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Effect of Polymer Coat, Seed Treatment Chemicals and Containers on Seed Germination, Vigour Index, Infestation and Other Quality Traits in Sweet Corn during Seed Storage

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A B S T R A C T

Sweet corn (*Zea mays* L. spp. *saccharata*) also known as sugar corn is a hybridized variety of maize (*Zea mays* L.) specifically bred to increase the sugar content. The information on storage of sweet corn seeds to preserve viability and vigour from harvest to next planting season is of prime importance in any seed production programme. Certain seed treatments and storage containers are known to influence the storability of seeds in several crops. Hence, the laboratory experiment was conducted from 2017-2018 at Regional Agricultural Research Station, Hitnalli Farm, Vijayapur to ascertain the effect of polymer coat, seed treatment chemicals and containers on sweet corn seed quality during seed storage. The experiment was carried out in two factorial two factorial design. First factor consisted of eight treatments and second factor consisted of two containers *viz.*, cloth bag and polythene bag. The results of investigation revealed that seeds stored in HDPE (polythene) bag showed better storability as compared to the cloth bag. At the end of nine months of storage period, seeds treated with polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed + bavistin 50% WP @ 2g/kg and seeds stored in polythene bag recorded significantly higher seed germination (89.00%), shoot length (17.81 cm), root length (19.58 cm), seedling vigour index (3390), ten seedling dry weight (2.36 g), 100 seed weight (10.81g) and lower EC value (0.341dSm^{-1}) as compared to control. The moisture content, seed infection and insect infestation were least in the seeds stored in polythene bags compared to the seeds stored in cloth bags.

Introduction

Sweet corn is a perishable product that has to be delivered onto the market in the form of fresh cobs, or to processing plants in the form of corn kernels for canned or frozen food. Seed is a basic and vital input for sustained growth in agricultural productivity and production since ninety percent of the food crops are grown from seed (Schwinn, 1994). Seeds also require seed treatment for enclosing the protective chemicals, and nutrients added to the seeds without significant increase in the seed size or weight.

Polymer coating enables accurate and even dosage of chemicals and reduces the chemical wastage. The polymer coat also provides protection from the stress imposed by accelerated ageing, fungal infection and pest infestation. It improves emergence of seedlings and plant stand in the field. Accurate application of polymer coat helps to make room for including all required ingredients, protectants, nutrients, plant growth promoters, hydrophobic / hydrophilic substances, oxygen suppliers etc by encasing the seed within a thin film of biodegradable polymer and adherence of seed treatment chemicals to the seed ensures dust free handling and make treated seed both useful and environment friendly. Polymer coating makes sowing operation easier due to the smooth flow of seeds. Addition of colorant helps in visual monitoring of placement accuracy enhances the appearance, marketability and consumer preference. The polymer film coat may act as a physical barrier, which has been reported to reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo (Vanangamudi *et al.,* 2003).

Good storage is a basic requirement in seed production program as the maintenance of high seed viability and vigour from the harvest to planting is of utmost important in a seed production program. In storage, the seeds are to be protected against the pests and pathogens. The seeds can be treated with different fungicides to prevent the growth of micro-organisms and insect infestation. Seed treatments with fungicides not only controls seed-borne diseases but also improve seed heath, plant stand, germination and crop yield (Tanweer, 1982). The detailed information on these aspects of sweet corn is lacking and thus deserves the attention of understanding the above aspects that would be of much practical significance to improve the seed production. Hence, an investigation was carried out to know effect of polymer coat, seed treatment chemicals and containers on sweet corn seed quality during seed storage.

Materials and Methods

The fresh seeds of sweet corn variety (Madhuri) were obtained from MARS, UAS Dharwad for the storability studies. The laboratory experiment was conducted at RARS, Vijayapur during *kharif* 2017-18 with eight seed treatments (T) *viz.*, T_{1}-(control), T_2-(polymer seed coating @ 10 ml/kg of seed), T_3-(Bavistin (carbendazim) 50% WP @ 2g/kg seed), T_4-(deltametrin 2.8EC @ 0.4ml/kg seed), T_5-(polymer seed coating @ 10 ml/kg of seed + bavistin (carbendazim) 50% WP @2g/kg seed), T_6-(polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed), T_7-(polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seed), T_8-(deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seed) and two containers *viz.*, cloth bag(C_1) and polythene bag (C_2).

The seed samples were treated as per the treatments and packed in containers and stored under ambient storage conditions for nine months. The seed samples were drawn at monthly intervals for determining the seed quality parameters *viz.,* germination, root length, shoot length, vigour index, seedling dry weight, hundred seed weight, electrical conductivity of seed leachate, moisture content and seed health.

Statistical analysis

The data collected from the experiment was analyzed statistically by adopting the procedures as described by Sundarajan *et al.*, (1972) and critical differences were calculated at one per cent level, wherever, ‘F’ test was significant. The data on germination percentage was transformed into Arc sine square root percentage values (Snedecor and Cochran, 1967).

Results and Discussion

Sweet corn seeds were treated with insecticide, fungicides and polymer coating exhibited superiority in maintaining the seed quality throughout the storage period. The seeds treated with Polymer seed coating @ 10 ml/kg of seed in combination with deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seeds recorded significantly higher seed quality parameters followed by the seeds treated with polymer seed coating @ 10 ml/kg of seed in combination with bavistin (carbendazim) 50% WP @2g/kg seed which were on par with each other in most of the seed quality parameters compared to the untreated control.

The germination percentage of sweet corn seeds declined progressively with the increase in the period of storage in all the treatment combinations, which may be attributed to the phenomenon of natural ageing and depletion of food reserves and decline in metabolic activity of seed due to respiration. There was a significant difference on germination per cent from the third month onwards of storage period and up to the end of nine months of storage (Table 1a & 1b). The germination was significantly higher (89.68%) in the seeds treated with polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seeds, and 88.53 per cent germination in polymer seed coating @ 10 ml/kg of seed + bavistin (carbendazim) 50% WP @2g/kg seed. On the contrary, significantly lower germination (83.95%) was noticed in the untreated seeds at the end of storage period. Higher germination percentage can be seen in the treated seeds and it may be due to pathogen and pest suppressive nature of chemicals. In general, Bavistin (carbendazim) reduces the impact of ageing enzymes, seed deterioration due to fungal invasion and physiological ageing. Deltamethrin is a pyrithroid and it was very effective in controlling the insect pest during storage due to the phytotoxic effect. Further polymer film acted as physical barrier, which has been reported to reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to embryo. So, the seed viability was maintained for comparatively longer period of time. These finding are in agreement with the results obtained by Shakuntala (2009) in sunflower; Imran Baig (2005) in soybean; Vinodkumar *et al.*, (2012) in pigeonpea and Sushma (2013) in bengal gram.

At the end of nine months of storage period, significantly higher shoot length (17.27 cm) and root length (18.9 cm) was recorded in the seeds treated with polymer seed coating @ 10 ml/kg of seed in combination with deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seeds (T_7) followed by treatment T_5 where in the seeds were treated with the combination of polymer seed coating @ 10 ml/kg of seed and bavistin (carbendazim) 50% WP @2g/kg seed which recorded the of shoot length (17.05 cm) and root length of (18.63 cm). Significantly lower shoot length (14.69 cm) and root length (15.91 cm) was observed in the untreated seeds. The shoot length and root length of polymer coated seeds with insecticide and fungicide were more as compared to the uncoated seeds. It is due to higher germination and healthy seedlings in seeds coated with polymer, insecticide and fungicide as this protected the seeds from fungi and insect invasion of seeds and there by good and better germination and subsequent higher root and shoot length was produced. Similar results were reported by Shakuntala (2009) in sunflower; Imran Baig (2005) in soybean and Poonam Singh *et al.*, (2004) in rice. Due to elongation of shoot due to proper supply of water and nutrients which were enabled by the polymers.

In the present study, significantly higher vigour index was recorded in treatment T_7 wherein the the seeds were treated with polymer seed coating @ 10 ml/kg of seed in combination of deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seeds (3261) and was on par with the seeds treated with polymer seed coating @ 10 ml/kg of seed in combination of bavistin (carbendazim) 50% WP @2g/kg seed (3187) T_5 and seeds treated with deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seed (3111) T_8 . While, significantly lower vigour index (2735) was recorded in the untreated seeds at the end of storage period (Table 2a & 2b). The decrease in vigour index may be due to age induced decline in germination, decrease in root and shoot length and seedling dry weight and higher electrical conductivity of seed leachate. Higher vigour index in polymer coating along with fungicide and insecticide is due to more germination coupled with root and shoot length, seedling dry weight, lesser infection by storage fungi and very low infestation of insects. Similar findings were reported by Savitri *et al.,* (1994) in sorghum; Savitri *et al.,* (1998) in groundnut and Suresh and Renganayaki (2008) in maize seeds.

Dry weight of seedling decreased with increase in the storage period. This may be due to natural ageing, which may be resulted due to deterioration of seed, decrease in the germination percentage and seedling length. Among the treatment combinations, the seeds treated with polymer seed coating @ 10 ml/kg of seed in combination of deltametrin 2.8 EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seeds T_7 recorded significantly highest seedling dry weight (2.27 g) followed by the seeds treated with polymer seed coating @ 10 ml/kg of seed in combination with bavistin (carbendazim) 50% WP @2g/kg seed (2.02 g) T_5. While, significantly lowest seedling dry weight was recorded in the (untreated) as 1.05 g noticed at the end of nine months of storage period. These results are in conformity with the findings of Paul *et al.,* (1996) in mungbean; Imran Baig (2005) in soybean; Shakuntala (2009) in sunflower and Hunje *et al.,* (1990) in cowpea seeds.

Hundred seed weight of treated seeds showed significant variation from fourth month to till the end of nine months. Significantly higher hundred seed weight (10.64 g) was recorded in seeds treated with combination of polymer seed coating @ 10 ml/kg of seed, deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seeds T_7 and was on par with the seeds treated with combination of polymer seed coating @ 10 ml/kg of seed and bavistin (carbendazim) 50% WP @2g/kg seed (10.43 g) T_5. While, significantly lower hundred seed weight (9.24 g) was recorded in untreated seeds. The decrease in the hundred seed weight was observed as the storage period increased. This may be due to fluctuation of seed moisture content during storage, infestation of the insects, which will feed both internally and externally and also due to activity of the fungi. These results are similar to the findings of Hussaini *et al.,* (1988) in maize seeds.

A number of water soluble compounds such as sugars, amino acids and organic acids are released when the seeds were soaked in water. The electrical conductivity of seed leachate indicates the membrane integrity and quality of seed and it was negatively correlated with the seed quality. In the present investigation significantly lower mean electrical conductivity ($0.341 dSm^{-1}$) was recorded in the seeds treated with combination of polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seeds T_7 followed by the seeds treated with combination of polymer seed coating @ 10 ml/kg of seed + bavistin (carbendazim) 50% WP @2g/kg seed (0.356 dSm^{-1}) T_5. While, significantly higher electrical conductivity of seed leachate (0.534dSm^{-1}) was recorded in the untreated seeds at the end of storage period. This variation in electrical conductivity of seed leachate indicated that increased membrane permeability and decreased compactness of seed coat and cellular membrane deterioration. Similar, findings were reported by Vasundhara and Bommegowda (1999) in groundnut; Vinodkumar (2012) in pigeonpea; Patil *et al.*, (2004) in pearl millet and Sushma (2003) in garden pea. The polymer film formed around seed acted a physical barrier, which has been reported to reduce leaching of inhibitors from seed covering and may restrict oxygen diffusion in to the embryo (Vanangamudi *et al.*, 2003). The stable cell membrane also rendered resistance to peroxidase and free radical reactions and bavistin (carbendazim) acted as antifungal and anti oxidant agent.

There was no significant difference in the moisture content due to seed polymer coating insecticide and fungicide up to the end of storage period. The results of the present study revealed that the moisture content of the seeds increased with increase in the period of storage. It ranged from 8.33 per cent at the beginning of storage to 9.24 per cent at the end of eight months after storage. Increase in the seed moisture might be due to metabolic release of water during respiration and the hygroscopic nature of seed. Seed health status of seed also might be one of the reasons for increasing moisture content in hydro-primed seeds. These results are in agreement with the findings of Roberts and Abdulla (1986) in barly, broad bean and peas.

Seed health is a major consideration in any seed production programme next to vigour and viability of seeds. Seed health is always associated with seed quality. Healthy seeds must be free from both insect infestation and pathogen infection. The fungal infection increased with the advancement of storage period. The seed infection may be due to seed polymer coating, insecticide and fungicide varied significantly after four months of storage period. The seeds treated with polymer seed coating @ 10 ml + deltametrin 2.8 EC @ 0.4ml + bavistin (carbendazim) 50% WP @ 2g/kg seed T_7 recorded the lowest (0.16 and 1.21%) followed by deltametrin 2.8 EC @ 0.4 ml/kg + bavistin (carbendazim) 50% WP @ 2g per kg seed (0.22 and 1.49%) T_8 and the seeds treated with combination of polymer seed coating @ 10 ml/kg of seed + bavistin (carbendazim) 50% WP @ 2g/kg seed (0.31 and 1.47 %) T_5 .

Seed infection was highest in control (0.99 and 3.05 %) at the fourth and nine months of storage period, respectively. The fungal pathogens namely, *Aspergillus flavus, Aspergillus niger, Penicillium spp., Fusarium moniliforme* and *Rhizopus spp*. were found on sweet corn seeds predominantly during storage and the infection was more in uncoated seeds. It might be due to increased moisture absorption by the seeds and the seed without plant protection chemicals. Lower percentage of infection in the coated seed might be due to the toxic effect of coating fungicide on pathogen, in spite of its higher moisture absorption.

Hence, the deterioration of treated seed was less compared to the untreated seeds. Similar reports were reported by Ravishankar *et al.*, (2002) in maize and sorghum; Manojkumar and Agarwal (1998) in which seeds treated with thiram effectively controlled the seed borne disease in maize; Paul and Mishra, 1994 in maize reported that mycelial growth was significantly less for the polymer coated soybean seeds at every observation period and the polymer coat itself provided protection from the fungi invasion.

Hunje (2002) reported that stable cell membrane rendered resistance to peroxidase and free radical reactions and thiram acted as antifungal agent.

The seed infestation due to the treatment of seed polymer coating, fungicide and insecticide varied significantly after two months of storage period (Table 3a & 3b). Significantly lower insect infestation was recorded in the seeds treated with deltametrin 2.8EC @ 0.4ml/kg seed (0.00 and 0.61 %) T_4 followed by deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seed (0.00 and 0.79 %) T_8 and polymer seed coating @ 10 ml/kg of seed + bavistin (carbendazim) 50% WP @2g/kg seed T_5 was less (0.00 and 0.80 %). It was highest in control (0.16 and 5.02 %) at the second and nine months of storage period, respectively. There was no insect infestation in the seeds treated with the combination of polymer coat, insecticide and fungicide. Seeds coated with liquid polymer created smooth surface on seed coat so there is no choice to lay eggs on seed coat apart from that deltamethrin is a pyrithroid which is very effective in controlling the insect pest during storage due to phytotoxic effect. Similar results were reported by Vijaykumar *et al.,* (2007) in cotton; Vinodkumar *et al.,* (2012) in pigeonpea and Sushma (2013) in bengal gram seeds.

Effect of containers on sweet corn seed quality during storage

The most important factors that determine the longevity of seed in storage are moisture content of seed, temperature and relative humidity. As the seed being hygroscopic in nature, it exhibited fluctuation in seed moisture content due to change in atmospheric relative humidity and temperature. Use of sealed container has also been reported to maintain seed viability and vigour (Roberts and Abdalla, 1986). The cereal seeds are packed in cloth or gunny bags, both of these containers are permeable to moisture. So, it is essential to preserve the seeds in suitable moisture proof containers, which eliminate dampness, deterioration and micro organism, thereby enhancing the seed longevity or seed storability.

This investigation was carried out with a view to study the storage behaviour of sweet corn seeds in moisture pervious and moisture impervious containers and was kept in ambient condition, which aimed at developing low cost input methods suitable under resource limitation. In the present study, the results of germination percentage, moisture content, root length and shoot length, seedling dry weight, vigour index, hundred seed weight, seed health status and electrical conductivity of seed leachate as influenced by containers are discussed here under. Containers did significantly influence on germination, moisture content, root length and shoot length, seedling dry weight, vigour index, hundred seed weight, seed health status and electrical conductivity of seed leachate. Quality of seeds in terms of above mentioned parameters were high in polythene bag as compared to cloth bag at the end of eight months of storage except seed health status and electrical conductivity of seed leachate.

Germination was higher with the seeds stored in polythene bag (87.98%) and lowest (85.21%) in the cloth bag at the end of nine months of storage period. The superiority of 700 gauge polythene bag in storage was recorded as compared to the cloth bag. Polythene bag which is moisture resistant experienced relatively low fluctuation in seed moisture as compared to the seeds stored in moisture pervious containers *i.e.* in cloth bag. These results are in conformity with the findings of Zink and DcMendonca (1965) in pumpkin and Martin *et al.,* (1960) in okra.

Germination rate of soybean seeds varied widely due to different moisture content of different containers. It was observed that germination rate was almost similar at initial stage but it decreased with increase of storage period. After storage the germination rate was better in seeds of tin (87.34%) and polythene bag (84.73%) compared to that of cloth bag (68.51%) (Monira *et al.*, 2012). The shoot length, root length, seedling dry weight and hundred seed weight of sweet corn seeds decreased gradually with the advancement in storage period. Significant difference was observed in the above parameters due to containers. Higher shoot length, root length, seedling dry weight and hundred seed weight (16.65 cm, 18.34 cm, 1.78 g and 10.24 g, respectively) were noticed in the seeds stored in the polythene bag as compared to the cloth bag which recorded lower speed of germination, lower shoot length (15.64 cm), root length (17.04 cm), seedling dry weight (1.50 g) and hundred seed weight (9.55 g). It is concluded that maintenance of vigour and viability was consistent in 700 gauge polythene bag as compared to the cloth bag due to less fluctuation in extrinsic factors such as relative humidity, temperature. These results are in conformity with the findings of Riudavets *et al.*, (2007) and Sunilkumar *et al.*, (2005) in sorghum and Merwade (2000) in chick pea.

Containers significantly influence the vigor throughout the storage period. Higher vigour index (3139) was recorded in seeds stored in polythene bag as compared to cloth bag which recorded lower vigour index (2891) at the end of nine months of storage period. The vigour index decreased with increase in the storage period due to decrease in germination, shoot and root length and seedling dry weight. Containers also have significantly influence on the moisture content, electrical conductivity of seed leachate and percent seed infection and infestation at the end of eight months of storage period. Lower electrical conductivity of seed leachate (0.381 dSm^{-1}), moisture content (8.68%), per cent infection (1.08%) and infestation (.99%) were recorded in the seeds stored in polythene bag where as higher electrical conductivity of seed leachate, moisture content, percent, infection and infestation (0.576 dSm^{-1}, 9.80%, 2.28% and 2.57%, respectively) were recorded in the seeds stored in cloth bag at the end of eight months of storage. The moisture content, electrical conductivity of seed leachate, percent seed infection and infestation was increased with the increase in the storage period due to ageing of seeds and invasion by storage fungi. It is reported that polythene bag is more resistant to biotic and abiotic stresses. These results are in conformity with the findings of Zink and DcMendonca (1965) in pumpkin.

Interaction effect

Germination percentage, shoot length, root length, vigour index, seedling dry weight, and hundred seed weight, moisture content, quality of seed in terms of above mentioned parameters showed non-significant differences in the interaction effect between treatment and containers up to the end of storage period. The interaction effects of storage containers and seed treatments were found significant from fourth month of storage up to eighth month in electrical conductivity of seed leachate. Among interactions significantly maximum (0.416 dSm^{-1}) electrical conductivity was recorded in C_1T_1 (Untreated seeds stored in cloth bag) followed by C_1T_4 (seeds treated with deltametrin 2.8EC @ 0.4ml/kg seed and stored in cloth bag) (0.404 dSm^{-1}) and was minimum with C_2T_7 (seeds treated with polymer seed coating @ 10 ml/kg of seed + deltametrin 2.8EC @ 0.4ml/kg seed + bavistin (carbendazim) 50% WP @ 2g/kg seed and stored in polythene bag) (0.208 dSm^{-1}).

Table.1 Effect of polymer coating, chemical seed treatment and containers on seed germination percentage of sweet corn cv. Madhuri

Treatments	Initial month			First month			Second month			Third month			Fourth month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	98.10 (82.30)*	98.23 (82.56)	**98.17 (82.43)**	98.10 (82.29)	98.31 (82.64)	**98.21 (82.46)**	95.38 (77.63)	97.13 (80.45)	**96.26 (79.04)**	93.96 (75.83)	95.10 (77.29)	**94.53 (76.56)**	93.11 (74.88)	94.28 (76.21)	**93.70 (75.52)**
T_2	98.34 (82.64)	98.50 (83.44)	**98.42 (83.04)**	98.15 (82.35)	98.34 (82.70)	**98.25 (82.53)**	96.86 (79.83)	97.75 (81.44)	**97.31 (80.64)**	95.00 (77.19)	95.88 (78.37)	**95.44 (77.78)**	94.06 (75.94)	95.21 (78.66)	**94.64 (76.67)**
T_3	98.50 (83.19)	99.26 (85.17)	**98.88 (84.18)**	98.50 (83.22)	99.10 (84.73)	**98.80 (83.97)**	97.00 (81.36)	98.10 (82.24)	**97.55 (81.80)**	96.08 (78.63)	96.53 (79.32)	**96.31 (78.98)**	94.87 (76.94)	96.10 (77.53)	**95.48 (77.80)**
T_4	98.25 (82.50)	98.75 (83.75)	**98.50 (83.13)**	98.40 (82.26)	98.75 (83.73)	**98.58 (83.29)**	96.34 (79.10)	98.00 (82.07)	**97.17 (80.58)**	94.86 (76.94)	95.86(78.33)	**95.36 (77.63)**	93.86 (75.70)	95.29 (78.57)	**94.57 (76.61)**
T_5	99.10 (84.71)	99.20 (84.96)	**99.15 (84.83)**	99.00 (84.46)	99.45 (85.97)	**99.23 (85.22)**	97.60 (81.15)	98.45 (83.06)	**98.03 (82.10)**	96.14 (78.76)	97.47 (81.15)	**96.81 (79.96)**	95.37 (77.66)	96.03 (78.57)	**95.70 (78.11)**
T_6	98.68 (83.51)	98.75 (83.67)	**98.72 (83.59)**	98.75 (83.76)	98.90 (84.08)	**98.83 (83.92)**	96.88 (79.88)	98.15 (82.27)	**97.52 (81.07)**	95.90 (78.49)	96.51 (76.41)	**96.21 (78.95)**	94.73 (76.79)	95.53 (77.89)	**95.13 (77.34)**
T_7	99.26 (85.19)	99.30 (85.36)	**99.28 (85.27)**	99.15 (84.82)	99.07 (84.51)	**99.11 (84.66)**	97.90 (81.73)	98.56 (83.22)	**98.23 (82.47)**	96.90 (79.97)	97.79 (81.53)	**97.34 (80.75)**	95.78 (78.19)	96.53 (79.32)	**96.15 (78.75)**
T_8	98.75 (83.71)	98.90 (84.04)	**98.83 (83.88)**	98.80 (83.77)	98.75 (83.64)	**98.78 (83.71)**	97.30 (80.61)	98.12 (82.26)	**97.71 (81.43)**	96.33 (79.02	96.62 (79.59)	**96.48 (79.31)**	95.06 (77.20)	95.25 (77.61)	**95.15 (77.40)**
C=Mean	**98.62 (83.47)**	**98.86 (84.12)**	**98.74 (83.79)**	**98.61 (83.44)**	**98.83 (84.00)**	**98.72 (83.72)**	**96.91 (80.61)**	**98.03 (82.13)**	**97.47 (81.14)**	**95.65 (78.10)**	**96.47 (79.39)**	**96.06 (78.74)**	**94.60 (76.66)**	**95.53 (77.90)**	**95.06 (77.28)**

	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)
Container (C)	0.30	NS	0.28	NS	0.40	1.51	0.31	1.17	0.21	0.79
Treatments (T)	0.60	NS	0.57	NS	0.81	NS	0.63	2.33	0.42	1.58
C XT	0.85	NS	0.80	NS	1.14	NS	0.88	NS	0.60	NS

NS – Non significant   * Figures in the parenthesis are arcsine transformed values

Containers (C) : C_1- Cloth bag C_2-Polythen bag

Treatments (T)		
T_1-Control		T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed		T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed		T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed		T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Table.1b Effect of polymer coating, chemical seed treatment and containers on seed germination percentage of sweet corn cv Madhuri

Treatments	Fifth month			Sixth month			Seventh month			Nine month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	92.46 (74.11)*	93.53 (75.31)	**93.00 (74.71)**	91.39 (72.99)	92.35 (73.99)	**91.87 (73.49)**	86.73 (68.68)	88.73 (70.45)	**87.73 (69.57)**	81.82 (64.81)	86.07 (68.17)	**83.95 (66.49)**
T_2	93.08 (74.79)	94.17 (76.07)	**93.62 (75.43)**	92.10 (73.76)	93.12 (74.88)	**92.61 (74.32)**	88.43 (70.22)	89.47 (71.13)	**88.95 (70.67)**	83.54 (66.12)	86.47 (68.46)	**85.00 (67.29)**
T_3	93.15 (74.88)	94.56 (76.55)	**93.86 (75.72)**	91.44 (73.05)	93.02 (74.72)	**92.23 (73.88)**	89.09 (70.81)	90.79 (72.39)	**89.94 (71.60)**	86.05 (68.11)	88.23 (70.01)	**87.14 (69.09)**
T_4	92.94 (74.63)	94.04 (75.91)	**93.49 (75.27)**	92.02 (73.64)	92.79 (74.50)	**92.41 (74.07)**	87.33 (69.19)	89.15 (70.97)	**88.24 (70.08)**	82.76 (65.50)	86.43 (68.46)	**84.60 (66.98)**
T_5	94.10 (75.98)	95.05 (77.19)	**94.58 (76.58)**	92.83 (74.52)	94.07 (75.99)	**93.45 (75.25)**	90.53 (72.19)	92.27 (74.09)	**91.40 (73.14)**	87.21 (69.12)	89.85 (69.12)	**88.53 (70.39)**
T_6	93.55 (75.32)	94.38 (76.34)	**93.97 (75.83)**	92.36 (74.00)	93.24 (75.02)	**92.80 (74.51)**	89.36 (71.07)	90.09 (71.77)	**89.73 (71.42)**	84.89 (67.18)	87.19 (69.16)	**86.04 (68.17)**
T_7	94.46 (76.42)	95.64 (77.99)	**95.05 (77.21)**	93.14 (74.86)	94.76 (76.80)	**93.95 (75.83)**	91.09 (72.70)	93.40 (75.19)	**92.24 (73.95)**	88.75 (70.57)	90.60 (72.37)	**89.68 (71.47)**
T_8	94.04 (75.92)	94.79 (76.87)	**94.41 (76.39)**	93.02 (74.74)	94.36 (76.33)	**93.69 (75.54)**	90.15 (71.77)	91.54 (73.21)	**90.85 (72.49)**	86.67 (68.71)	89.00 (70.84)	**87.83 (69.77)**
C=Mean	**93.47 (75.26)**	**94.52 (76.53)**	94.00 (75.89)	**92.29 (73.94)**	**93.46 (75.28)**	92.88 (74.61)	**89.09 (70.83)**	**90.68 (72.40)**	89.88 (71.61)	**85.21 (67.52)**	**87.98 (69.89)**	86.60 (68.70)

	Fifth month S.Em±	Fifth month CD(P=0.01)	Sixth month S.Em±	Sixth month CD(P=0.01)	Seventh month S.Em±	Seventh month CD(P=0.01)	Nine month S.Em±	Nine month CD(P=0.01)
Container (C)	0.11	0.42	0.22	0.82	0.40	1.50	0.45	1.70
Treatments (T)	0.22	0.84	0.44	1.65	0.80	2.99	0.91	3.39
C XT	0.32	NS	0.63	NS	1.13	NS	1.29	NS

NS – Non significant; Containers (C) : C_1- Cloth bag; C_2-Polythen bag

Treatments (T)	
T_1-Control	T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed	T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed	T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed	T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Table.2a Effect of polymer coating, chemical seed treatment and containers on seedling vigour index of sweet corn cv. Madhuri

Treatments	Initial month			First month			Second month			Third month			Fourth month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	3867	3880	**3874**	3828	3863	**3846**	3576	3756	**3666**	3411	3557	**3484**	3288	3456	**3372**
T_2	3867	3879	**3873**	3824	3853	**3839**	3652	3803	**3728**	3525	3673	**3599**	3419	3557	**3488**
T_3	3917	3939	**3928**	3898	3919	**3908**	3738	3880	**3809**	3627	3745	**3686**	3531	3653	**3592**
T_4	3908	3927	**3918**	3875	3904	**3889**	3646	3804	**3725**	3477	3633	**3555**	3343	3534	**3438**
T_5	3932	3948	**3940**	3912	3950	**3931**	3795	3893	**3844**	3698	3811	**3754**	3613	3717	**3665**
T_6	3910	3917	**3914**	3892	3907	**3899**	3703	3871	**3787**	3580	3708	**3644**	3513	3599	**3556**
T_7	3963	3973	**3968**	3938	3954	**3946**	3851	3927	**3889**	3762	3887	**3825**	3657	3788	**3722**
T_8	3919	3919	**3919**	3897	3905	**3901**	3774	3850	**3812**	3663	3758	**3710**	3560	3649	**3605**
C=Mean	**3910**	**3923**	**3917**	**3883**	**3907**	**3895**	**3717**	**3848**	**3782**	**3593**	**3721**	**3657**	**3491**	**3619**	**3555**

	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)
Container (C)	34.35	NS	33.09	NS	18.01	67.19	17.36	64.77	17.99	67.13
Treatments (T)	68.70	NS	66.18	NS	36.01	134.38	34.72	129.55	35.98	134.26
C XT	97.16	NS	93.60	NS	50.93	NS	49.10	NS	50.88	NS

NS – Non significant Containers (C) : C_1- Cloth bag C_2-Polythen bag

Treatments (T)	
T_1-Control	T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed	T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed	T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed	T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Table.2b Effect of polymer coating, chemical seed treatment and containers on seedling vigour index of sweet corn cv. Madhuri

Treatments	Fifth month			Sixth month			Seventh month			Nine month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	3179	3359	**3269**	2911	3197	**3054**	2820	3081	**2951**	2607	2862	**2735**
T_2	3299	3438	**3369**	3082	3296	**3189**	2946	3207	**3077**	2785	3055	**2920**
T_3	3418	3548	**3483**	3221	3419	**3320**	3099	3304	**3202**	2957	3190	**3073**
T_4	3327	3419	**3373**	2989	3246	**3117**	2913	3131	**3022**	2708	2946	**2827**
T_5	3501	3624	**3563**	3344	3506	**3425**	3268	3419	**3344**	3056	3318	**3187**
T_6	3378	3515	**3446**	3169	3355	**3262**	3027	3251	**3139**	2893	3116	**3005**
T_7	3551	3696	**3623**	3404	3575	**3489**	3343	3495	**3419**	3131	3390	**3261**
T_8	3447	3592	**3520**	3294	3451	**3372**	3180	3345	**3262**	2993	3230	**3111**
C=Mean	**3388**	**3524**	**3456**	**3177**	**3381**	**3279**	**3075**	**3279**	**3177**	**2891**	**3139**	**3015**

	Fifth month S.Em±	Fifth month CD(P=0.01)	Sixth month S.Em±	Sixth month CD(P=0.01)	Seventh month S.Em±	Seventh month CD(P=0.01)	Nine month S.Em±	Nine month CD(P=0.01)
Container (C)	21.40	79.86	37.20	138.81	36.17	134.98	44.12	164.65
Treatments (T)	42.80	159.72	74.40	277.62	72.34	269.96	88.24	329.30
C XT	60.53	NS	105.21	NS	102.31	NS	124.80	NS

NS – Non significant; Containers (C) : C_1- Cloth bag C_2-Polythen bag

Treatments (T)		
T_1-Control		T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed		T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed		T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed		T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Table.3a Effect of polymer coating, chemical seed treatment and containers on seed infection (%) of sweet corn cv. Madhuri

Treatments	Initial month			First month			Second month			Third month			Fourth month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.07	0.01	**0.04**	0.16	0.07	**0.12**	1.36	0.63	**0.99**
T_2	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.05	0.03	**0.04**	1.13	0.42	**0.78**
T_3	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.01	0.00	**0.01**	0.30	0.13	**0.22**
T_4	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.08	0.04	**0.06**	0.86	0.31	**0.59**
T_5	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.04	0.01	**0.03**	0.42	0.19	**0.31**
T_6	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.05	0.02	**0.04**	0.94	0.36	**0.65**
T_7	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.02	0.01	**0.02**	0.21	0.10	**0.16**
T_8	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.03	0.02	**0.03**	0.29	0.14	**0.22**
C=Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.01**	**0.06**	**0.03**	**0.04**	**0.69**	**0.28**	**0.49**

	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)	S.Em±	CD(P=0.01)
Container (C)	0.001	NS	0.001	NS	0.01	NS	0.04	NS	0.00	0.02
Treatments (T)	0.001	NS	0.001	NS	0.03	NS	0.08	NS	0.01	0.04
C XT	0.001	NS	0.001	NS	0.04	NS	0.11	NS	0.01	0.05

NS – Non significant; Containers (C) : C_1- Cloth bag C_2-Polythen bag

Treatments (T)	
T_1-Control	T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed	T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed	T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed	T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Table.3b Effect of polymer coating, chemical seed treatment and containers on seed infection (%) of sweet corn cv. Madhuri

Treatments	Fifth month			Sixth month			Seventh month			Nine month		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	1.94	0.78	**1.36**	2.64	1.12	**1.88**	3.42	1.53	**2.48**	4.21	1.89	**3.05**
T_2	1.52	0.59	**1.06**	1.93	0.83	**1.38**	2.10	1.01	**1.56**	2.68	1.38	**2.03**
T_3	0.46	0.21	**0.34**	0.69	0.34	**0.52**	0.93	0.46	**0.70**	1.31	0.68	**1.00**
T_4	1.04	0.39	**0.72**	1.43	0.49	**0.96**	1.86	0.73	**1.30**	2.15	0.86	**1.51**
T_5	0.82	0.34	**0.58**	1.24	0.49	**0.87**	1.63	0.67	**1.15**	2.04	0.89	**1.47**
T_6	1.21	0.47	**0.84**	1.61	0.61	**1.11**	2.13	0.79	**1.46**	2.53	0.92	**1.73**
T_7	0.49	0.24	**0.37**	0.82	0.42	**0.62**	1.28	0.67	**0.98**	1.49	0.93	**1.21**
T_8	0.67	0.37	**0.52**	1.19	0.49	**0.84**	1.45	0.71	**1.08**	1.86	1.12	**1.49**
C=Mean	**1.02**	**0.42**	**0.72**	**1.44**	**0.60**	**1.02**	**1.85**	**0.82**	**1.34**	**2.28**	**1.08**	**1.68**

	Fifth month S.Em±	Fifth month CD(P=0.01)	Sixth month S.Em±	Sixth month CD(P=0.01)	Seventh month S.Em±	Seventh month CD(P=0.01)	Nine month S.Em±	Nine month CD(P=0.01)
Container (C)	0.01	0.02	0.01	0.03	0.01	0.04	0.01	0.05
Treatments (T)	0.01	0.05	0.02	0.07	0.02	0.09	0.03	0.11
C XT	0.02	0.07	0.03	0.10	0.03	0.12	0.04	0.15

NS – Non significant; Containers (C): C_1- Cloth bag C_2-Polythen bag

Treatments (T)	
T_1-Control	T_5- Polymer seed coating @ 10 ml/kg of seed + Bavistin (carbendazim) 50% WP @2g/kg seed
T_2- Polymer seed coating @ 10 ml/kg of seed	T_6- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed
T_3- Bavistin (carbendazim) 50% WP @ 2g/kg seed	T_7- Polymer seed coating @ 10 ml/kg of seed + Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed
T_4- Deltametrin 2.8EC @ 0.4ml/kg seed	T_8- Deltametrin 2.8EC @ 0.4ml/kg seed + Bavistin (carbendazim) 50% WP @ 2g/kg seed

Whereas, the C_2T_5 (seeds treated with polymer seed coating @ 10 ml/kg of seed and stored in polythene bag) recorded EC of (0.211 dSm^{-1}) after the fourth month of storage. Similar trend of electrical conductivity among the containers and treatments were recorded in entire storage period. These results are in conformity with the findings of Suresh and Renganayaki (2008) in maize seeds.

Significant difference was observed in interaction effects of storage containers and seed treatments from fourth month of storage up to nine months in seed infection. Among the interactions, significantly highest seed infection was recorded in C_1T_1 (1.36 %) (Untreated seeds stored in cloth bag) followed by C_1T_2 (polymer seed coating @ 10 ml/kg of seed and stored in cloth bag 1.13%) and lowest seed infection was seen in C_2T_7 (polymer seed coating @ 10 ml/kg of seed in combination of deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg treated seed and stored in polythene bag 0.10 %) and the same trend was continued up to the end of storage period. At the end of nine months of storage, significantly highest seed infection was recorded in C_1T_1 (4.21%) followed by C_1T_2 (2.68 %) and was minimum with C_2T_7 (0.93 %). The seeds stored in polythene bag helped in maintaining the seed quality at higher level due to less degradation of seed reserve and minimum influence of extrinsic factors. These results are in conformity with the findings of Suresh and Renganayaki (2008) in maize and Raikar *et al.*, (2011) in rice.

Insect infestation in sweet corn as influenced by the interaction effects of seed treatments and containers showed significant differences from second month of storage up to the end of storage period. Significantly highest seed infection was recorded in C_1T_1 (Untreated seeds stored in cloth bag, 0.31 % seed infection) and no insect damage was seen in other interaction after second month of storage. At the end of nine months of storage significantly highest seed infection was recorded in (7.94 %) C_1T_1 (untreated seeds stored in cloth bag) followed by C_1T_3 (bavistin (carbendazim) 50% WP @ 2g/kg seed and stored in cloth bag, 5.23 %) and was minimum with C_2T_4 (deltametrin 2.8EC @ 0.4ml/kg seed and stored in polythene bag, 0.43 %). These results are in conformity with the findings of Suresh and Renganayaki (2008) in maize seeds.

From the present investigation it is concluded that sweet corn seeds stored in polythene bag maintained better seed quality parameters throughout the storage period as compared to the seeds stored in cloth bag under ambient condition. Seed coating with polymer seed coating @ 10 ml/kg of seed in combination with deltametrin 2.8EC @ 0.4ml/kg seed and bavistin (carbendazim) 50% WP @ 2g/kg seed helped to maintain higher seed quality as compared to the coating with polymer alone for more than nine months.

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