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# Maintenance of seed quality by seed treatment and packing materials during storage in onion (*Allium cepa* L.)

**Shantappa Tirakannanavar, Ashok, Ratnakar M Shet and Raghunath R**

**Abstract**
The storability experiment was conducted on onion seed cv. N-53 in the Laboratory of Department of Seed Science & Technology, at KRC College of Horticultural College Arabhavi. Freshly harvested seeds were stored for a period of 10 months under ambient condition to study the effect of seed treatment chemicals and containers on seed quality of stored onion seeds. Seeds were treated with captan (2g/kg), thiram (2g/ kg), *Trichoderma viride* (4g/ kg) and *Pseudomonas fluorescens* (5g/ kg) and packed in two containers viz.., Polythene bag (700 gauge) and cloth bag and stored under ambient condition. The results revealed that among the seed treatments the seeds were treated with captan (2g/kg) recorded significantly higher germination percentage (72.20%), seedling length (12.70 cm), seedling dry weight (28.10 mg) and vigour index (920) at the end of 10 months of storage. Between the storage containers, seeds packed in 700 gauge polythene bag recorded significantly the highest germination percentage (67.44%), seedling length (12.40 cm), seedling dry weight (28.42mg) and vigour index (845) compared to cloth bag at the end of 10 months of storage. The interaction effects showed no significant effects in these quality parameters.

**Keywords:** *Allium cepa*, *Trichoderma viride, Pseudomonas fluorescens*, captan, thiram, polythene bag, germination, vigour

## Introduction
Onion (*Allium cepa* L.) is one of the major bulb crops of the world and important commercial vegetable grown all over the world. Onion accounts for 90 per cent of the export of vegetables from India in terms of value. It is rich in vitamin 'B' and has traces of vitamin 'C'. It's important characteristic is pungency, which is due to a volatile oil comprising as many as 50 known compounds. Among these, major compound is allylprophyl disulphide (Anon., 1978) [3]. The bulb is useful as a heart stimulant. Extracts of onion are being used in the prevention of "antherosclerosis and coronary heart disease' as they can inhibit the aggregation of human blood platelets which form the clods, which have the potential for arterial blocking. It has got effects on lowering blood sugar and lipid with good coagulation efficiency.

Good seed is a basic input in vegetable production. Successful vegetable production programme depends on the quality of seeds used for sowing. Hence, the seed producers hold great responsibility of maintaining genetically pure seeds so as to preserve the quality of seeds from harvest to next sowing. Onion is an important vegetable crop, however the storage potential of onion is very poor and it loses its viability within a year under ambient storage conditions. 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, 1988) [4]. Among these, the major factors affecting the seed quality during storage are temperature and relative humidity, cause rapid deterioration of seed. Apart from this, fungi associated with stored seeds are mainly responsible for deterioration of seed quality and reduction in germination potential.

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, besides sanitation of the storage place. Seed treatment with chemicals is found to be more useful in storage for maintaining

better seed quality up to one year in onion by suppressing the storage pests and fungi (Gupta *et al*., 1989) [7]. The information on prolonging the shelf life of onion seeds under storage by using different seed treatment chemicals and packed in proper container is very limited and hence the present study has been undertaken with following objectives.

## Materials and Methods

Freshly harvested seeds of onion cv. N-53 were treated with captan (2g/kg), thiram (2g/ kg), *Trichoderma viride* (4g/ kg) and *Pseudomonas fluorescens* (5g/ kg) and packed in polythene bag (700 gauge) and cloth bag and stored for 10 months under ambient condition at KRC College of Horticultural College, Arabhavi, District Belgaum of Karnataka State. The bimonthly observations were recorded on seed germination (%), seedling length, seedling dry weight and vigour index. The laboratory germination test was conducted as per ISTA procedure by adopting rolled towel paper method (Anon., 1996) [3]. Vigour index was calculated by using the formula, VI = Germination per cent (%) x Total seedling length (cm) (Abdul-Baki and Anderson, 1973) [1]. Ten normal seedlings used for measuring seedling length were dried in a hot air oven at $70\pm1^0$C temperature for 24 hours. Then the seedlings were cooled in desiccators for 30 minutes and weight was recorded and expressed in milli grams (Evans and Bhatt, 1977) [5].

## Results and Discussion

The results of the germination per cent, seedling length, seedling dry weight and vigour index of onion seeds during two, four, six, eight and ten months of storage as influenced by seed treatment, containers and their interaction are presented in Tables 1 to 4.

**Table 1:** Effect of seed treatment and containers on germination percentage (%) of onion during storage cv. N – 53

| Treatments (T) | Storage period (Months) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 4 | | | 6 | | | 8 | | | 10 | | |
| | Containers | | | | | | | | | | | | | | |
| | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean |
| $T_1$ – Thiram (2g/kg) | 97.10 (80.20)* | 97.00 (80.30) | 97.05 (80.20) | 90.10 (71.66) | 90.80 (72.34) | 90.45 (71.95) | 87.30 (69.12) | 84.50 (66.82) | 85.91 (67.94) | 82.30 (65.12) | 75.00 (60.00) | 78.65 (62.44) | 74.00 (59.34) | 67.10 (55.00) | 70.55 (57.10) |
| $T_2$– Captan (2g/ kg) | 96.80 (79.70) | 98.00 (81.87) | 97.40 (80.72) | 91.20 (72.74) | 90.10 (71.66) | 90.65 (72.15) | 88.20 (69.91) | 85.80 (67.86) | 87.00 (68.87) | 83.80 (66.27) | 76.10 (60.73) | 79.95 (63.36) | 75.60 (60.40) | 68.80 (56.07) | 72.20 (58.18) |
| $T_3$ – *Trichoderma viride* (4g/ kg) | 97.00 (80.03) | 98.07 (82.08) | 97.53 (80.90) | 89.60 (70.91) | 91.00 (72.54) | 90.15 (71.66) | 84.30 (66.66) | 84.10 (66.50) | 84.20 (66.58) | 72.17 (58.12) | 70.20 (56.91) | 71.18 (79.48) | 65.00 (53.73) | 63.20 (52.65) | 64.10 (53.15) |
| $T_4$ – *Pseudomonas fluorescens* (5g/ kg) | 95.90 (78.32) | 96.03 (76.61) | 95.97 (78.32) | 89.10 (70.72) | 91.43 (72.95) | 90.27 (71.85) | 83.80 (66.27) | 80.70 (63.94) | 82.25 (66.05) | 71.10 (57.48) | 69.10 (56.23) | 70.10 (56.85) | 62.30 (52.12) | 58.30 (49.78) | 60.30 (50.94) |
| $T_5$ - Control | 95.00 (77.08) | 94.60 (76.69) | 94.80 (76.82) | 88.20 (69.91) | 90.93 (72.44) | 89.57 (71.19) | 91.20 (64.30) | 78.80 (62.58) | 80.00 (63.43) | 67.00 (54.94) | 66.30 (54.51) | 66.65 (54.70) | 60.30 (50.94) | 56.27 (48.62) | 58.20 (49.78) |
| Mean | 96.30 (78.91) | 96.74 (79.53) | 96.55 (79.37) | 89.58 (71.19) | 90.85 (72.44) | 90.22 (71.76) | 84.96 (67.21) | 82.78 (65.50) | 83.87 (66.34) | 75.27 (60.20) | 71.34 (57.61) | 73.31 (58.89) | 67.44 (55.18) | 62.73 (52.36) | 65.09 (53.79) |
| For comparing the means of | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% |
| Treatments (T) | 0.39 | | 1.14 | 0.80 | | NS | 0.55 | | 1.62 | 0.44 | | 1.27 | 0.47 | | 1.37 |
| Containers (C) | 0.10 | | NS | 0.21 | | NS | 0.15 | | 0.43 | 0.12 | | 0.34 | 0.12 | | 0.36 |
| Interactions (T × D) | 0.31 | | NS | 0.64 | | NS | 0.44 | | NS | 0.35 | | 1.05 | 0.37 | | NS |

Containers: $C_1$ – 700 gauge polythene bag, $C_2$ – Cloth bag, NS – Non significant, * - Angular transformed values

**Table 2:** Effect of seed treatment and containers on seedling length (cm) of onion during storage cv. N – 53

| Treatments (T) | Storage period (Months) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 4 | | | 6 | | | 8 | | | 10 | | |
| | Containers | | | | | | | | | | | | | | |
| | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean |
| $T_1$ – Thiram (2g/kg) | 16.10 | 16.53 | 16.32 | 15.20 | 15.60 | 15.40 | 14.50 | 14.10 | 14.30 | 14.00 | 13.00 | 13.50 | 13.30 | 11.60 | 12.45 |
| $T_2$– Captan (2g/ kg) | 16.30 | 16.30 | 16.30 | 16.00 | 16.00 | 16.00 | 15.00 | 14.30 | 14.65 | 14.20 | 13.20 | 13.70 | 13.60 | 11.80 | 12.70 |
| $T_3$ – *Trichoderma viride* (4g/ kg) | 16.80 | 16.90 | 16.85 | 16.30 | 15.73 | 16.02 | 14.80 | 14.00 | 14.40 | 13.80 | 12.80 | 13.30 | 12.80 | 11.00 | 11.90 |
| $T_4$ – *Pseudomonas fluorescens* (5g/ kg) | 15.80 | 15.50 | 15.65 | 15.10 | 14.80 | 14.95 | 14.00 | 13.90 | 13.95 | 12.40 | 11.60 | 12.00 | 11.60 | 10.20 | 10.90 |
| $T_5$ - Control | 16.00 | 15.80 | 15.90 | 14.90 | 15.00 | 14.95 | 13.30 | 12.30 | 12.80 | 12.30 | 10.70 | 11.50 | 10.90 | 09.60 | 10.25 |
| Mean | 16.20 | 16.21 | 16.20 | 15.90 | 14.43 | 15.46 | 14.32 | 13.72 | 14.02 | 13.34 | 12.26 | 12.80 | 12.40 | 10.84 | 11.64 |
| For comparing the means of | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% |
| Treatments (T) | 0.27 | | NS | 0.30 | | NS | 0.31 | | NS | 0.23 | | 0.67 | 0.21 | | 0.62 |
| Containers (C) | 0.07 | | NS | 0.08 | | NS | 0.08 | | NS | 0.07 | | 0.18 | 0.06 | | 0.16 |
| Interactions (T × D) | 0.22 | | NS | 0.24 | | NS | 0.25 | | NS | 0.18 | | NS | 0.17 | | 0.49 |

Containers: $C_1$ – 700 gauge polythene bag, $C_2$ – Cloth bag, NS – Non significant,

**Table 3:** Effect of Seed treatment and containers on seedling dry weight (mg) of onion during storage cv. N – 53

| Treatments (T) | Storage period (Months) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 4 | | | 6 | | | 8 | | | 10 | | |
| | Containers | | | | | | | | | | | | | | |
| | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean |
| $T_1$ – Thiram (2g/kg) | 41.00 | 41.00 | 41.00 | 38.40 | 38.60 | 38.50 | 35.40 | 34.80 | 35.10 | 32.44 | 29.20 | 30.82 | 29.90 | 24.80 | 27.35 |
| $T_2$– Captan (2g/ kg) | 42.20 | 41.30 | 41.25 | 40.20 | 39.40 | 39.80 | 36.20 | 35.10 | 35.65 | 33.40 | 30.40 | 31.90 | 31.00 | 25.20 | 28.10 |
| $T_3$ – *Trichoderma viride* (4g/ kg) | 41.50 | 41.80 | 41.65 | 40.00 | 39.73 | 39.87 | 35.80 | 34.00 | 35.90 | 32.50 | 29.10 | 30.80 | 29.00 | 24.00 | 26.50 |
| $T_4$ – *Pseudomonas fluorescens* (5g/ kg) | 40.20 | 39.20 | 39.70 | 37.90 | 37.40 | 37.65 | 34.60 | 32.10 | 33.35 | 30.60 | 28.40 | 29.50 | 26.40 | 23.20 | 24.85 |
| $T_5$ - Control | 40.30 | 38.10 | 39.20 | 37.60 | 37.10 | 37.35 | 33.80 | 31.80 | 32.80 | 30.10 | 28.10 | 29.10 | 25.80 | 22.00 | 23.90 |
| Mean | 40.84 | 40.28 | 40.56 | 38.82 | 38.45 | 38.63 | 35.16 | 33.57 | 34.36 | 31.81 | 29.04 | 30.42 | 28.42 | 23.86 | 26.15 |
| For comparing the means of | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% |
| Treatments (T) | 0.61 | | NS | 0.39 | | 1.15 | 0.33 | | 0.96 | 1.12 | | 1.13 | 0.36 | | 1.07 |
| Containers (C) | 0.16 | | NS | 0.10 | | NS | 0.09 | | 0.26 | 0.10 | | 0.30 | 0.10 | | 0.28 |
| Interactions (T × D) | 0.49 | | NS | 0.31 | | NS | 0.26 | | NS | 0.90 | | NS | 0.29 | | NS |

Containers: $C_1$ – 700 gauge polythene bag, $C_2$ – Cloth bag, NS – Non significant

**Table 4:** Effect of Seed treatment and containers on Vigour index of onion during storage cv. N – 53

| Treatments (T) | Storage period (Months) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 4 | | | 6 | | | 8 | | | 10 | | |
| | Containers | | | | | | | | | | | | | | |
| | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean | $C_1$ | $C_2$ | Mean |
| $T_1$ – Thiram (2g/kg) | 1563 | 1552 | 1558 | 1371 | 1426 | 1399 | 1266 | 1191 | 1229 | 1152 | 0975 | 1064 | 0984 | 0699 | 0841 |
| $T_2$– Captan (2g/ kg) | 1578 | 1587 | 1588 | 1459 | 1444 | 1425 | 1323 | 1227 | 1275 | 1190 | 1004 | 1097 | 1028 | 0812 | 0920 |
| $T_3$ – *Trichoderma viride* (4g/ kg) | 1633 | 1660 | 1646 | 1459 | 1450 | 1454 | 1248 | 1177 | 1213 | 0996 | 0899 | 0948 | 0832 | 0695 | 0764 |
| $T_4$ – *Pseudomonas fluorescens* (5g/ kg) | 1515 | 1489 | 1502 | 1347 | 1305 | 1326 | 1173 | 1123 | 1148 | 0850 | 0771 | 0810 | 0723 | 0595 | 0659 |
| $T_5$ - Control | 1519 | 1495 | 1507 | 1310 | 1315 | 1312 | 1080 | 0969 | 1025 | 0824 | 0473 | 0648 | 0657 | 0540 | 0599 |
| Mean | 1562 | 1559 | 1560 | 1389 | 1388 | 1389 | 1218 | 1137 | 1178 | 1002 | 0824 | 0913 | 0845 | 0668 | 0576 |
| For comparing the means of | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% | SE m± | | CD at 5% |
| Treatments (T) | 18.32 | | 53.61 | 32.11 | | NS | 27.95 | | 81.76 | 35.56 | | 104.03 | 15.23 | | 44.55 |
| Containers (C) | 04.89 | | NS | 08.56 | | NS | 07.45 | | NS | 09.48 | | 027.74 | 04.06 | | 11.88 |
| Interactions (T × D) | 14.66 | | NS | 25.69 | | NS | 22.36 | | NS | 28.45 | | NS | 12.18 | | NS |

Containers: $C_1$ – 700 gauge polythene bag, $C_2$ – Cloth bag, NS – Non significant

A gradual decrease in germination per cent, seedling length, seedling dry weight and vigour index were noticed with increase in storage period. Seed treatment showed significant influence on germination percentage. The germination was maximum (72.20%) with captan treated seeds followed by the seeds treated with thiram (70.55 %) at the end of 10 months of storage (Table 1). The germination was minimum (58.20%) in control at the end of 10 months of storage. The highest germination could be due to effective control of storage diseases and insect pests. The decrease in seed quality during storage may be attributed to ageing effects, leading to depletion of food reserves and decline in synthetic activity of the embryo apart from death of seeds because of fungal invasion (Gupta and Singh, 1993) [7]. However, the average germination was above the minimum seed certification standards (70.0%) even after 10th months of storage. The similar results were reported in onion by Singh *et al*., (1996) [14], Gupta *et al*., (1989) [8] and Sharma *et al*., (2000) [13] in chilli by Grover and Bansal (1970) [6] and in brinjal by Sushma (2003) [15].

The germination percentage vary significantly due to containers and it was maximum in seed stored in 700 gauge polythene bag (67.44%) compared to cloth bag (62.73%) at end 10 months of storage. Similar results were observed by Vijayakumar *et al*., 1991 [16], Singh *et al*., (1996) [14] and Nagaveni (2005) [10] in onion. The interaction effects during 10 months of storage did not vary significant.

Seed treatment showed significant influence on seedling length, seedling dry weight and vigour index at the end of 10 months of storage (Table 2, 3 & 4). At the end of 10 months of storage, the maximum seedling length (12.70cm), seedling dry weight (28.10 mg) and vigour index (920) were recorded in captan treatment and it was on par seeds treated with thiram (12.45cm, 27.35mg and 841, respectively). The lowest seedling length (10.25cm), seedling dry weight (23.90 mg) and vigour index (576) was noticed with control treatment at the end of 10 month's storage.

Seedling length, Seedling dry weight and vigour index showed significant influence on containers at the end of 10 months of storage. The maximum seedling length (12.40cm), seedling dry weight (28.42 mg) and vigour index (845) was observed with seeds are packed in $C_1$ container (700 gauge polythene bag). The lowest seedling length (10.84cm), seedling dry weight (23.86 mg) and vigour index (668) was noticed in $C_2$ container (cloth bag) at the end of 10 month's storage. The superiority of 700 gauge polythene bag in maintaining the higher seed quality parameters has been reported earlier by Pandey *et al*., 1994 [11] and Jagadish *et al*., 1994 [9] in onion seeds and Shantappa and Munikrishnappa (2011) [12] in bitter gourd.

The interaction effects of seed treatment and containers did not vary significant at the end of 10 months of storage for seedling dry weight and vigour index. Interaction effects showed significant influence for seedling length. The maximum seedling length was observed in the seeds are

treated with captan and packed in 700 gauge polythene bag ($T_2C_1$) at the end of 10 months of storage(13.60cm) and it was on par with $T_1C_1$ treatment combination (13.30cm). Similar results were reported by Singh *et al*., (1996) [14] and Nagaveni (2005) [10] in onion.

Finally it can be concluded that the seeds of onion cv. N-53 treated with captan or thiram and packed in polythene bag (700 gauges) and stored for 10 months under ambient condition maintained maximum seed quality i.e. more than minimum seed certification standard of 70 per cent germination.

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