	7.15	33.25	925	1.034	0.819
T_{17}	84.75	77.00	7.27	8.22	38.50	1313	1.307	0.632
T_{18}	85.50	79.00	7.54	8.55	39.50	1376	1.314	0.616
T_{19}	84.00	78.00	7.29	8.23	38.25	1303	1.313	0.636
Mean	80.05	73.30	6.53	7.50	36.04	1126	1.268	0.700
S.Em±	0.972	0.408	0.110	0.090	0.540	16.971	0.004	0.002
CD at 1%	3.655	1.536	0.399	0.331	2.040	63.849	0.014	0.009

T_0: Absolute control (unprimed seeds), T_1: Seeds are soaked in 5% marigold extract, T_2: Seeds are soaked in 10% marigold extract, T_3: Seeds are soaked in 5% waste tea extract, T_4: Seeds are soaked in 10% waste tea extract, T_5: Seeds are soaked in 5% *Acacia* extract, T_6: Seeds are soaked in 10% *Acacia* extract, T_7: Seeds are soaked in 5% periwinkle leaf extract, T_8: Seeds are soaked in 10% periwinkle leaf extract, T_9: Seeds are soaked in 5% moringa leaf extract, T_{10}: Seeds are soaked in 10% moringa leaf extract, T_{11}: Seeds soaked in 50 ppm ascorbic acid solution, T_{12}: Seeds soaked in 100 ppm ascorbic acid solution, T_{13}: Seeds soaked in 1.0 mM salicylic acid solution, T_{14}: Seeds soaked in 2.0 mM salicylic acid solution, T_{15}: Seeds soaked in 0.1% alpha-tocopherol solution, T_{16}: Seeds soaked in 0.3% alpha-tocopherol solution, T_{17}: Seeds soaked in 40 mM of quercitin solution, T_{18}: Seed soaked in 5% KNO_3 solution, T_{19}: Seed soaked in 40 ppm GA_3 solution

Table 2: Effect of plant extracts, antioxidants and chemicals on germination (%), seedling emergence (%), shoot length (cm), root length (cm), seedling dry weight (mg), seedling vigour index, dehydrogenase enzyme activity (OD value) and electrical conductivity (dSm^{-1}) in fresh seed lot of chilli

Treatments	Germination (%)	Seedling emergence (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	Seedling vigour index	Dehydrogenase enzyme activity (OD value)	Electrical conductivity (dSm^{-1})
T_0	82.75	78.00	6.98	7.59	34.00	1121	1.286	0.496
T_1	90.00	83.00	7.34	8.46	38.00	1371	1.337	0.326
T_2	85.00	79.00	7.12	7.99	36.75	1273	1.304	0.357
T_3	84.50	79.00	7.02	7.75	37.25	1241	1.291	0.367
T_4	91.00	84.00	7.56	8.31	38.00	1361	1.332	0.322
T_5	89.00	82.00	7.41	8.61	38.00	1369	1.314	0.333
T_6	84.50	79.00	7.09	7.73	35.00	1189	1.291	0.365
T_7	89.50	84.00	7.16	8.38	38.00	1337	1.325	0.344
T_8	86.00	80.00	7.12	7.79	35.00	1196	1.305	0.347
T_9	86.00	79.00	7.59	8.28	38.00	1361	1.333	0.322
T_{10}	91.75	85.00	7.63	9.30	40.50	1511	1.337	0.318
T_{11}	77.25	70.00	6.77	8.60	36.25	1280	1.258	0.395
T_{12}	85.25	80.00	7.10	8.82	37.00	1389	1.306	0.339
T_{13}	91.00	84.00	7.54	8.92	38.75	1399	1.333	0.322
T_{14}	80.50	75.00	6.89	8.21	34.75	1118	1.276	0.385
T_{15}	90.25	83.00	7.41	8.98	37.50	1393	1.332	0.333
T_{16}	81.50	76.00	6.95	8.15	34.50	1121	1.277	0.378
T_{17}	91.50	85.00	7.59	9.22	39.00	1492	1.337	0.322
T_{18}	92.13	86.00	7.69	9.55	41.00	1543	1.337	0.318
T_{19}	91.50	84.00	7.34	9.23	39.00	1458	1.333	0.328
Mean	87.04	80.75	7.26	8.49	37.31	1326	1.31	0.35
S.Em±	0.767	0.408	0.069	0.088	0.490	18.797	0.001	0.001
CD at 1%	2.883	1.536	0.260	0.332	1.850	70.720	0.004	0.005

T_0: Absolute control (unprimed seeds), T_1: Seeds are soaked in 5% marigold extract, T_2: Seeds are soaked in 10% marigold extract, T_3: Seeds are soaked in 5% waste tea extract, T_4: Seeds are soaked in 10% waste tea extract, T_5: Seeds are soaked in 5% *Acacia* extract, T_6: Seeds are soaked in 10% *Acacia* extract, T_7: Seeds are soaked in 5% periwinkle leaf extract, T_8: Seeds are soaked in 10% periwinkle leaf extract, T_9: Seeds are soaked in 5% moringa leaf extract, T_{10}: Seeds are soaked in 10% moringa leaf extract, T_{11}: Seeds soaked in 50 ppm ascorbic acid solution, T_{12}: Seeds soaked in 100 ppm ascorbic acid solution, T_{13}: Seeds soaked in 1.0 mM salicylic acid solution, T_{14}: Seeds soaked in 2.0 mM salicylic acid solution, T_{15}: Seeds soaked in 0.1% alpha-tocopherol solution, T_{16}: Seeds soaked in 0.3% alpha-tocopherol solution, T_{17}: Seeds soaked in 40 mM of quercitin solution, T_{18}: Seed soaked in 5% KNO_3 solution, T_{19}: Seed soaked in 40 ppm GA_3 solution

Conclusion

The results of this study concluded that seed priming with 5 per cent KNO_3 or 10 per cent moringa leaf extract can be used to obtain healthy, uniform, vigorous seedlings from seedling emergence (in portray) test in both aged seed lot and fresh seed lot. As moringa leaf extract showed better effect on seed quality of chilli it can used for promoting organic seed production which has high value in market. Among antioxidants salicylic acid showed significant effect on seed quality.

Acknowledgments

The authors are thankful to the Department of Seed Science and technology, University of Agricultural Sciences, Raichur.

References

1. Afzal I, Basra SMA, Ahmad N, Cheema MA, Haq MA, Kazmi MH, Irfan S. Enhancement of antioxidant defense system induced by hormonal priming in wheat, Cereal Research Communications. 2010; 39(3):334-342.
2. Amalesh Samanta, Gouranga Das, Sanjoy Kumar Das. Role of flavanoids in plants. International Journal of Pharmaceutical Science and Technology. 2011; 6(1):12-35.
3. Basra SMA, Iftikhar MN, Afzal I. Potential of moringa (*Moringa oleifera*) leaf extract as priming agent for hybrid maize seeds. International Journal of Agriculture and Biology. 2011; 13(6):1006-1010.
4. Prabha D, Negi S, Kumari P, Negi YK, Chauhan JS. Effect of seed priming with some plant leaf extract on seedling growth characteristics and root rot disease in tomato. International Journal of Agriculture System. 2016; 4(1):46-51.
5. Farooq M, Aziz T, Basra SMA, Cheema MA, Rehman H. Chilling tolerance in hybrid maize induced by seed priming with salicylic acid. Journal of Agronomy and Crop Science. 2008; 194(2):161-8.
6. Farooq M, Basra SMA, Wahid A, Ahmad N. Changes in nutrient-homeostasis and reserves metabolism during rice seed priming: consequences for seedling emergence and growth. Agricultural Sciences in China. 2010; 9(2):191-8.
7. Foidl N, Makkar HPS, Becker K. The potential of *Moringa oleifera* for agricultural and industrial uses. The miracle tree: The multiple attributes of Moringa. 2001; 29:45-76.
8. Govindaraj M, Masilamani P, Albert VA, Bhaskaran M. Role of antioxidant in seed quality-A review. Agricultural Reviews. 2017; 38(3):180-190.
9. Heydecker W, Higgins J, Turner YJ. Invigoration of seeds. Seed Science and Technology. 1975; 3(3, 4):881-8.
10. Rafi H, Dawar S, Zaki M J. Seed priming with extracts of *Acacia nilotica* (L.) willd. ex Delile and *Sapindus mukorossi* (L.) plant parts in the control of root rot fungi and growth of plants. Pakistan Journal Botany. 2015; 47(3):1129-35.
11. ISTA, International rules for seed testing. Seed Sci. and Technol., Supplement rule. 2013; 27:27-31.
12. Kang GZ, Wang ZX, Xia KF, Sun GC. Protection of ultrastructure in chilling-stressed banana leaves by salicylic acid. Journal of Zhejiang University Science *B.* 2007; 8(4):277-82.
13. Kazım mavi, Mehmet Atak. Effect of organic priming on seedling emergence of watermelon under low temperature stress. In Proceedings of the 7th international scientific agriculture symposium. 2017; 1727-1732.
14. Kazim Mavi. Use of extract from dry marigold (*Tagetes* spp.) flowers to prime eggplant (*Solanum melongena* L.) Seeds. Acta Scientiarum Polonorum Horticulture. 2014; 13(4):3-12.
15. Khan MI, Shah F. Effect of potassium nitrate and thiourea on seed germination of crops and weeds. African Crop Science Society. Uganda. 2011; 18:461-463.
16. Kittock DL, Law AG. Relationship of Seedling Vigor to Respiration and Tetrazolium Chloride Reduction by Germinating Wheat Seeds. Agronomy Journal. 1968; 60(3):286-8.
17. Milosevic MM, Vujakovic D, Karagic. Vigour tests as indicators of seed viability. Genetica. 2010; 42(1):103-118.
18. Shakeel Imran, Irfan Afzal, Muhammad Amjad, Ahsan Akram, Khalid Mahmood Khawar, Seef Pretorius. Seed priming with aqueous plant extracts improved seed germination and seedling growth under chilling stress in Lentil (*Lens culinaris* Medik). Advances in Applied Agricultural Sciences. 2014; 02(11):58-69.
19. Trigo MFOO, Nedel JL, Trigo LF. Osmotic conditioning of onion seeds: I. Germination effects. Scientia Agricola. 1999; 56(4):1059-67.