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# Effect of Seed Coating with Polymers and Fungicide on Seed Quality of Chilli during Storage

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**ABSTRACT** An experiment was conducted at Seed Research Laboratory, National Seed Project (Crops), University of Agricultural Sciences, Dharwad, during 2006-07 to study the effect of seed coating with polymer and fungicide on seed quality of chilli cv. Byadagi Kaddi. The seeds were coated with polymer, fungicide and polymer dyes-fungicide combinations and stored in polythene bag for 12 months. Seed coating with polymer pink @ 20.00 ml per kg of seed and thiram @ 2.00 g per kg of seed ($T_4$) maintained the chilli seed germination above the minimum seed certification standard upto 12 months (69.83%), seedling length (14.76cm), vigour index (1030), field emergence (66.12%), electrical conductivity of seed leachate (2.011 dSm-1) and seed infection (7.30%) as compared to control.

**Key words:** Chilli, storage, seed quality, polymers and fungicide

Chilli (*Capsicum annuum* L.) is an important spice crop of global importance and belongs to the family Solanaceae and it is the most important commercial tropical vegetable crop of India ranks first in both area and production. Chilli is a poor storer and losses viability and vigour rapidly in storage. The success of seedling establishment at the field level largely depends on the initial quality of the seed. In recent times various quality enhancement treatments 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 seeds without significantly increasing the size or weight of seed. This type of plasticizer polymers form a flexible film that prevent dusting off and loss of fungicide during handling and are readily soluble in water (hydrophilic), so as not to impede with normal germination [1].

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 [2]. Film coating along with colourant is an emerging per-sowing seed management technique, recommended for high value agricultural crops [1]. Hence, an attempt was made to prolong the shelf life of the seeds through seed management practices for ambient storage conditions.

## MATERIAL AND METHODS

An experiment was conducted at Seed Research Laboratory, National Seed Project, University of Agricultural Sciences, Dharwad during 2006-07, to know the effect of polymers and fungicide on seed quality during storage. The freshly harvested seeds were taken and cleaned thoroughly. The seeds were dried to seven per cent moisture content and then imposed with following seed treatment which includes $T_1$ - Polymer blue @ 20.00ml + thiram @ 2.00g per kg of seed; $T_2$ - Polymer red @ 20.00ml + thiram @ 2.00g-per kg of seed; $T_3$ - Polymer green @ 20.00ml + thiram @ 2.00g per kg of seed; $T_4$ - Polymer pink @ 20.00ml + thiram @ 2.00g per kg of seed; $T_5$ - Polymer black @ 20.00ml + thiram

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@ 2.00g per kg of seed; $T_6$- Polymer clear @ 20.00ml + thiram @ 2.00g per kg of seed; $T_7$ -Polymer clear @ 20.00ml per kg of seed and $T_8$ - Control (Untreated) and stored for 12 months in polythene bag with four replications.

Five hundred grams of freshly harvested chilli cv. Byadagi Kaddi seeds were taken for each treatment. Care was taken during mixing to have uniformity in coating and the seeds were air dried under shade to bring back to its original moisture content. The experiment was laid in Completely Randomized Block Design with four replications.

Then the seeds were packed in polythene bag. The tri-monthly observation on germination percentage [3], seedling length, vigour index [4], field emergence, electrical conductivity of seed leachate [5] and per cent seed infection were recorded. The statistical analysis was done as per procedure [6].

## RESULTS AND DISCUSSION

Significant results were obtained due to polymer coating for all the seed quality parameters evaluated in the laboratory. The germination percentage gradually decreased from 84.97 to 67.42 per cent and it was above minimum seed certification standards (i.e., 60.00%) at the end of 12 months of storage. The effect of seed coating with chemicals on germination is concerned, all the treatments recorded significantly higher germination upto 12 months of storage as compared to control. Among the different treatment combinations, the seeds coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) recorded significantly higher germination (69.83%) followed by 69.00 per cent in $T_2$ (seed coating with polymer red @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed) as compared to control (64.97%) (Table 1).

The decline in germination percentage may be attributed to ageing effect, leading to depletion of food reserves and decline in synthetic 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 [7] and also due to dye treatment in sorghum [8]. Thiram 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 [9]. The film formed around seed act as a physical barrier, which has been reported to reduce leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo [10]. The higher germination percentage can be seen in polymer dye coated seeds. It is due to increase in the rate of imbibition where the fine particles in the coating acts as a "wick" or moisture attracting material or perhaps to improve germination.

Significantly higher seedling length (14.76 cm) was recorded in seeds coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) followed by 13.73 cm in $T_2$ (polymer red @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed) as compared to untreated seeds ($T_8$) which recorded lower seedling length (9.89 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 metabolics 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 (Table 1). Significantly higher vigour index (1030) was recorded in seeds coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) followed by 947 in $T_2$ (Seed coating with polymer red @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed) as compared to control ($T_8$) which recorded significantly lower seedling vigour index (642) 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 seedlings and decrease in seedling length. Similar findings were reported in sorghum [9] and chilli [11].

Significantly higher field emergence of (66.12%) was recorded in seeds coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) followed by 55.11 per cent in $T_2$

Table 1. Effect of seed coating with polymers and fungicide on germination (%), seedling quality of chilli under ambient conditions of storage

| Treatments | Months after storage | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Germination (%) | | | | | Seedling length (cm) | | | | | Seedling vigour index | | | | |
| | 0 | 3 | 6 | 9 | 12 | 0 | 3 | 6 | 9 | 12 | 0 | 3 | 6 | 9 | 12 |
| $T_1$ | 84.90* (67.11) | 83.19 (65.77) | 79.89 (63.33) | 74.49 (59.64) | 68.28 (55.70) | 18.30 | 16.57 | 15.40 | 14.17 | 12.91 | 1554 | 1378 | 1230 | 1056 | 881 |
| $T_2$ | 85.00 (67.19) | 83.92 (66.33) | 80.61 (63.85) | 75.58 (60.36) | 69.00 (56.14) | 18.41 | 17.39 | 16.22 | 15.03 | 13.73 | 1556 | 1456 | 1310 | 1138 | 947 |
| $T_3$ | 84.98 (67.17) | 83.71 (66.17) | 80.41 (63.7) | 75.11 (60.05) | 68.80 (56.02) | 18.41 | 17.19 | 16.02 | 14.79 | 13.53 | 1554 | 1438 | 1288 | 1112 | 930 |
| $T_4$ | 85.01 (67.19) | 84.75 (66.99) | 81.45 (64.46) | 75.85 (60.54) | 69.83 (56.66) | 18.40 | 18.32 | 17.15 | 15.99 | 14.76 | 1556 | 1552 | 1396 | 1215 | 1030 |
| $T_5$ | 84.98 (67.17) | 82.67 (65.37) | 79.05 (62.74) | 73.42 (58.94) | 66.79 (54.79) | 18.38 | 15.82 | 14.68 | 13.45 | 12.19 | 1554 | 1310 | 1160 | 987 | 814 |
| $T_6$ | 85.00 (67.19) | 82.04 (64.90) | 78.45 (62.32) | 72.84 (58.57) | 66.20 (54.43) | 18.41 | 15.13 | 13.96 | 12.73 | 11.47 | 1554 | 1241 | 1086 | 927 | 760 |
| $T_7$ | 84.90 (67.11) | 81.70 (67.11) | 78.05 (62.04) | 72.00 (58.03) | 65.50 (54.01) | 18.40 | 14.31 | 13.24 | 12.05 | 10.85 | 1556 | 1164 | 1030 | 870 | 712 |
| $T_8$ | 84.98 (67.17) | 80.78 (63.97) | 77.21 (61.46) | 71.60 (57.77) | 64.97 (53.69) | 18.41 | 13.50 | 12.33 | 11.12 | 9.89 | 1555 | 1093 | 951 | 769 | 642 |
| Mean | 84.97 (67.16) | 83.25 (65.97) | 79.39 (62.99) | 73.86 (59.24) | 67.42 (55.18) | 18.39 | 16.03 | 14.88 | 13.67 | 12.42 | 1554 | 1329 | 1181 | 1012 | 840 |
| S.Em± | 0.07 | 0.10 | 0.12 | 0.10 | 0.11 | 0.07 | 0.07 | 0.06 | 0.08 | 0.07 | 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 |

*Values in the parentheses are arc sine transformed values; NS: Non significant

$T_1$ - Polymer blue @ 20.00 ml + thiram @2.00 g per kg of seed
$T_2$ - Polymer red @ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_3$ - Polymer green @ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_4$ - Polymer pink @20.00 ml + thiram @ 2.00 g per kg of seed;
$T_5$ - Polymer black @ 20.00 ml + thiram @ 2.00 g per kg of seed;
$T_6$ - Polymer clear,@ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_7$ - Polymer clear @ 20.00 ml per kg of seed
$T_8$ - Control (untreated)

(Polymer red @ 20.00 ml per kg of seed and thiram @ 2.00g kg of seed) as compared to uncoated seeds ($T_8$) which recorded lower field emergence (39.13%) at he 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 imbibition where the fine particles in the coating act as a "wick" or moisture attracting material 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 [12].

Significantly lower electrical conductivity of seed leachate (2.011 $dsm^{-1}$) was recorded in seed coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) followed by 2.035 $dsm^{-1}$ in $T_2$ (polymer red @ 20.00 ml per kg of seed and thiram @ 2.00g per kg of seed) as compared to control ($T_8$) which recorded significantly higher electrical conductivity of seed leachate (2.160 $dsm^{-1}$) at the end of 12 months of storage period (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 Patil *et al.* [13] 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 [10].

In the present study, the fungal infection found

Table 2. Effect of seed coating with polymers and fungicide on field emergence (%), electrical conductivity of seed leachate ($dSm^{-1}$) and seed infection (%) of chilli under ambient conditions of storage

| Treatments | Months after storage | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field emergencee (%) | | | | | Electrical conductivity of seed leachate ($dSm^{-1}$) | | | | | Seed infection (%) | | | | |
| | 0 | 3 | 6 | 9 | 12 | 0 | 3 | 6 | 9 | 12 | 0 | 3 | 6 | 9 | 12 |
| $T_2$ | 82.10 (64.94)* | 71.80 (57.9) | 64.40 (53.35) | 56.00 (48.43) | 45.92 (42.64) | 0.343 | 0.429 | 1.240 | 1.825 | 2.079 | 3.00 (9.97)* | 3.93 (11.43) | 5.51 (13.57) | 7.40 (15.78) | 8.70 (17.75) |
| $T_2$ | 82.13 (64.97) | 76.50 (60.98) | 70.52 (57.43) | 63.55 (52.84) | 55.11 (47.91) | 0.342 | 0.384 | 1.198 | 1.790 | 2.035 | 3.10 (10.14) | 3.58 (10.9) | 5.17 (13.14) | 7.06 (15.7) | 8.36 (16.8) |
| $T_3$ | 82.11 (64.95) | 75.80 (60.51) | 69.52 (56.47) | 62.55 (52.25) | 54.55 (47.59) | 0.343 | 0.402 | 1.213 | 1.799 | 2.054 | 3.00 (9.97) | 3.75 (11.16) | 5.34 (13.36) | 7.23 (15.59) | 8.53 (16.97) |
| T4 | 82.11 (64.95) | 81.50 (64.5) | 77.81 (61.88) | 73.31 (58.87) | 66.12 (54.38) | 0.344 | 0.363 | 1.175 | 1.768 | 2.011 | 2.90 (9.80) | 3.15 (10.22) | 4.68 (12.49) | 6.00 (14.17) | 7.30 (15.67) |
| $T_5$ | 82.12 (64.96) | 69.40 (56.39) | 62.20 (52.04) | 54.40 (47.51) | 45.70 (42.52) | 0.342 | 0.451 | 1.265 | 1.850 | 2.084 | 3.10 (10.14) | 4.09 (11.66) | 5.68 (13.98) | 7.57 (15.96) | 8.87 (17.32) |
| $T_6$ | 82.12 (64.96) | 67.40 (55.16) | 59.21 (50.29) | 51.10 (45.61) | 42.70 (40.79) | 0.342 | 0.473 | 1.288 | 1.879 | 2.110 | 3.10 (10.14) | 4.26 (11.91) | 5.85 (13.99) | 7.74 (16.15) | 9.04 (17.49) |
| $T_7$ | 82.11 (64.95) | 66.00 (54.31) | 58.20 (49.7) | 49.80 (45.87) | 41.10 (39.86) | 0.342 | 0.495 | 1.310 | 1.905 | 2.139 | 3.10 (10.14) | 4.56 (12.32) | 6.20 (14.41) | 8.16 (16.59) | 9.65 (18.09) |
| $T_8$ | 82.11 (64.95) | 64.11 (53.18) | 56.22 (48.55) | 47.78 (43.71) | 39.13 (38.71) | 0.343 | 0.515 | 1.335 | 1.935 | 2.160 | 3.10 (10.14) | 4.80 (12.65) | 6.70 (15.00) | 8.60 (17.05) | 10.23 (18.65) |
| Mean | 82.11 (64.95) | 71.56 (57.87) | 64.76 (53.71) | 57.31 (49.26) | 48.79 (44.3) | 0.343 | 0.439 | 1.253 | 1.844 | 2.084 | 3.05 (10.05) | 4.02 (11.53) | 5.64 (13.72) | 7.47 (15.84) | 8.84 (17.27) |
| 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 | 0.020 | 0.023 | NS | 0.41 | 0.43 | 1.00 | 1.01 |

*Values in the parentheses are arc sine transformed values; NS: Non significant

$T_1$ - Polymer blue @ 20.00 ml + thiram @2.00 g per kg of seed
$T_2$ - Polymer red @ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_3$ - Polymer green @ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_4$ - Polymer pink @20.00 ml + thiram @ 2.00 g per kg of seed;
$T_5$ - Polymer black @ 20.00 ml + thiram @ 2.00 g per kg of seed;
$T_6$ - Polymer clear,@ 20.00 ml + thiram @ 2.00 g per kg of seed
$T_7$ - Polymer clear @ 20.00 ml per kg of seed
$T_8$ - Control (untreated)

significant influence from one month of storage upto 12 months. Significantly lower seed infection (7.30%) was recorded with seeds coated with polymer pink @ 20.00ml per kg of seed and thiram @ 2.00g per kg of seed ($T_4$) as compared to uncoated seeds ($T_8$) which recorded higher seed infection (12.63%) at the end of 12 months of storage (Table 2). However, non-significant results were recorded in $T_2$, $T_1$, $T_3$, $T_5$, $T_6$ treatment which were on par with each other. The infection by the fungal pathogen was comparatively low in above treatments compared to control (10.23%) due to the preventive mechanism in seeds coated with fungicide and similar findings were reported in maize [14].

The studies show that germination percentage, seedling length, vigour index, field emergence and lower electrical conductivity of seed leachate and per cent seed infection was recorded in the seeds coated with polymer pink @ 20.00ml per kg of seed and thiram 2.00g per kg of seed ($T_4$) and packed in polythene bag 700 gauge prolonged storage period by more than 12 months.

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