*Available online at* www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7056

**ISSN: 2320 – 7051**

*Int. J. Pure App. Biosci.* **6 (6):** 80-86 (2018)

International Journal of Pure & Applied Bioscience

*Research Article*

OPEN ACCESS

# Effect of Cold Storage Condition on Viability and Vigour of Groundnut Seeds

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Received: 5.11.2018 | Revised: 3.12.2018 | Accepted: 8.12.2018

**ABSTRACT**

*The study was undertaken in order to know the effect of cold storage conditions on viability and vigour of groundnut seeds. The seeds produced in different locations were stored in different containers in the form of pods and kernels under cold storage condition. Among them, the seeds produced at Bagalkot and stored as pods in vacuum pack recorded significantly higher seed quality parameters, compared to other locations viz Dharwad and Kumta, kernel form and containers viz polylined gunny bag and HDPE bag. The seeds produced in Bagalkot, stored as pods in vacuum packing recorded significantly higher germination per cent (73.70 %), seedling length (18.36 cm) and seedling vigour index (2179) compared to other treatments.*

***Key words:*** *Viability, Vigour, Vacuum pack, Germination, Groundnut.*

## INTRODUCTION

Groundnut is a major oilseed crop amenable for seed viability deterioration. The seed produced needs to maintain its quality parameters from the time of harvest till the time it is again sown back in the field. Seed viability has been recognized as one of the important aspects of seed quality. Several pre and post-harvest factors affect seed yield and quality. Good quality seeds not only perform better in fields but also in storage. Loss of seed viability due to deterioration in storage is inexorable, irreversible, inevitable, but the rate of deterioration can be slowed down by producing the seeds in suitable agroclimatic location, storing the seeds at cold storage conditions having low relative humidity, optimum temperature, safe seed moisture content apart from using moisture impervious containers. Hence, primary objective is to store seeds under controlled conditions, to maintain original quality of the seeds and to minimize deteriorative changes during storage. With this background, an attempt was made to ascertain the influence of cold storage condition on seed longevity in groundnut.

## MATERIAL AND METHODS

Seed materials (GPBD-4) required for storage experiments were produced during *rabi/summer* season of 2015-16 and stored under cold storage conditions in cold storage unit Dharwad.

**Cite this article:** Sujatha, M. and Uppar, D. S., Effect of Cold Storage Condition on Viability and Vigour of Groundnut Seeds, *Int. J. Pure App. Biosci.* **6(6):** 80-86 (2018). doi: http://dx.doi.org/10.18782/2320-7051.7056

It consists of three factors *viz.*, Factor-I: Production locations (L) ($L_1$-Dharwad, $L_2$-Bagalkot, $L_3$-Kumata), Factor-II: Seed forms (S) ($F_1$-Pod, $F_2$-Kernel) and Factor-III: Storage containers (B) ($B_1$-Polylined gunny bag, $B_2$-HDPE bag, $B_3$-Vacuum pack container). Seed materials were collected bimonthly to assess the seed quality parameters in laboratory of National Seed Project, University of Agricultural Sciences, Dharwad.

## RESULT AND DISCUSSION

The present study on storability of seeds produced in three different agro-climatic conditions of Karnataka revealed that, there was a significant influence of production locations on initial seed quality and storability. The seeds produced at Bagalkot ($L_1$) location and stored in cold storage condition maintained higher seed germination (74.50 %), followed by Dharwad ($L_2$) (73.07 %) and Kumta ($L_3$) (70.18 %) which was above prescribed minimum standard of seed certification for germination (70.00 %) up to $6^{th}$ month of storage (Table 1). The seeds produced at Bagalkot ($L_1$) recorded significantly higher seedling length and seedling vigour index (16.91 cm & 955 respectively) at the end of 12 months of storage compared to Dharwad and Kumta (Table 2 & 3).

In the present investigation the provenance influenced the seed germination significantly under cold condition. Irrespective of other treatments, the seeds produced at Bagalkot ($L_2$) recorded significantly higher seed germination throughout the storage period followed by Dharwad location ($L_1$) and lower seed germination was recorded in Kumta location ($L_3$). The seeds preserved in the cold storage maintained higher seed viability, vigour and quality because of lower respiration rate and metabolic activity as it is evidenced by higher germination at the end of 12 months of storage period. Also at low temperature, degradation rate of stored food is lower as compared to higher temperature which helped to increase the germinability and vigour of the seeds for longer time[4].

The seeds stored in the form of pods ($F_1$) recorded significantly higher seed germination throughout the storage period over kernel storage ($F_2$) under cold condition. The seeds stored as both pods and kernels retained germination per cent (70.00 %) above minimum seed certification standards up to $6^{th}$ month of storage under cold condition. Between Kernel and pod storage, pod storage was able to maintain higher germination, seedling length and seedling vigour index (56.68 %, 16.46 cm & 947) compared to kernels (50.07 %, 15.57 cm & 795) at the end of twelve months of storage which might be due to lower respiration rate and metabolic activity at lower temperature. Higher seedling vigour parameters is an indication of maintenance of vigour in the seeds preserved in cold storage. These results are in accordance with Basavegowda *et al.*[1], in chickpea and Salimath *et al.*[6], in green gram.

Among the containers, vacuum packed seeds of groundnut stored under cold condition were found better over polylined gunny bag and HDPE bag. In the vacuum packed bags, germination values were higher than polylined gunny bag and HDPE bag. Significantly higher germination, values were recorded in the vacuum packed seeds ($B_3$) (72.31%), which was above the prescribed seed certification standard (70%) up to eight months of storage, as compared to polylined gunny bag ($B_2$) (66.19%) and HDPE bag ($B_1$) (51.43%), while it was up to $6^{th}$ and $4^{th}$ month of storage in poly lined gunny bag and HDPE, respectively. This could be due to differential response between containers as optimum seed moisture content in vacuum packed is maintained since these are impervious to the exchange of water vapour from the atmosphere. While the polylined gunny bag and HDPE bag contain minute pores through which there is possibility of gain or loss of seed moisture content and hence, the seeds cannot be stored for longer period without deterioration in the quality. These results are in

agreement with the findings of Meena[3] in groundnut, Biradar[2], in soybean, Naik[5].

The interaction among L x F x B were found significant for seed germination, seedling length and seedling vigour index. The seeds produced at Bagalkot and stored as pod in vacuum pack were significantly superior and germination maintained upto eight months (73.70%), followed by Dharwad (72.95%) and Kumta (69.56%). Kumta seeds stored in HDPE bag found to be poor (44.30%). They also maintained significantly higher seedling length (18.36 cm) and seedling vigour index (2179) compared to Dharwad and Kumta at 12th month of storage. The seeds of Bagalkot stored as pods in vacuum packing were found to have better storability under cold storage conditions, followed by Dharwad.

**Table 1: Effect of provenance, storage containers and seed forms on germination (%) in summer groundnut stored under cold condition**

| Treatments | | Months after storage | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Initial | 2nd month | 4th month | 6th month | 8th month | 10th month | 12th month |
| Locations (L) | Dharwad ($L_1$) | 90.33(71.93) | 87.05(69.00) | 81.89(65.01) | 73.07(58.93) | 63.88(53.23) | 58.07(49.76) | 53.91(47.32) |
| | Bagalkot ($L_2$) | 91.30(72.90) | 88.10(69.91) | 83.06(65.88) | 74.50(59.90) | 65.56(54.26) | 59.91(50.86) | 55.70(48.37) |
| | Kumta ($L_3$) | 90.46(72.06) | 85.85(68.02) | 80.20(63.78) | 70.18(57.06) | 60.49(51.18) | 54.68(47.76) | 50.52(45.32) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 0.61 | 0.33 | 0.35 | 0.38 | 0.39 | 0.41 | 0.40 |
| | C. D. (0.01) | NS | 1.23 | 1.32 | 1.40 | 1.44 | 1.52 | 1.48 |
| Forms of storage (F) | Pod ($F_1$) | 90.70(72.30) | 87.69(69.56) | 82.97(65.81) | 74.98(60.17) | 65.96(54.47) | 60.38(51.13) | 56.68(48.95) |
| | Kernel ($F_2$) | 90.70(72.30) | 86.31(68.40) | 80.47(63.960 | 70.18(57.08) | 60.66(51.30) | 54.73(47.79) | 50.07(45.05) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 0.49 | 0.27 | 0.29 | 0.31 | 0.32 | 0.33 | 0.32 |
| | C. D. (0.01) | NS | 1.00 | 1.08 | 1.14 | 1.18 | 1.24 | 1.21 |
| Bags for storage (B) | HDPE bag ($B_1$) | 90.70(72.30) | 84.51(66.90) | 76.22(60.880 | 64.39(53.42) | 51.43(45.85) | 43.74(41.41) | 38.08(38.10) |
| | Polylined gunny bag ($B_2$) | 90.70(72.30) | 87.41(69.27) | 82.78(65.550 | 74.65(59.85) | 66.19(54.50) | 60.79(51.27) | 56.64(48.86) |
| | Vacuum packing ($B_3$) | 90.70(72.30) | 89.08(70.76) | 86.16(68.23) | 78.70(62.61) | 72.31(58.31) | 68.14(55.69) | 65.42(54.04) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 0.61 | 0.33 | 0.35 | 0.38 | 0.39 | 0.41 | 0.40 |
| | C. D. (0.01) | NS | 1.23 | 1.32 | 1.40 | 1.44 | 1.52 | 1.48 |
| Interaction (LxF) | $L_1F_1$ | 90.33(71.93) | 87.77(69.60) | 83.18(65.96) | 75.52(60.50) | 66.58(54.84) | 60.97(51.48) | 57.36(49.35) |
| | $L_1F_2$ | 90.33(71.93) | 86.33(68.39) | 80.61(64.06) | 70.61(57.35) | 61.18(51.61) | 55.18(48.05) | 50.47(45.28) |
| | $L_2F_1$ | 91.30(72.90) | 88.81(70.54) | 84.35(66.85) | 76.92(61.48) | 68.23(55.86) | 62.73(52.53) | 58.85(50.24) |
| | $L_2F_2$ | 91.30(72.90) | 87.38(69.29) | 81.78(64.91) | 72.08(58.31) | 62.90(52.65) | 57.09(49.18) | 52.55(46.51) |
| | $L_3F_1$ | 90.46(72.06) | 86.48(68.54) | 81.38(64.64) | 72.50(58.54) | 63.07(52.71) | 57.45(49.39) | 53.84(47.27) |
| | $L_3F_2$ | 90.46(72.06) | 85.22(67.51) | 79.02(62.91) | 67.85(55.59) | 57.91(49.65) | 51.91(46.13) | 47.20(43.36) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 0.86 | 0.47 | 0.50 | 0.53 | 0.55 | 0.58 | 0.56 |
| | C. D. (0.01) | NS | 1.74 | 1.87 | 1.98 | 2.04 | 2.15 | 2.09 |
| Interaction (LxB) | $L_1B_1$ | 90.33(71.93) | 85.00(67.27) | 76.83(61.29) | 65.08(53.83) | 52.03(46.19) | 44.28(41.73) | 38.62(38.42) |
| | $L_1B_2$ | 90.33(71.93) | 87.25(69.12) | 82.75(65.54) | 74.75(59.90) | 66.50(54.68) | 61.00(51.39) | 56.85(48.98) |
| | $L_1B_3$ | 90.33(71.93) | 88.91(70.59) | 86.10(68.20) | 79.36(63.04) | 73.10(58.81) | 68.93(56.17) | 66.27(54.54) |
| | $L_2B_1$ | 91.30(72.90) | 86.04(68.12) | 78.04(62.11) | 66.48(54.69) | 53.68(47.14) | 46.12(42.79) | 40.46(39.50) |
| | $L_2B_2$ | 91.30(72.90) | 88.32(70.06) | 84.02(66.49) | 76.52(61.11) | 68.77(56.08) | 63.57()52.92 | 59.42(50.48) |
| | $L_2B_3$ | 91.30(72.90) | 89.94(71.56) | 87.13(69.03) | 80.49(63.89) | 74.24(59.55) | 70.04(56.86) | 67.22(55.13) |
| | $L_3B_1$ | 90.46(72.06) | 82.50(65.32) | 73.78(59.23) | 61.60(51.75) | 48.58(44.21) | 40.83(39.72) | 35.17(36.37) |
| | $L_3B_2$ | 90.46(72.06) | 86.65(68.61) | 81.58(64.63) | 72.68(58.54) | 63.29(52.75) | 57.79(49.51) | 53.64(47.13) |
| | $L_3B_3$ | 90.46(72.06) | 88.40(70.14) | 85.25(67.47) | 76.25(60.90) | 69.60(56.58) | 65.43(54.04) | 62.77(52.46) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 1.05 | 0.57 | 0.61 | 0.65 | 0.67 | 0.71 | 0.69 |
| | C. D. (0.01) | NS | 2.13 | 2.29 | 2.42 | 2.49 | 2.63 | 2.56 |
| Interaction (FxB) | $F_1B_1$ | 90.70(72.30) | 85.73(67.88) | 77.84(61.98) | 67.63(55.37) | 55.28(48.06) | 47.34(43.50) | 40.96(39.80) |
| | $F_1B_2$ | 90.70(72.30) | 87.69(69.51) | 84.04(66.51) | 76.94(61.37) | 68.91(56.16) | 63.51(52.88) | 60.84(51.30) |

| Treatments | | Months after storage | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Initial | 2nd month | 4th month | 6th month | 8th month | 10th month | 12th month |
| | $F_1B_3$ | 90.70(72.30) | 89.64(71.28) | 87.02(68.95) | 80.36(63.78) | 73.69(59.20) | 70.30(57.02) | 68.25()55.75 |
| | $F_2B_1$ | 90.70(72.30) | 83.29(65.92) | 74.59(59.77) | 61.15(51.47) | 47.58(43.64) | 40.14(39.33) | 35.20(36.40) |
| | $F_2B_2$ | 90.70(72.30) | 87.12(69.02) | 81.52(64.59) | 72.36(58.33) | 63.46(52.85) | 58.06(49.67) | 52.43(46.42) |
| | $F_2B_3$ | 90.70(72.30) | 88.52(70.24) | 85.30(67.52) | 77.04(61.44) | 70.94(57.43) | 65.97(54.36) | 62.59(52.34) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 0.86 | 0.47 | 0.50 | 0.53 | 0.55 | 0.58 | 0.56 |
| | C. D. (0.01) | NS | 1.74 | 1.87 | 1.98 | 2.04 | 2.15 | 2.09 |
| Interaction (LxFxB) | $L_1F_1B_1$ | 90.33(71.93) | 86.33(68.34) | 78.66(62.54) | 68.66(55.99) | 56.16(48.56) | 48.16(43.97) | 41.83(40.32) |
| | $L_1F_1B_2$ | 90.33(71.93) | 87.50(69.34) | 84.00(66.49) | 77.00(61.39) | 69.20(56.33) | 63.70(52.98) | 61.20(51.50) |
| | $L_1F_1B_3$ | 90.33(71.93) | 89.48(71.12) | 86.88(68.85) | 80.88(64.13) | 74.38(59.63) | 71.04(57.48) | 69.04(56.23) |
| | $L_1F_2B_1$ | 90.33(71.93) | 83.66(66.20) | 75.00(60.04) | 61.50(51.68) | 47.90(43.82) | 40.40(39.48) | 35.40(36.53) |
| | $L_1F_2B_2$ | 90.33(71.93) | 87.00(68.91) | 81.50(64.58) | 72.50(58.41) | 63.80(53.04) | 58.30(49.80) | 52.50(46.46) |
| | $L_1F_2B_3$ | 90.33(71.93) | 88.33(70.07) | 85.33(67.55) | 77.83(61.96) | 71.83(57.98) | 66.83(54.87) | 63.50(52.86) |
| | $L_2F_1B_1$ | 91.30(72.90) | 87.37(69.23) | 79.87(63.38) | 70.07(56.88) | 57.82(49.53) | 50.02(45.03) | 43.52(41.30) |
| | $L_2F_1B_2$ | 91.30(72.90) | 88.57(70.28) | 85.27(67.47) | 78.77(62.64) | 71.47(57.75) | 66.27(54.53) | 63.27(52.73) |
| | $L_2F_1B_3$ | 91.30(72.90) | 90.50(72.10) | 87.90(69.69) | 81.90(64.92) | 75.40(60.31) | 71.90(58.03) | 69.75(56.68) |
| | $L_2F_2B_1$ | 91.30(72.90) | 84.70(67.01) | 76.21(60.84) | 62.89(52.50) | 49.54(44.76) | 42.22(40.54) | 37.39(37.71) |
| | $L_2F_2B_2$ | 91.30(72.90) | 88.07(69.84) | 82.77(65.51) | 74.27(59.58) | 66.07(54.41) | 60.87(51.31) | 55.57(48.22) |
| | $L_2F_2B_3$ | 91.30(72.90) | 89.37(71.02) | 86.37(68.38) | 79.08(62.86) | 73.08(58.78) | 68.19(55.70) | 64.69(53.58) |
| | $L_3F_1B_1$ | 90.46(72.06) | 83.50(66.07) | 75.00(60.03) | 64.15(53.25) | 51.85(46.08) | 43.85(41.49) | 37.52(37.78) |
| | $L_3F_1B_2$ | 90.46(72.06) | 87.00(68.91) | 82.85(65.57) | 75.05(60.08) | 66.05(54.39) | 60.55(51.12) | 58.05(49.68) |
| | $L_3F_1B_3$ | 90.46(72.06) | 88.95(70.63) | 86.30(68.32) | 78.30(62.28) | 71.30(57.64) | 67.96(55.57) | 65.96(54.35) |
| | $L_3F_2B_1$ | 90.46(72.06) | 81.50()64.56 | 72.55(58.43) | 59.05(50.24) | 45.31(42.33) | 37.81(37.96) | 32.81(34.95) |
| | $L_3F_2B_2$ | 90.46(72.06) | 86.30(68.32) | 80.30(63.69) | 70.30(57.01) | 60.52(51.10) | 55.02(47.91) | 49.22(44.58) |
| | $L_3F_2B_3$ | 90.46(72.06) | 87.85(69.64) | 84.20(66.62) | 74.20(59.51) | 67.90(55.52) | 62.90(52.51) | 59.57(50.56) |
| | Mean | 90.70(72.30) | 87.00(68.98) | 81.72(64.89) | 72.58(58.63) | 63.31(52.89) | 57.55(49.46) | 53.38(47.00) |
| | S. Em. ± | 1.48 | 0.81 | 0.87 | 0.92 | 0.95 | 1.00 | 0.97 |
| | C. D. (0.01) | NS | 3.01 | 3.23 | 3.43 | 3.53 | 3.72 | 3.63 |

- Figures in parenthesis indicate arcsine transformed values.

**Table 2: Effect of provenance, storage containers and seed forms on germination (%) in summer groundnut under ambient condition**

| Treatments | | Months after storage | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Initial | 2nd month | 4th month | 6th month | 8th month | 10th month | 12th month |
| Locations (L) | Dharwad ($L_1$) | 90.33(71.93) | 85.72(67.91) | 79.27(63.52) | 70.00(56.98) | 60.27(50.66) | 53.08(47.34) | 49.34(45.14) |
| | Bagalkot ($L_2$) | 91.30(72.90) | 86.93(68.92) | 80.80(64.56) | 71.68(58.03) | 62.50(51.99) | 55.76(48.78) | 52.14(46.67) |
| | Kumta ($L_3$) | 90.46(72.06) | 84.97(67.31) | 77.57(61.95) | 65.52(54.20) | 53.56(46.71) | 45.91(42.60) | 40.91(39.58) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 0.61 | 0.32 | 0.36 | 0.41 | 0.42 | 0.43 | 0.46 |
| | C. D (0.01) | NS | 1.18 | 1.35 | 1.53 | 1.58 | 1.62 | 1.70 |
| Forms of storage (F) | Pod ($F_1$) | 90.70(72.30) | 86.70(68.72) | 80.42(64.29) | 71.37(57.84) | 61.60 51.46) | 54.35(48.00) | 50.88(45.96) |
| | Kernel ($F_2$) | 90.70(72.30) | 85.05(67.37) | 78.00(62.40) | 66.75(54.96) | 55.95(48.11) | 48.81(44.48) | 44.05(41.64) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 0.49 | 0.26 | 0.30 | 0.33 | 0.35 | 0.35 | 0.37 |
| | C. D (0.01) | NS | 0.96 | 1.10 | 1.25 | 1.29 | 1.32 | 1.39 |
| Bags for storage (B) | HDPE bag ($B_1$) | 90.70(72.30) | 82.61(65.41) | 72.90(58.68) | 59.77(50.68) | 45.83(42.61) | 38.25(38.17) | 33.42(35.23) |
| | Polylined gunnybag ($B_2$) | 90.70(72.30) | 86.63(68.61) | 79.60(63.96) | 70.69(57.30) | 60.22(50.96) | 51.92(47.02) | 46.46(43.86) |
| | Vacuum packing ($B_3$) | 90.70(72.30) | 88.38(70.13) | 85.14(67.39) | 76.74(61.22) | 70.28(55.78) | 64.57(53.53) | 62.51(52.30) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 0.61 | 0.32 | 0.36 | 0.41 | 0.42 | 0.43 | 0.46 |
| | C. D (0.01) | NS | 1.18 | 1.35 | 1.53 | 1.58 | 1.62 | 1.70 |
| Interaction (LxF) | $L_1F_1$ | 90.33(71.93) | 86.50(68.55) | 80.42(64.45) | 72.27(58.40) | 63.21(52.40) | 55.78(49.11) | 52.61(47.25) |
| | $L_1F_2$ | 90.33(71.93) | 84.93(67.27) | 78.12(62.59) | 67.72(55.55) | 57.32(48.91) | 50.37(45.57) | 46.07(43.04) |
| | $L_2F_1$ | 91.30(72.90) | 87.63(69.52) | 81.90(65.49) | 73.83(59.41) | 65.08(53.53) | 58.08(50.33) | 55.02(48.53) |
| | $L_2F_2$ | 91.30(72.90) | 86.23(68.33) | 79.70(63.62) | 69.53(56.65) | 59.92(50.45) | 53.43(47.23) | 49.27(44.80) |
| | $L_3F_1$ | 90.46(72.06) | 85.95(68.10) | 78.95(62.92) | 68.02(55.73) | 56.52(48.45) | 49.19(44.55) | 45.02(42.09) |
| | $L_3F_2$ | 90.46(72.06) | 83.99(66.53) | 76.18(60.98) | 63.01(52.67) | 50.60(44.97) | 42.63(40.65) | 36.80(37.08) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 0.86 | 0.45 | 0.51 | 0.58 | 0.60 | 0.61 | 0.64 |
| | C. D (0.01) | NS | 1.67 | 1.91 | 2.16 | 2.23 | 2.29 | 2.40 |
| Interaction (LxB) | $L_1B_1$ | 90.33(71.93) | 82.48(65.30) | 72.95(58.70) | 60.23(50.94) | 46.79(43.17) | 39.56(38.98) | 35.23(36.40) |
| | $L_1B_2$ | 90.33(71.93) | 86.50(68.49) | 79.75(64.50) | 72.50(58.43) | 62.75(52.43) | 53.97(48.84) | 49.05(46.00) |
| | $L_1B_3$ | 90.33(71.93) | 88.18(69.94) | 85.11(67.35) | 77.26(61.56) | 71.26(56.37) | 65.71(54.20) | 63.75(53.02) |
| | $L_2B_1$ | 91.30(72.90) | 83.90(66.39) | 75.18(60.15) | 63.00(52.57) | 49.98(45.01) | 43.03(41.00) | 38.71(38.48) |
| | $L_2B_2$ | 91.30(72.90) | 87.70(69.51) | 81.20(65.41) | 73.72(59.21) | 64.33(53.37) | 56.46(49.89) | 51.67(47.12) |
| | $L_2B_3$ | 91.30(72.90) | 89.21(70.93) | 86.00(68.1) | 78.31(62.33) | 73.20(57.58) | 67.81(55.45) | 66.10(54.40) |
| | $L_3B_1$ | 90.46(72.06) | 81.50(64.55) | 70.61(57.2) | 56.16(48.53) | 40.72(39.65) | 32.24(34.53) | 26.35(30.81) |
| | $L_3B_2$ | 90.46(72.06) | 85.7(67.8) | 77.85(62.01) | 65.82(54.27) | 53.69(47.08) | 45.31(42.34) | 38.76(38.45) |
| | $L_3B_3$ | 90.46(72.06) | 87.8(69.6) | 84.31(66.73) | 74.63(59.80) | 66.47(53.40) | 60.28(50.94) | 57.72(49.48) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 1.05 | 0.55 | 0.63 | 0.71 | 0.73 | 0.75 | 0.79 |
| | C. D (0.01) | NS | 2.04 | 2.34 | 2.65 | 2.74 | 2.81 | 2.94 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Interaction (FxB) | $F_1B_1$ | 90.70(72.30) | 83.73(66.26) | 74.33(59.60) | 62.65(52.36) | 49.32(44.63) | 41.99(40.39) | 37.18(37.55) |
| | $F_1B_2$ | 90.70(72.30) | 87.13(69.03) | 80.55(64.86) | 72.98(58.76) | 62.82(52.49) | 54.06(48.62) | 50.14(46.35) |
| | $F_1B_3$ | 90.70(72.30) | 89.22(70.88) | 86.39(68.40) | 78.49(62.41) | 72.67(57.26) | 67.00(54.98) | 65.32(53.97) |
| | $F_2B_1$ | 90.70(72.30) | 81.48(64.56) | 71.47(57.76) | 56.89(48.99) | 42.33(40.59) | 34.51(35.94) | 29.66(32.91) |
| | $F_2B_2$ | 90.70(72.30) | 86.12(68.18) | 78.64(63.06) | 68.39(55.85) | 57.63(49.43) | 49.78(45.43) | 42.78(41.37) |
| | $F_2B_3$ | 90.70(72.30) | 87.54(69.38) | 83.88(66.37) | 74.98(60.04) | 67.88(54.31) | 62.14(52.07) | 59.70(50.64) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.40) | 58.78(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 0.86 | 0.45 | 0.51 | 0.58 | 0.60 | 0.61 | 0.64 |
| | C. D (0.01) | NS | 1.67 | 1.91 | 2.16 | 2.23 | 2.29 | 2.40 |
| Interaction (LxFxB) | $L_1F_1B_1$ | 90.33(71.93) | 83.50(66.07) | 74.30(59.57) | 63.10(52.62) | 50.42(45.26) | 43.22(41.12) | 38.80(38.55) |
| | $L_1F_1B_2$ | 90.33(71.93) | 87.00(68.91) | 80.75(65.53) | 75.00(60.03) | 65.50(54.06) | 55.93(50.50) | 52.43(48.47) |
| | $L_1F_1B_3$ | 90.33(71.93) | 89.00(70.68) | 86.20(68.23) | 78.70(62.55) | 72.95(57.89) | 68.20(55.70) | 66.60(54.72) |
| | $L_1F_2B_1$ | 90.33(71.93) | 81.45(64.52) | 71.60(57.83) | 57.35(49.25) | 43.15 (57.89) | 35.90(36.83) | 31.65(34.25) |
| | $L_1F_2B_2$ | 90.33(71.93) | 86.00(68.07) | 78.75(63.47) | 70.00(56.82) | 60.00 (50.79) | 52.00(47.17) | 45.66(43.54) |
| | $L_1F_2B_3$ | 90.33(71.93) | 87.35(69.21) | 84.02(66.48) | 75.82(60.58) | 68.82 (54.86) | 63.22(52.69) | 60.89(51.32) |
| | $L_2F_1B_1$ | 91.30(72.90) | 84.90(67.17) | 76.40(60.97) | 65.55(54.09) | 53.25(46.89) | 46.45(42.99) | 41.95(40.39) |
| | $L_2F_1B_2$ | 91.30(72.90) | 88.00(69.78) | 82.00(66.34) | 76.05(60.73) | 67.05 (55.00) | 58.35(51.53) | 55.10(49.63) |
| | $L_2F_1B_3$ | 91.30(72.90) | 90.00(71.61) | 87.30(69.16) | 79.90(63.40) | 73.70(58.69) | 69.45(56.48) | 68.00(55.58) |
| | $L_2F_2B_1$ | 91.30(72.90) | 82.90(65.61) | 73.95(59.34) | 60.45(51.06) | 46.71(43.14) | 39.61(39.02) | 35.46(36.57) |
| | $L_2F_2B_2$ | 91.30(72.90) | 87.39(69.24) | 80.39(64.48) | 71.39(57.69) | 61.61 (51.74) | 54.56(48.25) | 48.23(44.61) |
| | $L_2F_2B_3$ | 91.30(72.90) | 88.40(70.13) | 84.75(67.05) | 76.75(61.20) | 71.45 (56.48) | 66.12(54.43) | 64.12(53.23) |
| | $L_3F_1B_1$ | 90.46(72.06) | 82.80(65.53) | 72.30(58.27) | 59.30(50.39) | 44.30(41.75) | 36.30(37.07) | 30.80(33.73) |
| | $L_3F_1B_2$ | 90.46(72.06) | 86.40(68.40) | 78.90(62.69) | 67.90(55.52) | 55.90(48.41) | 47.90(43.82) | 42.90(40.94) |
| | $L_3F_1B_3$ | 90.46(72.06) | 88.66(70.37) | 85.66(67.79) | 76.86(61.28) | 69.36 (55.19) | 63.36(52.78) | 61.36(51.59) |
| | $L_3F_2B_1$ | 90.46(72.06) | 80.10(63.54) | 68.87(56.12) | 52.87(46.67) | 37.13(37.56) | 28.03(31.98) | 21.88(27.90) |
| | $L_3F_2B_2$ | 90.46(72.06) | 84.98(67.24) | 76.78(61.23) | 63.78(53.03) | 51.28(45.76) | 42.78(40.87) | 34.45(35.96) |
| | $L_3F_2B_3$ | 90.46(72.06) | 86.88(68.81) | 82.88(65.60) | 72.38(58.33) | 63.38 (51.60) | 57.08(49.10) | 54.08(47.36) |
| | Mean | 90.70(72.30) | 85.87(68.05) | 79.21(63.34) | 69.06(56.400 | 57.59(49.79) | 51.58(46.24) | 47.46(43.80) |
| | S. Em± | 1.48 | 0.77 | 0.89 | 1.00 | 1.04 | 1.06 | 1.12 |
| | C. D (0.01) | NS | 2.89 | 3.31 | 3.75 | 3.87 | 3.97 | 4.16 |

- Figures in parenthesis indicate arcsine transformed values.

**Table 3: Effect of provenance, storage containers and seed forms on seedling length (cm) in summer groundnut under ambient condition**

| **Treatments** | | **Months after storage** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Initial** | **2nd month** | **4th month** | **6th month** | **8th month** | **10th month** | **12th month** |
| Locations (L) | Dharwad ($L_1$) | 23.82 | 23.04 | 21.88 | 20.38 | 18.26 | 16.88 | 15.66 |
| | Bagalkot ($L_2$) | 23.95 | 23.18 | 22.05 | 20.61 | 18.91 | 17.63 | 16.53 |
| | Kumta ($L_3$) | 23.68 | 22.53 | 21.06 | 19.35 | 17.12 | 15.61 | 14.29 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.15 | 0.14 | 0.16 | 0.16 | 0.16 | 0.15 | 0.16 |
| | C. D (0.01) | NS | NS | 0.60 | 0.58 | 0.60 | 0.56 | 0.59 |
| Forms of storage (F) | Pod ($F_1$) | 23.82 | 23.04 | 21.87 | 20.41 | 18.44 | 17.13 | 15.95 |
| | Kernel ($F_2$) | 23.82 | 22.79 | 21.46 | 19.82 | 17.76 | 16.29 | 15.03 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.12 | 0.12 | 0.13 | 0.13 | 0.13 | 0.12 | 0.13 |
| | C. D (0.01) | NS | NS | 0.49 | 0.47 | 0.49 | 0.46 | 0.48 |
| Bags for storage (B) | HDPE bag ($B_1$) | 23.82 | 22.45 | 20.78 | 18.88 | 16.49 | 14.98 | 13.73 |
| | Polylined gunnybag ($B_2$) | 23.82 | 22.88 | 21.42 | 19.92 | 17.99 | 16.76 | 15.66 |
| | Vacuum packing ($B_3$) | 23.82 | 23.42 | 22.78 | 21.55 | 19.82 | 18.39 | 17.09 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.15 | 0.14 | 0.16 | 0.16 | 0.16 | 0.15 | 0.16 |
| | C. D (0.01) | NS | NS | 0.60 | 0.58 | 0.60 | 0.56 | 0.59 |
| Interaction (LxF) | $L_1F_1$ | 23.82 | 23.11 | 22.03 | 20.61 | 18.55 | 17.25 | 16.06 |
| | $L_1F_2$ | 23.82 | 22.96 | 21.73 | 20.14 | 17.98 | 16.51 | 15.26 |
| | $L_2F_1$ | 23.95 | 23.30 | 22.25 | 20.91 | 19.24 | 18.06 | 16.99 |
| | $L_2F_2$ | 23.95 | 23.06 | 21.85 | 20.31 | 18.58 | 17.21 | 16.07 |
| | $L_3F_1$ | 23.68 | 22.71 | 21.33 | 19.70 | 17.53 | 16.08 | 14.81 |
| | $L_3F_2$ | 23.68 | 22.35 | 20.80 | 19.01 | 16.72 | 15.14 | 13.77 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.21 | 0.20 | 0.23 | 0.22 | 0.23 | 0.21 | 0.22 |
| | C. D (0.01) | NS | NS | 0.85 | 0.82 | 0.85 | 0.79 | 0.83 |
| Interaction (LxB) | $L_1B_1$ | 23.82 | 22.70 | 21.14 | 19.22 | 16.76 | 15.28 | 14.06 |
| | $L_1B_2$ | 23.82 | 22.95 | 21.62 | 20.14 | 18.09 | 16.88 | 15.78 |
| | $L_1B_3$ | 23.82 | 23.47 | 22.88 | 21.78 | 19.95 | 18.49 | 17.15 |
| | $L_2B_1$ | 23.95 | 22.73 | 21.16 | 19.31 | 17.24 | 15.83 | 14.69 |
| | $L_2B_2$ | 23.95 | 23.15 | 21.88 | 20.48 | 18.89 | 17.81 | 16.84 |
| | $L_2B_3$ | 23.95 | 23.75 | 23.11 | 22.04 | 20.61 | 19.37 | 18.15 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $L_3B_1$ | 23.68 | 21.91 | 20.15 | 18.10 | 15.58 | 13.82 | 12.45 |
| | $L_3B_2$ | 23.68 | 22.54 | 20.87 | 19.13 | 17.09 | 15.61 | 14.45 |
| | $L_3B_3$ | 23.68 | 23.14 | 22.46 | 20.84 | 18.90 | 17.41 | 16.18 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.26 | 0.25 | 0.28 | 0.27 | 0.28 | 0.26 | 0.27 |
| | C. D (0.01) | NS | NS | 1.04 | 1.00 | 1.04 | 0.97 | 1.02 |
| Interaction (FxB) | $F_1B_1$ | 23.82 | 22.62 | 21.10 | 19.36 | 17.04 | 15.55 | 14.35 |
| | $F_1B_2$ | 23.82 | 23.04 | 21.63 | 20.21 | 18.28 | 17.15 | 16.05 |
| | $F_1B_3$ | 23.82 | 23.46 | 22.88 | 21.65 | 19.99 | 18.68 | 17.46 |
| | $F_2B_1$ | 23.82 | 22.28 | 20.47 | 18.39 | 15.94 | 14.40 | 13.11 |
| | $F_2B_2$ | 23.82 | 22.71 | 21.22 | 19.63 | 17.69 | 16.38 | 15.27 |
| | $F_2B_3$ | 23.82 | 23.38 | 22.69 | 21.45 | 19.64 | 18.09 | 16.72 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.21 | 0.20 | 0.23 | 0.22 | 0.23 | 0.21 | 0.22 |
| | C. D (0.01) | NS | NS | 0.85 | 0.82 | 0.85 | 0.79 | 0.83 |
| Interaction (LxFxB) | $L_1F_1B_1$ | 23.82 | 22.84 | 21.43 | 19.70 | 17.29 | 15.83 | 14.66 |
| | $L_1F_1B_2$ | 23.82 | 23.05 | 21.75 | 20.36 | 18.31 | 17.19 | 16.10 |
| | $L_1F_1B_3$ | 23.82 | 23.45 | 22.92 | 21.78 | 20.04 | 18.72 | 17.43 |
| | $L_1F_2B_1$ | 23.82 | 22.56 | 20.85 | 18.74 | 16.23 | 14.72 | 13.46 |
| | $L_1F_2B_2$ | 23.82 | 22.84 | 21.49 | 19.91 | 17.86 | 16.56 | 15.46 |
| | $L_1F_2B_3$ | 23.82 | 23.49 | 22.85 | 21.77 | 19.85 | 18.26 | 16.87 |
| | $L_2F_1B_1$ | 23.95 | 22.87 | 21.45 | 19.79 | 17.78 | 16.40 | 15.30 |
| | $L_2F_1B_2$ | 23.95 | 23.38 | 22.13 | 20.84 | 19.24 | 18.26 | 17.30 |
| | $L_2F_1B_3$ | 23.95 | 23.66 | 23.18 | 22.09 | 20.71 | 19.52 | 18.36 |
| | $L_2F_2B_1$ | 23.95 | 22.59 | 20.87 | 18.82 | 16.70 | 15.26 | 14.07 |
| | $L_2F_2B_2$ | 23.95 | 22.93 | 21.63 | 20.13 | 18.53 | 17.36 | 16.39 |
| | $L_2F_2B_3$ | 23.95 | 23.65 | 23.04 | 21.99 | 20.50 | 19.02 | 17.74 |
| | $L_3F_1B_1$ | 23.68 | 22.14 | 20.41 | 18.59 | 16.07 | 14.43 | 13.09 |
| | $L_3F_1B_2$ | 23.68 | 22.71 | 21.02 | 19.42 | 17.30 | 16.00 | 14.75 |
| | $L_3F_1B_3$ | 23.68 | 23.28 | 22.55 | 21.09 | 19.22 | 17.81 | 16.60 |
| | $L_3F_2B_1$ | 23.68 | 21.68 | 19.69 | 17.62 | 14.90 | 13.22 | 11.80 |
| | $L_3F_2B_2$ | 23.68 | 22.37 | 20.53 | 18.83 | 16.68 | 15.21 | 13.96 |
| | $L_3F_2B_3$ | 23.68 | 22.99 | 22.17 | 20.58 | 18.58 | 17.00 | 15.55 |
| | Mean | 23.82 | 22.91 | 21.66 | 20.11 | 18.10 | 16.71 | 15.49 |
| | S. Em± | 0.36 | 0.35 | 0.39 | 0.38 | 0.39 | 0.37 | 0.39 |
| | C. D (0.01) | NS | NS | 1.47 | 1.42 | 1.47 | 1.37 | 1.45 |

**Table 4: Effect of provenance, storage containers and seed forms on seedling vigour index in summer groundnut under ambient condition**

| Treatments | | Months after storage | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Initial | 2nd month | 4th month | 6th month | 8th month | 10th month | 12th month |
| Locations (L) | Dharwad ($L_1$) | 2063 | 1976 | 1750 | 1434 | 1101 | 926 | 803 |
| | Bagalkot ($L_2$) | 2179 | 2016 | 1796 | 1485 | 1182 | 1010 | 890 |
| | Kumta ($L_3$) | 2122 | 1916 | 1639 | 1277 | 920 | 735 | 606 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 16.18 | 12.29 | 11.02 | 12.34 | 12.42 | 9.81 | 9.12 |
| | C. D (0.01) | NS | 45.88 | 41.11 | 46.06 | 46.36 | 36.61 | 34.03 |
| Forms of storage (F) | Pod ($F_1$) | 2121 | 1999 | 1773 | 1464 | 1137 | 960 | 842 |
| | Kernel ($F_2$) | 2121 | 1940 | 1684 | 1334 | 999 | 821 | 690 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 13.21 | 10.04 | 8.99 | 10.08 | 10.14 | 8.01 | 7.45 |
| | C. D (0.01) | NS | 37.46 | 33.57 | 37.61 | 37.85 | 29.89 | 27.79 |
| Bags for storage (B) | HDPE bag ($B_1$) | 2121 | 1855 | 1517 | 1131 | 761 | 579 | 466 |
| | Polylined gunnybag ($B_2$) | 2121 | 1982 | 1728 | 1410 | 1087 | 902 | 760 |
| | Vacuum packing ($B_3$) | 2121 | 2070 | 1940 | 1655 | 1355 | 1191 | 1072 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 16.18 | 12.29 | 11.02 | 12.34 | 12.42 | 9.81 | 9.12 |
| | C. D (0.01) | NS | 45.88 | 41.11 | 46.06 | 46.36 | 36.61 | 34.03 |
| Interaction (LxF) | $L_1F_1$ | 2063 | 2000 | 1790 | 1495 | 1169 | 995 | 877 |
| | $L_1F_2$ | 2063 | 1951 | 1711 | 1373 | 1033 | 858 | 729 |
| | $L_2F_1$ | 2179 | 2043 | 1839 | 1549 | 1249 | 1078 | 965 |
| | $L_2F_2$ | 2179 | 1989 | 1752 | 1421 | 1115 | 942 | 815 |
| | $L_3F_1$ | 2122 | 1953 | 1689 | 1347 | 991 | 806 | 685 |
| | $L_3F_2$ | 2122 | 1878 | 1590 | 1207 | 850 | 664 | 527 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 22.88 | 17.39 | 15.58 | 17.46 | 17.57 | 13.87 | 12.90 |
| | C. D (0.01) | NS | NS | 58.14 | 65.14 | 65.56 | 51.77 | 48.13 |
| Interaction (LxB) | $L_1B_1$ | 2063 | 1872 | 1543 | 1159 | 786 | 606 | 497 |
| | $L_1B_2$ | 2063 | 1985 | 1760 | 1460 | 1135 | 956 | 817 |
| | $L_1B_3$ | 2063 | 2069 | 1948 | 1682 | 1382 | 1216 | 1094 |
| | $L_2B_1$ | 2179 | 1907 | 1591 | 1217 | 863 | 683 | 570 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $L_2B_2$ | 2179 | 2030 | 1808 | 1511 | 1216 | 1042 | 906 |
| | $L_2B_3$ | 2179 | 2110 | 1988 | 1726 | 1467 | 1307 | 1193 |
| | $L_3B_1$ | 2122 | 1785 | 1416 | 1017 | 632 | 447 | 331 |
| | $L_3B_2$ | 2122 | 1931 | 1617 | 1260 | 911 | 709 | 557 |
| | $L_3B_3$ | 2122 | 2031 | 1885 | 1555 | 1218 | 1049 | 930 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 28.03 | 21.30 | 19.08 | 21.38 | 21.52 | 16.99 | 15.79 |
| | C. D (0.01) | NS | NS | 71.20 | 79.78 | 80.30 | 63.41 | 58.94 |
| Interaction (FxB) | $F_1B_1$ | 2121 | 1894 | 1569 | 1214 | 843 | 657 | 538 |
| | $F_1B_2$ | 2121 | 2008 | 1772 | 1477 | 1152 | 969 | 846 |
| | $F_1B_3$ | 2121 | 2093 | 1977 | 1700 | 1414 | 1254 | 1143 |
| | $F_2B_1$ | 2121 | 1816 | 1464 | 1048 | 678 | 501 | 394 |
| | $F_2B_2$ | 2121 | 1956 | 1685 | 1344 | 1023 | 835 | 674 |
| | $F_2B_3$ | 2121 | 2047 | 1903 | 1609 | 1297 | 1127 | 1002 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 22.88 | 17.39 | 15.58 | 17.46 | 17.57 | 13.87 | 12.90 |
| | C. D (0.01) | NS | NS | 58.14 | 65.14 | 65.56 | 51.77 | 48.13 |
| Interaction (LxFxB) | $L_1F_1B_1$ | 2063 | 1907 | 1592 | 1243 | 872 | 684 | 569 |
| | $L_1F_1B_2$ | 2063 | 2005 | 1801 | 1527 | 1199 | 1023 | 902 |
| | $L_1F_1B_3$ | 2063 | 2087 | 1976 | 1714 | 1437 | 1277 | 1161 |
| | $L_1F_2B_1$ | 2063 | 1838 | 1493 | 1075 | 700 | 528 | 426 |
| | $L_1F_2B_2$ | 2063 | 1964 | 1719 | 1394 | 1072 | 890 | 733 |
| | $L_1F_2B_3$ | 2063 | 2052 | 1920 | 1651 | 1326 | 1154 | 1027 |
| | $L_2F_1B_1$ | 2179 | 1941 | 1639 | 1297 | 947 | 762 | 642 |
| | $L_2F_1B_2$ | 2179 | 2057 | 1856 | 1585 | 1290 | 1118 | 1003 |
| | $L_2F_1B_3$ | 2179 | 2129 | 2024 | 1765 | 1511 | 1356 | 1248 |
| | $L_2F_2B_1$ | 2179 | 1873 | 1543 | 1138 | 780 | 604 | 499 |
| | $L_2F_2B_2$ | 2179 | 2004 | 1760 | 1437 | 1142 | 965 | 808 |
| | $L_2F_2B_3$ | 2179 | 2091 | 1953 | 1688 | 1424 | 1258 | 1137 |
| | $L_3F_1B_1$ | 2122 | 1833 | 1476 | 1102 | 712 | 524 | 403 |
| | $L_3F_1B_2$ | 2122 | 1962 | 1658 | 1319 | 967 | 766 | 633 |
| | $L_3F_1B_3$ | 2122 | 2064 | 1932 | 1621 | 1295 | 1128 | 1019 |
| | $L_3F_2B_1$ | 2122 | 1737 | 1356 | 932 | 553 | 371 | 258 |
| | $L_3F_2B_2$ | 2122 | 1901 | 1576 | 1201 | 855 | 651 | 481 |
| | $L_3F_2B_3$ | 2122 | 1997 | 1837 | 1490 | 1140 | 970 | 841 |
| | Mean | 2121 | 1969 | 1728 | 1399 | 1068 | 891 | 766 |
| | S. Em± | 39.63 | 30.12 | 26.98 | 30.23 | 30.43 | 24.03 | 22.34 |
| | C. D (0.01) | NS | NS | 100.70 | 112.82 | 113.56 | 89.68 | 83.36 |

## CONCLUSION

Considering the changes in seed quality parameters studied with different packing materials over locations, vacuum packaging found best and performed better for storing seeds grown in areas with high temperature and humidity. The seeds of Bagalkot stored as pods in vacuum packing were found to have better storability under cold storage condition, followed by Dharwad Kumta is not suitable for production and storage of groundnut.

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