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EFFECT OF SEED TREATMENTS ON STORABILITY OF VEGETABLE SEEDS: A REVIEW

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Abstract

Seed treatment is the application of physical, chemical and biological agents to the seeds during seed storage in order to suppress, control or repel pathogens, insects and other pests that attack seeds and reduce the vigour and viability of seeds during storage. Seed micro flora is mainly responsible for the degradation of protein, carbohydrates and other food reserves resulting in reduction of vigour and germination. In order to prevent the quantitative and qualitative losses due to several biotic factors during storage, several methods are being adopted such as seed treatment with suitable chemicals or plant products. The effect of seed treatments on storability of vegetable crops is reviewed herewith, which may help to the researchers in planning their research very precisely and in right direction to get more fruitful results.

Introduction

Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw, or cooked (Oyenuga and Fetuga, 1975, Fayemi, 1999, Dhellot *et al*., 2006, Hassan *et al.,* 2007). They are important food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. Vegetables are valuable in maintaining alkaline reserve of the body. They are valued mainly for their high carbohydrate, vitamin and mineral contents. There are different kinds of vegetables. Vegetables may be edible roots, stems, leaves, fruits or seed. Each group contributes to diet in its own way (Robinson, 1990).

Vegetables contribute minerals, vitamins and fiber to the diet. Minerals are naturally occurring inorganic substances with a definite chemical composition and an ordered atomic arrangement.Vegetables also act as buffering agents for acidic substances produced during the digestion process (Fayemi, 1999). Vitamins are organic compounds occurring in natural foods especially in vegetables either as such or as utilizable "precursors". Vegetables contain low calories and negligible quantities of utilizable energy hence they are ideal for obese people who can satisfy their appetite without consuming much carbohydrate (Oke and Ojofehintimi, 1988).

Good seed is a basic input in vegetable production. Successful olericulture programme depends on the quality of seeds used for sowing. Thus, the seed producers hold greater responsibility in maintaining genetically pure seeds and to preserve the quality of seeds from harvest to next sowing. Since, seed is a living entity and is subjected to various environmental stresses which affect the quality. In storage, the viability and vigour of the seeds not only vary from genera to genera and variety to variety, but it also regulated by many physico-chemical factors like moisture content, atmospheric relative humidity, temperature, initial seed quality, physical and chemical composition of seed, gaseous exchange, storage structure, packaging materials, etc., (Doijode, 1988a). Among these, the major factors affecting the seed quality during storage are temperature and relative humidity, which results in drastic deterioration of seed. Apart from this, fungi associated with stored seeds are mainly responsible for deterioration of quality and reduction in germination

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potential.

Deterioration of seed is associated with ageing phenomenon which is defined as an irreversible degradation change in the quality of a seed after it has reached stage. Its maximum quality level and the seed deterioration also start immediately after attaining the physiological maturity on the plant itself (Abdul-Baki and Anderson, 1973). In order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted such as seed treatment with suitable chemicals or plant products and storing in safe containers.

In recent times various seed quality enhancement treatments are given to the seeds as a pre-sowing treatment. Proper seed treatments are needed to maintain the seed quality during storage. The seed deterioration starts right at the field level immediately after the physiological maturity. Seed deterioration is inevitable and irreversible process but the rate of seed deterioration could best owed down either by storing the seeds under controlled conditions or by imposing polymer film coating along with seed treatment chemicals. As the controlled condition involves huge cost, seed treatment remains the best alternative approach to maintain the seed quality.

Since, the loss of viability impairs the biological and planting value of seed, it is of special concern to breeders, businessmen and farmers. Several factors *viz*., inherent genetic potential, initial seed quality, environment during seed production, seed moisture content, mechanical damage, seed borne mycoflora, storage insects, seed dressing chemicals and seed treatments influenced the seed longevity and affect subsequent field performance. Hence, storage of seeds after harvest till next planting time assumes prime importance for successful seed production programme.

Effect of seed treatment on quality of vegetable seeds

Seed treatment with chemicals is found to be more useful in storage for maintaining better seed quality by suppressing the storage pests and fungi (Gupta *et al.,* 1989). Though the chemicals are the front line defence against storage fungi and pests, but their use is problematic. But the descriptive use of chemicals and their residual toxicity adversely affect the non-target animals including human being besides, affecting the seed quality. Many of the synthetic chemicals look effective, but they are not readily degradable physically or biologically which yield more toxic residues. However, the use of chemicals is still in vague. In view of these problems, the researchers are working out for other alternatives in place of chemicals pesticides. The safe and feasible approach is the treatment of seeds with botanicals, organics etc., which are safe, economical, cheap, eco-friendly in nature and non-toxic to man and animals. Among botanicals, using the castor, neem powder and neem oils are proved to be effective protectants against storage insects, as they can reduce infestation and maintained the quality of the seed in terms of viability and vigour for longer period in storage (Kulkarni *et al.,* 1988). The ideal seed treatment should be: (1) very effective against seed-borne pathogens, (2) relatively non-toxic to animals and plants, even if misused, (3) effective for a long time during seed storage, (4) easy to use, (5) acceptable according to the OMRI list of practices and (6) economical (Copeland and McDonald, 2001).

Seed treatment of chilli with thiram improved emergence and untreated seeds showed lowest emergence after 10 months of storage (Koteshwar Rao *et al.,* 1962). Bujdoso (1979) recommended cucumber seed treatment with ceresan, thiram or captan to protect from storage fungi and also to maintain higher germination. Muthuswamy *et al*. (1983) reported that among all the fungicides tested for chilli, captan (4 g/kg), sulphur dust (4 g/kg), bavistin (2 g/kg), vitavax (2 g/kg) and benlate (benomyl, 4 g/kg) recorded higher germination compared to the untreated seeds. Vadivelu and Ramaswamy (1983) packed the tomato seeds at seven per cent moisture content treated with captan and thiram in vapour proof containers and untreated seeds packed in cloth bag as control. The seeds treated with captan and stored in moisture proof package recorded the higher germination (70%) as compared to control after 30 months of storage. Chilli seeds treated with captan and packed in aluminium laminated bags gave higher germination after 30 months of storage (Vadivelu and Ramaswamy, 1983). Karivaratharaju *et al*. (1987) revealed that the seeds of brinjal cv., MPD-1 with seven per cent moisture content treated with captan gave 80 and 82 per cent germinability after 21 months of storage in cloth bag and polythene bag (700 guage). Jacqualine and Selvaraj (1988) reported that the brinjal seeds treated with thiram and bavistin alone and in combination gave maximum germination and vigour when stored in aluminium foil, polythene pouch followed by polythene and cloth bag after 18 months of storage.

Gupta *et al.* (1989) reported that onion seeds treated with different chemicals *viz*., thiram, captan, captafol, and cytozyme retained the germination up to 12 months. Gupta and Singh (1990) revealed that the viability of vegetable mung and brinjal seeds was not affected up to 36 months and 18 months respectively, when stored under

ambient condition after treating with thiram and bavistin. Dhyani *et al.* (1991) reported that the seed treatment with captafol, thiram, aureofungin, topsin and vitavax each at 0.3 per cent concentration of seed weight improved seed germination and seedling length of chilli.

Gupta *et al.* (1992) revealed loss of germination below minimum seed certification standard within the period of 10 months, when chilli (Pusa Jwala) seeds treated with thiram, bavistin, captan and mancozeb at a moisture content of 8-10.5 per cent and stored in cloth bag as compared to the seeds stored in tin container. Jayaraj *et al.* (1993) opined that tomato and chilli seeds treated with captan and thiram and stored in aluminium foil pouch recorded more than 77 and 70 per cent germination, respectively up to 18 months of storage under temperate conditions as compared to the seeds stored in cloth bag under tropical and subtropical conditions. Brinjal and okra seeds were also treated with the same chemicals (captan and thiram) and packed in aluminium foil pouch were retained 78 and 84 percent germination for 12 and 15 months, respectively under temperate condition as compared to seeds stored in cloth bag under tropical and subtropical conditions. Devi and Selvaraj (1994) studied germination of bitter gourd enhanced by soaking its seeds in a number of chemicals like, bavistin, boric acid, calcium hydroxide, calcium oxychloride, sodium dihydrogen phosphate, potassium dihydrogen phosphate and succinic acid. Raju and Sivaprakasan (1994) recorded highest germination (>80%) in cabbage seeds treated with thiram and bavistin. After six months of ambient storage, the untreated (control) seeds recorded 71 per cent of germination, while the highest germination per cent and root length in chilli seeds was recorded for one year under ambient condition after treating with thiram @ 0.4 per cent. Reddy and Reddy (1994) treated the seeds of egg plant with thiram (2.5 g/kg), delson (1 ml/kg) and captan (2.5 g/kg) and observed that the thiram maintained higher germination up to 21 months of storage.

Nargis (1995) reported that pelleting of tomato seeds with pongamia and arappu leaf powder showed better performance in laboratory and field conditions compared to control. Singh *et al.* (1996) reported that onion seed treated with thiram and bavistin with 2 g/kg of seed and stored in polythene bag maintained higher germination after six months of storage with effective control of *Alternaria alternata*, *Rhizopus* spp. and *Fusarium* spp. Kotreppagouda (1997) reported that the chilli seeds treated with bavistin with 1g/kg of seed and stored in polythene bag showed fairly high degree of preservation of seed quality by recording germination of 53.64 per cent, while in control recorded 49.31 per cent at the end of six months of storage period. Suresh (1999) reported that the onion seeds treated with captan (2 g/kg of seed) and stored in polythene bag (1000 guage) improves the seed quality. Ravikumar (2001) opined that cucumber seeds treated with Bavistin (1 g/kg) and stored in polythene bag and aluminium foil showed higher germination (76.4 and 76.1% respectively) and vigour index (1435 and 1420 respectively), over untreated control after 14 months of storage period. Nagaveni (2005) reported that the seed treatment with bavistin recorded higher germination, vigour index, field emergence and lower EC (70.4%, 1017, 60.50% and 0.526 dSm^{-1}) compared to the seeds treated with neem leaf powder (67.4%, 945, 55.30% and 0.528 dSm^{-1}) and control (61.1%, 856, 50.00% and 0.529 dSm^{-1}, respectively) at the end of nine months of storage. Hunje *et al.* (2007) studied that halogenation and plant bio-products on storability of chilli seeds for 20 month storage period. Among the halogen treatments, seeds treated with potassium iodide (10^{-3}M) recorded highest germination and vigour parameters and lowest electrical conductivity at the end of 20 months storage period. Among the plant bio-products, seeds treated with *Pongamia* leaf powder (40g/kg of seed) recorded highest germination and vigour parameters and lowest electrical conductivity at the end of the storage period. Kavitha (2007) reported that the chilli seed pelleting with captan + imidachloprid with wood ash as filler material recorded higher seed quality parameters followed by neem leaf powder performed better throughout the storage period by recording better seed quality parameters.

Basavaraj *et al.* (2008) studied the effect of fungicide and polymer film coating on storability of onion seeds. Among the treatments, seed coating with polymer @ 12 ml + thiram @ 2 g per kg of seeds recorded higher germination, vigour index, dry weight of seedlings and lower seed infection and electrical conductivity as compared to control. The higher germination percentage, seedling length, vigour index, field emergence and lower electrical conductivity of seed leachate and percent seed infection was recorded in onion seed coated with polymer @ 7.0 g/kg and thiram @ 2.0 g/kg of seed followed by seed coated with polymer @ 5.0g/kg and thiram @ 2.0 g/kg of seed compared to uncoated seeds Manjunatha *et al.* (2008b). Manjunatha *et al.* (2009) reported that the seed pelleted with captan and imidacloprid recorded higher seed quality followed by $ZnSO_4$ + captan + imidacloprid against unpelleted control throughout the storage period. Shashibhaskar *et al.* (2008) reported significantly the maximum seedling length (26.83 cm), seedling vigour index (2362), seedling dry weight (41.41mg), speed of germination (24.35), dehydrogenase activity (0.721 OD

value) with lower moisture content (6.25%), electrical conductivity (0.393 dS m^{-1}) with zero infection (0.00%) in the tomato seeds pelleted with carbendazim followed by $CaOCl_2$ and Neem leaf powder pelleted seeds. Venkata subramanian and Umarani (2010) recommended that tomato seed cane be hydro primed for 48 h in water (double the volume of seeds), while eggplant and chilli seeds can be subjected to sand matric priming (80 % water holding capacity) for 3 days and dried back to original moisture content can be stored in aluminium pouches for at least six months without losing the efficacy of the priming treatment and seed quality parameters.

Kuppusamy and Ranganathan (2014) recommended that better improvement in seed quality with good storability can be obtained in okra by subjecting the seeds sand matric priming (60 % WHC) for 3 h while for beet root seeds, hydropriming for 12 h in water (double the volume of seeds) can be adopted. Kumari *et al.* (2014) observed gradual decrease in all the seed viability characters of chilli over periods of storage starting from 6 months to 20 months. Seed coated with plant protection chemicals alone or in combination with polymer lost its viability during storage before six months under ambient conditions. It can be inferred that under ambient conditions of storage the chill seed can be stored viable for 6 months when coated with polymer alone and for 12 months without any seed coating. Satish kumar *et al.* (2014) studied the effect of seed pelleting chemicals on storability of brinjal (*Solanum melongena* L.). Seed pelleting treatments, bavistin (1%) recorded significantly higher germination percentage (85.70%) and seedling vigour index (887) than the other treatments ($ZnSO_4$, $MnSO_4$, DAP and control) followed by arappu leaf powder (250g/ kg) at the end of12 months of storage period. Sultana *et al*. (2015) studied the effect of seed treatments and storage periods on the incidence ofseed borne disease and seed quality of okra seed *(Abelmoschus esculentus)*. Provax-200 treated seeds were showed the lowest prevalence of *Fusarium* spp, *Chaetomium globosum, Aspergillus flaws, Aspergillus niger, Rhizopus stolonifer and Curvularia*s pp and maximum germination, longest shoot and root length, highest seed vigour index, highest dry weight of seedlings and filed emergence at 4 months of storage due to low moisture content. Seed infested was highest and lower performance in seed germination, shoot length, root length, seedling vigour index and dry weight of seedlings and filed emergence in non-treated seeds at 12 months of storage due to high moisture content.

Conclusion

Seed treatment is effective method for maintaining vigour and viability of vegetable seed quality in storage and also controlling storage insect and pest infection. Many of the synthetic chemicals look effective, but they are not readily degradable physically or biologically which yield more toxic residues. The safe and feasible approach is the treatment of seeds with botanicals, organics etc., which are safe, economical, cheap, eco-friendly in nature and non-toxic to man and animals.

References

Basavaraj, B.O., N.K. Biradar Patil, B.S. Vyakarnahal, N. Basavaraj, B.B. Channappagoudar and R. Hunje (2008). Effect of fungicide and polymer film coating on storability of onion seeds. *Karnataka J. Agric. Sci.,* **21(2)**: 212-218.

Bujdoso, G. (1979). The effect of seed dressing prior to storage on germination of cucumber. *Zoldsegtermesztesi Kutato Intezetbulletinje*, **13(13)**: 49-54.

Copeland, L.O. and M.B. McDonald (2001). Principles of Seed Science and Technology. 4th ed. Norwell, Massachusetts: Kluwer Academic Publishers. 488 pp.

Devi, J.R. and J.A. Selvaraj (1994). Effect of presowing treatment on germination and vigour in bitter gourd (*Momordica charantica* L.) cv. Co. 1. *Seed Res.,* **22**: 64-65.

Dhellot, J.R., E. Matouba, M.G. Maloumbi, J.M. Nzikou, D.G. Safou-Ngoma, M. Linder, S. Desobry and M. Parmentier (2006). Extraction, chemical composition and Nutritional characterization of vegetable oils: Case of *Amaranthus hybridus* (Var 1 and 2) of Congo Brazzaville. *African J. Biotech.,* **5(11)**: 1095-1101.

Dhyani, A.P.; M.C. Sati and R.D. Khulbe (1991). Seed health testing of red pepper and bell peper with special reference to the pathogenesity and control of *Mycrothecium verrucaria*. *Int. J. Trop. Plant Diseases*, **9**: 207-220.

Doijode, S.D. (1988a). Effect of storage environment on brinjal (*Sorghum melongena*) seed viability. *Pogressive Horti*., **20**: 292-293.

Fayemi, P.O. (1999). Nigerian Vegetables, 1st Edition, Heinemann Educational Books Nigeria, pp. 1-8.

Gupta, A. and D. Singh (1990). Viability of fungicide treated seeds of mungbean and cowpea in storage. *Seed Res.,* **18(1)**: 70-76.

Gupta, A., D. Singh and V.K. Maheshwari (1992). Effect of containers on the viability of fungicide treated chilli seeds. *Seed Res.,* **20(2)**: 160-161.

Gupta, R.P., Usha Mehra; U.B. Pandey U. and Mehra (1989). Effect of various chemicals on viability of onion seed in storage. *Seed Res*., **17(1)**: 99-101.

Hassan, L.G., K.J. Umar and A.A. Tijjani (2007). Preliminary Investigation on the feed quality of Monechmacilition Seeds. *Chem. Class J*., **4**: 83.

Hunje, R., B.S. Vyakarnahal and R.C. Jagadeesh (2007). Studies

on halogenation and plant bio - products on storability of chilli seed. *Karnataka J. Agric. Sci.,* **20(3)**: 506-510.

Jacqualine, A. and Selvaraj (1988). Studies on storage of brinjal (*Solanum melongena* L.) seeds, I. Biocide treatments and containers for storage. *South Indian Hort*., **36**: 313-317.

Jayaraj, T., K.K. Vadivelu, C. Dharmalingam, A. Jayakumar and I. Irulappan (1993). Effect of seed treatments and containers on vegetable seed storage under different agroclimatic conditions. *Seed Res.*, **3(1)**: 337-341.

Karivaratharaju, V., V. Palaniswamy and K. Kumarsen (1987). Effect of seed treatment and containers on the storability of brinjal seeds. *Seed Res.,* **120**: 141-153.

Kavitha M. (2007). Seed quality enhancement and storability studies in chilli (*Capsicum annuum* L.). M.Sc. (Agri.). Thesis (unpublished) submitte to University of Agricultural Sciences, Dharwad.

Koteshwar Rao, O., K. Srihari Rao and P. Govind Rao (1962). Effect of seed treatment of chilli with organic fungicides in improving germination. *Andhra Agric. J.,* **9**: 55-59.

Kotreppagouda, N.P. (1997). Seed quality and storability studies in chilli (*Capsicum annuum* L.) M.Sc. (Agri.). Thesis (unpublished) submitted to University of Agricultural Sciences, Dharwad.

Kulkarni, S.G., S> Harode, P.S. Borikar, S.N. Puri and S.D. Deshpande (1988). Effect of containers and seed treatment on the storage of legumes. *Seed Res*., **16(1)**: 121-122.

Kumari, S.S.; K. Umajyothi, K. Giridhar, T. Vijayalakshmi, A. Rajani, C.V. Ramana and L.N. Naidu (2014). Influence of temperature and relative humidity on viability of coated seeds of chilli under stored conditions. *J. Agric. Vet. Sci.,* **7(1)**: 40-44.

Kuppusamy, N. and U. Ranganathan (2014). Storage potential of primed seeds of okra (*Abelmoschus esculentus*) and beet root (*Beta vulgaris*). *Australian J. Crop Sci.*, **8(9)**:1290-1297.

Muthuswamy, S., D. Padmanabbhan and R. Nagarajan (1983). Efficacy of fungicides on the viability of chilli seeds. *Pesticide*, **17**: 23-28.

Nagaveni, P.K. (2005). Effect of storage conditions, packing material and seed treatment on viability and vigour of onion seeds. Ph.D. Thesis (unpublished) submitted to University of Agricultural Sciences, Dharwad.

Nargis, S. (1995). Influence of pelleting, magnetic treatments and radiation on the performance of differentially aged seeds in tomato (*Lycopersicon esculentum* Mill.) cv. PKM-1, M.Sc. (Agri.) Thesis (unpublished) submitted to Tamil Nadu Agricultural University, Coimbatore.

Oke, L.O. and O. Ojofehintimi (1988). *Nutrition for Nurses*, Tropical, 2nd Ed., Health Series, London Group Ltd, Pp: 91-92.

Oyenuga, V.A. and B.L. Fetuga (1975). First National Seminar on Fruits and Vegetables. *In: Proc. and Recom. & Papers by NIHORT*, Ibadan.

Raju, U.J. and K. Sivaprakasan (1994). Seed treatment of cabbage seeds by chemicals and non-chemical methods on the viability. *Madras Agric. J.,* **81**: 237-238.

Ravikumar, G.H. (2001). Investigations on seed production and post harvest techniques in cucumber (*Cucumis sativus* L.) cv. Poinsette. Ph.D. Thesis (unpublished) submitted to University of Agricultural Sciences, Dharwad.

Reddy, S.V. and M.B. Reddy (1994). Effect of seed protectants on storability of egg plant (*Solanum melongena* L.) seed. *Seed Res*., **22**: 181-183.

Robinson, D.S. (1990). Food Biochemistry and Nutritional Value. Longman Scientific and Technical Publisher, New York. USA. 52- 58.

Satishkumar, Basavegowda and Sharnkumar (2014). Effect of seed pelleting chemicals and storage containers on storability of brinjal (*Solanum melongena* L.). *Int. J. Plant Sci.,* **9(1)**: 173-179.

Shashibhaskar, M.S., S.N. Vasudevan, M.B. Kurdikeri, R.L. Ravikumar and N. Basavaraj (2008). Influence of seed pelleting on storability of tomato (*Lycopersicum esculentum*Mill.). *Karnataka J. Agric. Sci.,* **22(5)**: 1097-1103.

Singh, B., P. Singh, C.P. Vaish and R.P. Katiyar (1996). Effect of various fungicides on viability of onion (*Allium cepa* L.) seed in storage. *Seed Res*., **24(1)**: 61-63.

Sultana, R., M.S.M. Chowdhury, M.R. Islam, S.M. Mohsin and A.N.F. Ahmmed (2015). Effect of seed treatments and storage periods on the incidence of seed borne disease and seed quality of okra seed (*Abelmoschus esculentus*). *Int. J. Sustain. Agril, Tech.,* **11(9)**: 28-35.

Suresh, H. (1999). Studies on storability of onion seeds (*Allium cepa* L.). M.Sc. (Agri.) Thesis (unpublished) submitted to University of Agricultural Sciences, Dharwad.

Venkatasubramanian, A. and R. Umarani (2010). Storability of Primed Seeds of tomato (*Lycoperison esculentum*), eggplant (*Solanum melongena*) and chilli (*Capsicum annum*). *Madras Agric J.,* **4(6)**: 117-124.