Vegetable Science (2016) 43 (2) : 168-171

Impact of seed coating with polymers and bavistin on seed quality and storability in tomato (*Solanum lycopersicum* L.)

VK Sachan[1] and Rabindra Kumar[2]

Received: July 2015 / Accepted: July 2016

Abstract

The investigations were carried out at Krishi Vigyan Kendra, VPKAS, Almora, Uttarkashi during 2013-14 to explore the effect of seed coating with polymers and bavistin on seed quality and storability of tomato cv. VLTomato-4. The seeds were coated with polymers, bavistin and polymers dyes- bavistin combinations and stored in polythene bags for 12 months. Seed coating with polymers pink @ 20 ml per kg of seed and bavistin @ 1 g per kg of seed (T_5) recorded higher germination (77.83 %), seedling length (15.76), vigour index (1227), field emergence (76.12 %), less electrical conductivity of seed leachate (1.511 dSm-1) and seed infection (5.30%) up to 12 months of storage as compared to control.

Keywords: Tomato, seed quality, storage and seed coating

Introduction

Tomato is one of the most popular vegetable crops of global importance and belongs to the family of *Solanaceae* and it is the most important commercial sub-tropical vegetable crop of India ranks second in both area and production. The success of seedling establishment at the field level largely depends on the initial quality of the seed. In recent times various quality improvement treatment are given to the seeds as a pre-sowing treatment. Seed coating is a pre-sowing technique, where an external material is applied on the seed which does not obscure its shape. Polymer is a film coating chemical normally applied over seed without significantly increasing the size or weight of seeds. This type of plasticizer polymers form a flexible film that prevent dusting off and loss of fungicide during handling and are rapidly soluble in water (hydrophilic), so as not to impede with normal germination.

The application of polymers to seed serves as an extra exterior shell in order to give the desired seed characteristics viz. quick or delayed water uptake and enhanced germination that would be beneficial for better emergence and establishment in the given environment (Clayton 1988). Film coating along with colorant is an emerging pre-sowing seed management technique, recommended for high value agricultural crops (Savitri *et al.* 1994 and Manjunatha *et al.* 2008). Hence, an attempt was made to prolong the longevity of the seeds through seed management practices for ambient storage conditions.

Materials and Methods

A Laboratory experiment was undertaken at Krishi Vigyan Kendra (ICAR-VPKAS), Chinyalisaur, Uttarkashi, Uttrakhand during 2013-14 to evaluate the effect of polymers and fungicides on seed quality during storage.

The freshly harvested seeds were taken and cleaned thoroughly. The seeds were dried to 6% moisture content and then imposed with the following seed treatments which includes T_1- Polymer blue @ 20 ml+ bavistin @1g / kg of seed; T_2- Polymer red @ 20 ml + bavistin @ 1 g / kg of seed; T_3- Polymer green @ 20 ml + bavistin @ 1 g/kg of seeds; T_4- polymer black @ 20 ml + Bavistin @ 1g /kg of seed; T_5- Polymer pink @ 20 ml + Bavistin @ 1 g/kg of seed; T_6- Polymer clear @ 20 ml + bavistin @ 1g/kg of seed; T_7- Polymer clear @ 20 ml/kg of seed and T_8- control and stored for 12 months in polythene bag with four replications. Five hundred grams of freshly harvested tomato cv. VLT-4 seeds were taken for each treatment. Care was taken during mixing to have

[1]Krishi Vigyan Kendra (ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora), Chinyalisiur, Uttarkashi, Uttarakhand

[2]National Seeds Corporation, Sheikhpura, Rajabazar, Patna 800014, Bihar

uniformity in coating and the seeds were air dried under shade to bring back to its original moisture content. The experiment was laid out in Completely Randomized Block Design (CRD) with four replications. Then the seeds were packed in polythene bags. The tri-monthly observation on germination percentage (Anonymous 1996), seedling length, vigour index (Abdul and Anderson 1973), field emergence, electrical conductivity of seed leachate (Presley 1958) and seed inspection per cent were calculated. The statistical analysis was done as per procedure given by Panse and Sukhatme (1985).

Results and Discussion

Significant results were recorded due to polymer coating for all the seed quality parameters analysed in the laboratory (Table 1). The germination percentage gradually decreased from 89.97 to 75.42 which were above minimum seed certification standards (70%) at the end of 12 months of storage (Trivedi and Gunasekaran 2013). As the effect of seed coating with chemicals on germination is concerned; all the treatments recorded significantly higher germination up to 12 months of storage as compared to control. Among the different treatment combinations, the seeds coated with polymer pink @ 20 ml + bavistin @1 g / kg of seed (T_5) recorded significantly higher germination (77.83%) followed by 77 % in T_2 (seed coating with polymer red @20 ml + bavistin @1g/ kg of seed) as compared to control (72.97). The decline in germination percentage may be attributed to ageing effect, leading to depletion of food reserves and decline in synthesize activity of embryo apart from death of seed because of fungal invasion, insect damage and storage conditions. Likewise decrease in germination with increase in storage period was reported in soybean (Kurdikeri *et al*. 1996) and also due to dye treatment in sorghum (Savitri *et al*. 1994).

The chemical acts as protective agent against seed deterioration due to fungal invasion and physiological ageing as a result of which the seed viability was maintained for a comparatively longer period of time (Kurdikeri *et al*. 1996). The higher germination percentage in polymer dye coated seeds was due to increase in the rate of imbibition where the fine particle in the coating acts as a “wick” or moisture attracting materials or perhaps to improve germination.

Significantly higher seedling length (15.76 cm) was recorded in seeds coated with polymer pink @ 20 ml + bavistin @ 1 g / kg of seed (T_5). Followed by 14.73 cm in T_2 (polymer red @ 20 ml + bavistin @ 1 g/kg of seed) as compared to untreated seeds (T_8) which recorded lower seedling length (10.89 cm) at the end of 12 months of storage period. The decline in seedling length may be attributed to age induced decline in germination and damage caused by fungi and insects and due to toxic metabolic that might have hindered the seedling growth and higher seedling length in polymer coated seeds were due to higher rate of water uptake and low seed deterioration of seed during storage.

Gradual decrease in seed vigour was noticed with increase in storage period irrespective of seed treatment (Table1). Significantly higher vigour index (1227) was recorded in seeds coated with polymer pink @ 20 ml+ bavistin @ 1g/kg of seed (T_5) followed by 1134 in T_2 (polymer red @ 20 ml + bavistin @1 g /kg of seed) as compared to untreated seeds (T_8) which recorded significantly lower seedling vigour index (795) at the end of 12 months of storage. The decrease in vigour index may be due to age induced decline in germination, decrease in dry matter accumulation in seedling and decrease in seedling length. Similar findings were

Table 1: Effect of seed coating with polymers and bavistin on germination (%), seedling length (cm) and seedling vigour index-I in tomato seed under ambient storage conditions.

Treatments	Months after storage														
	Germination (%)					Seedling length (cm)					Seedling vigour index -I				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
T_1	89.90	88.19	84.89	84.49	76.28	19.30	17.57	16.40	15.17	13.91	1735	1550	1392	1282	1061
T_2	90.00	88.92	85.61	80.58	77.00	19.41	18.39	17.22	16.03	14.73	1747	1635	1474	1292	1134
T_3	89.98	88.71	85.41	80.11	76.80	19.41	18.19	17.02	15.79	14.53	1747	1614	1454	1265	1116
T_4	89.98	87.67	84.05	78.42	74.79	19.38	16.82	15.68	14.45	15.19	1744	1475	1318	1133	1136
T_5	90.01	89.75	86.45	80.85	77.83	19.40	19.32	18.15	16.99	15.76	1746	1734	1569	1274	1227
T_6	90.00	87.04	83.45	77.84	74.20	19.41	16.13	14.96	13.73	12.47	1747	1404	1248	1069	925
T_7	89.90	86.70	83.05	77.00	73.50	19.40	15.31	14.24	13.85	11.85	1744	1327	1183	1066	871
T_8	89.98	85.78	82.21	76.60	72.97	19.41	14.50	13.33	12.12	10.89	1747	1244	1096	928	795
Mean	89.97	88.25	84.39	78.86	75.42	19.39	17.03	15.88	14.67	13.42	1532	1503	1340	1157	1012
S.Em ±	0.07	0.10	0.12	0.10	0.11	0.07	0.07	0.06	0.08	0.70	12	14	16	12	13
CD at 5 %	NS	0.29	0.35	0.31	0.34	NS	0.20	0.18	0.23	0.21	NS	39	46	34	38

Table 2: Effect of seed coating with polymers and bavistin on field emergence (%), electrical conductivity of seed leachate (dSm^{-1}) and seed infection (%) in tomato seed under ambient storage conditions

Treatments	Months after storage														
	Field emergence (%)					Electrical conductivity of seed leachate (dSm^{-1})					Seed Infection (%)				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
T_1	88.10	77.80	70.40	66.00	55.92	0.333	0.419	0.740	1.325	1.579	2.90	3.83	4.51	5.40	6.70
T_2	88.13	82.50	76.52	73.55	65.11	0.332	0.374	0.698	1.290	1.535	3.00	3.48	4.17	5.06	6.36
T_3	88.11	81.80	75.52	72.55	64.55	0.333	0.392	0.713	1.299	1.554	2.90	3.65	4.34	5.23	6.53
T_4	88.12	75.40	68.20	64.40	55.70	0.332	0.441	0.765	1.350	1.584	3.00	3.99	4.68	5.57	6.87
T_5	88.11	87.50	83.81	83.31	76.12	0.334	0.353	0.675	1.268	1.511	2.80	3.05	3.68	5.00	5.30
T_6	88.12	73.40	65.21	61.10	52.70	0.332	0.463	0.788	1.379	1.610	3.00	4.16	4.85	5.74	7.04
T_7	88.11	72.00	64.20	59.80	51.10	0.332	0.485	0.810	1.405	1.639	3.00	4.46	5.20	6.16	7.65
T_8	88.11	70.11	62.22	57.78	49.13	0.333	0.505	0.835	1.435	1.660	3.00	4.70	5.70	6.60	8.23
Mean	88.11	77.56	70.76	67.31	58.79	0.333	0.429	0.753	1.344	1.584	2.95	3.92	4.64	5.47	6.84
S.Em ±	0.08	0.37	0.37	0.34	0.34	0.007	0.007	0.008	0.007	0.008	0.10	0.14	0.15	0.36	0.36
CD at 5 %	NS	1.10	1.09	1.00	1.01	NS	0.020	0.022	0.20	0.023	NS	0.41	0.43	1.00	1.01

reported in sorghum (Savitri *et al.*, 1994) and chilli (Geetharani *et al.*, 2006).

Significantly higher field emergence of (76.12%) was recorded in seeds coated with polymer pink @ 20 ml + bavistin @ 1 g/kg of seed (T_5) followed by 65.11 % in T_2 (polymer red @ 20 ml + bavistin @ 1 g/kg of seed) as compared to untreated seeds (T_8) which recorded significantly lower field emergence (49.13%) at the end of 12 months of storage (Table 2). This decrease in field emergence may be due to age induced deteriorative changes in cell and cell organelles and germination capacity of seed under natural soil conditions. Higher field emergence can be seen in polymer dye coated seeds. It is due to increase in the rate of imbibitions, where the fine particles in the coating acts as " wick" or moisture attracting materials or perhaps to improve seed soil contact . Coating with hydrophilic polymer regulates the rate of water uptake, reduce imbibition damage and improve the emergence of soybean seeds (Hwang & Sung 1991)

Significantly lower electrical conductivity of seed leachate (1.511 dSm^{-1}) was recorded in seeds coated with polymer pink @ 20ml + bavistin @ 1g/ kg of seed (T_5) followed by 1.535 dSm^{-1} in T_2 (polymer red@ 20 ml + bavistin @ 1g/ kg of seed) as compared to untreated seeds (T_8) which recorded significantly higher electrical conductivity of seed leachate (1.660 dSm^{-1}) at the end of 12 months of storage (Table 2). This variation in electrical conductivity of seed leachate indicating increased membrane permeability and decreased compactness of seed coat and cellular membrane deterioration. Similar findings were reported by Patel *et al.* (2004) and the polymer film formed around seed acts as a physical barrier, which has been reported to reduce leaching of inhibitors from the seed covering and may restrict oxygen diffusion to the embryo (Duan and Burris 1997).

In the present study, the fungal infection found significant influence from one month of storage up to 12 months. Significantly lower seed infection (5.30%) was recorded in seeds coated with polymer pink @ 20 ml + bavistin @1g/kg of seed (T_4) followed by 6.36 % in T_2 (polymer red @ 20 ml+ bavistin @ 1g /kg of seed) as compared to untreated seeds (T_8) which recorded higher seed infection (8.23%) at the end of 12 months of storage (Table 2). However, non–significant results were recorded in T_2, T1, T3, T4, T6 treatment which were at par with each other. The infection by the fungal pathogen was comparatively low in above treatments compared to control due to the preventive mechanism in seeds coated with fungicide and similar findings were reported in various crops (Kumar and Agrawal 1998, Manjunatha *et al.* 2008, Bhanuprakash *et al.* 2008).

सारांश

टमाटर की प्रजाति वी एल टमाटर–4 के बीजों की गुणवता व भण्डारण को ज्ञात करने के लिए पालीमर तथा वाविस्टीन की कोटिंग का परीक्षण कृषि विज्ञान केन्द्र (भाकृअनुप–विवेकानंद पर्वतीय कृषि अनुसंधान शाला अल्मोरा) उत्तरकाशी में वर्ष 2013–2014 में किया गया। बीजों पर वाविस्टीन तथा पालीमर रंग–वाविस्टीन संयोजक तथा पालीथीन में बीजों को 12 महीने तक रखा गया। पालीमर पिंक की 20 मिली. प्रति किलोग्राम बीज एवं वाविस्टीन की 1 ग्राम प्रति किलोग्राम बीज (टी–5) से सर्वाधिक बीज जमाव (77.83 प्रतिशत), अंकुर लम्बाई (15.75), ओज गुणांक (1227), प्रक्षेत्र निर्गमन (76.12 प्रतिशत) बीज विक्षालन की विधुत चालकता (1.511 डी एस एम–1) तथा बीज संक्रमण (5.3 प्रतिशत), नियंत्रक की तुलना में 12 महीने तक अच्छी तरह भण्डारित पाये गये।

References

Abdul-Baki AA and Anderson JP (1973) Vigour deterioration in soybean by multiple criteria. Crop Sci 13: 630-637.

Anonymous (1996) International Rules for seed testing. Seed Sci Technol 24 (supl.): 1-228.

Bhanuprakash K, Yogeesha HS, Arun MN and Naik LB (2008) Effect of storage and priming on seed viability and vigour in khirni. Seed Res 36 (1): 47-50.

Clayton PB (1988) Seed treatment technology: the challenge ahead for the agricultural chemical industry. British Crop Protection Council, pp247-256.

Duan X and Burris JS (1997) Film coating impairs leaching of germination inhibitors in sugar beet seeds. Crop Sci 37: 515-520.

Geetharani, Ponnuswamy AS and Srimathi P (2006). Influence of polymer coating on nursery management in chillies. Seed Res 34 (2): 212-214.

Hwang WD and Sung FJM (1991) Prevention of soaking injury in edible soybean-seeds by ethyl cellulose coating. Seed Sci Technol 19: 269-278.

Kumar M and Agrawal VK (1998) Effect of fungicides seed treatment on seed fungi, germination and seedling Vigour in maize. Seed Res 26 (2): 147-151.

Kurdikeri MB, Basavaraj GT, Hiremath NV and Aswathanarayan SC (1996) Storability of soybean seed under ambient condition. Karnataka J Agric Sci 9: 552-554.

Manjunatha SN, Hunje R, Vyakaranahal BS and Kalappanavar K (2008) Effect of seed coating with polymers and fungicide on seed quality of chilli during storage. Seed Res 36(1): 42-46.

Panse VG and Sukhatme PV (1985) Statistical methods for agricultural workers, ICAR, New Delhi, pp 327-340.

Patil SK, Janpure SV, Shelar VR and Dumbre AD (2004) Efficacy of insecticides and fungicides on seed germination, insect infestation and seed mycoflora on pearlmillet during storage. Seed Res 32 (2): 189-192.

Presley HT (1958) Relation of protoplast permeability of cotton seed viability and predisposition to seedling diseases. Plant Disease Report, pp 42:52.

Savitri HM, Sugunakar Reddy M and Muralimohan B (1994) Effect of seed treatment with fungicides and insectides on seed borne fungi, storage insect pest and seed viability and seedling vigour in sorghum. Seed Res 22 (2):146-155.

Trivedi PK and Gunasekaran M (2013). Indian Minimum Seed Certification Standards. The Central Seed Certification Board, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.