*Asian J. of Adv. Basic Sci.: 2(3), 1-6*
*ISSN (Online): 2347 - 4114*
*www.ajabs.org*

# Effect of seed storage on seed viability, germinability and morphological characteristics of karonda (*Carissa carandas*) seedlings

**Deepika[*], Vanajalatha[**] and Ashok Yadav[*]**

[*] *Department of Fruit science, Dr.Y.S.P. UHF, Nauni, Solan, Himachal Pradesh INDIA-173230*
[**] *Professor Fruit Science, Dr.Y.S.R. Horticultural University, Rajendranagar, Hyderbad, INDIA-500030*

*Email ID: deepi.mystery@gmail.com and ashokkumartherock@gmail.com*

**ABSTRACT: The experiment was conducted to study the influence of period of seed storage on germination and morphological characteristics of karonda and comprised of seven treatments *viz.*, zero days of extraction, 10 days of extraction, 20 days of extraction, 30 days of extraction, 40 days of extraction, 50 days of extraction and 60 days of extraction and replicated thrice. The results indicated that seeds sown at zero days of extraction recorded maximum germination percentage followed by seeds sown after 10 days of extraction. Also minimum days taken for initiation of germination, maximum shoot length, root length, number of roots and vigour index parameters were recorded in same treatment ($T_1$) followed by 10 days after extraction ($T_2$). The increase in period of storage after extraction of seed from fruit resulted in loss of viability and vigour parameters and after 60 days of extraction ($T_7$) only 20.33 % germination was recorded. However, seeds sown after 10 days of extraction ($T_2$) maintained good vigour than other treatments therefore karonda seeds could be stored at ambient condition for 10 days after extraction without much variation in growth parameters.**

**Keywords:** Germination, period of seed storage and seedling vigour.

## INTRODUCTION

*Carissa carandas* Linn. belonging to the family Apocynaceae commonly known as *"Karaunda"* in India; *'Bengal currant'* or *"Christ's thorn"* in South India (Imran *et al*., 2012 ). Karonda is indigenous to India. It is found wild in Bihar, West Bengal and South India and in commercial plantations in the Varanasi district of Uttar Pradesh (Banik *et al*., 2012). *Carissa* species is of much socio-economic importance in the tribal area of Gujarat, Maharashtra, Rajasthan, and Madhya Pradesh. Karonda is a small to big evergreen shrub usually 2-4 m tall. The stem is rich in white latex and the branches contain sharp spines. Flowers are white in colour, measuring 3-5 cm in diameter. The fruit is a berry, formed in clusters of 3-10 fruits and globose to broad ovoid in shape. Young fruits are pinkish white, at maturity fruit colour vary from white, green and pinkish red depending on the genotype. Seed 3-5 per fruit, blackish brown, flat and elliptical light in weight. Flowering starts in the month of January-February and fruits mature in May-June. Fruits are generally harvested at immature stage for vegetable purpose, fully ripen fruits are consumed fresh or processed (Malik *et al*., 2010). Karonda is very hardy, drought-tolerant, flourish well on lands with high temperatures and wide range of soils. It can be grown for making beautiful juvenile hedge and because of the presence of axiliary spines it can be a very good bio-fence (Sharma and Banyal, 2010). There are no well established varieties of karonda. Cultivated types are classified on the basis of fruit colour- green fruited, whitish fruits with pink blush and dark purple fruited. The *C. carandas* (L.) has been recognized in different system of traditional medicine to cure various diseases. The unripe fruit is sour, astringent, bitter, thermogenic, constipating, aphrodisiac, appetiser and antipyretic, and useful in vitiated conditions of *pitta* and *kapha*, hyperpiesia, diarrhoea, anorexia, and intermittent fevers. The ripe fruit is sweet, cooling, appetiser and antiscorbutic and is useful in burning sensation, skin diseases, scabies and pruritus. The roots are anthelmintic, stomachic and antiscorbutic, and are useful in stomach

disorders, intestinal worms, scabies and pruritus (Imran *et al*., 2012). Under the changing world trade scenario, it can be exploited on a commercial scale as a fruit for the processing industries. As it is rich source of iron (39.10 mg/100 g) and carbohydrates (67.10 mg/100 g edible portion), the raw and ripe fruits are used to prepare preserved products like jam, jelly, squash and pickle (Peter, 2007).

*Carrisa carandas* is usually propagated by seeds and sown immediately after extraction as longevity of seeds is short. The longevity of seeds can considerably be increased by storing them in certain well defined conditions (Sharma and Singh, 1997).

Information on seed germination behavior, viability and longevity of seeds under ambient conditions is needed to ascertain their storability. And also the planning for seed storage requires information on relative storability of seeds of particular species under ambient conditions in different agro-climatic zones. Therefore the objective of this experiment was to study the seed longevity and seedling growth of karonda.

## MATERIAL AND METHODS

The experiment was conducted during August 2012 – December 2012 at Agricultural Research Institute, Rajendranagar, Hyderabad. The experimental designe was RBD and comprised of seven treatments *viz.*, zero days of extraction, 10 days of extraction, 20 days of extraction, 30 days of extraction, 40 days of extraction, 50 days of extraction and 60 days of extraction and replicated thrice. The fully ripe karonda fruits were collected from Agricultural Research Institute, Rajendranagar in the month of August 2012. The ripe fruits were soaked in water for overnight to allow the fruit pulp to become soft and were separated by rubbing the seeds against hard surface. The seeds were washed with water to remove the mucilaginous covering over the seed surface. The seeds were shade dried. The required seeds were kept in butter paper bags and stored at ambient temperature except first treatment where seeds are sown immediately after extraction. These stored seeds were taken for further seed germination studies.

Black polythene bags of 15x22 cm size and 300 gauge thickness were filled with potting mixture of red soil, FYM and soil at a proportion of 1:1:1 along with 1 g of carbendazim per cubic meter of potting mixture was added as a prophylactic measure to prevent the disease occurrence**.** Seeds were sown treatment wise in polythene bag containing potting mixture at 1-1.5cm depth. The potting mixture was moistened before sowing and watering was done regularly as and when the top two cm media got dried.Weeding and watering were done at regular intervals whenever needed. The medium was drenched with carbendazim (0.15 %) at fortnightly intervals to check disease incidence.

**Days taken for initiation of germination**

Initiation of germination was recorded from the date of sowing till first seed germinated and days taken for initiations of germination were recorded.

**Germination percentage (%)**

Germination percentage was worked out after the final germination, i.e., after stoppage of germination. It was calculated by dividing the total number of seeds sown with the number of seeds germinated and multiplied by 100.

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

**Shoot length (cm)**

Plant height was recorded at monthly intervals and measured from a marked point just above the crown region up to the tip and was expressed in centimeters.

**Root length (cm)**

The length of the longest root was measured from the morphological base to the morphological top with the help of scale and is expressed in centimeters.

**Number of roots**

Five randomly selected and tagged seedlings along with the polybags were brought to the laboratory and the seedlings were carefully removed by cutting the polybags. The soil adhering to the roots was separated from the roots carefully. The numbers of roots per seedling were counted.

**Vigour index (g)**

Vigour index of seedling was calculated by multiplying dry weight of seedling with germination percentage and expressed in terms of grams.

## RESULTS AND DISCUSSION

**Days taken for initiation of germination:** The period of seed storage had influenced the days taken for initiation of germination. The seeds sown at zero days of extraction ($T_1$) recorded minimum number of days taken for initiation of germination (9.28 days) which was on par with seeds sown at 10 days after extraction ($T_2$) (9.48 days). Significantly highest days required for initiation of germination (15.45 days) was observed for seeds sown at 60 days after extraction ($T_7$) which is on par with $T_6$ (15.08 days) followed by $T_5$ (14.66 days), $T_3$ and $T_4$ the days taken for initiation of germination was 10.65 days, 13.45 respectively (Table 1). The observations from Table 4 clearly established the fact that there was consequential increase in germination time with advancement of seed storage period from zero days of extraction to 60 days of extraction. This could be attributed to the seed deterioration during storage, leading to reduction in vigour, germination rate, enzymatic activity, respiration, increase in permeability and susceptibility in stresses, decrease in seedling growth rate, reproductive processes and yield as reported by Verma *et al.*, 2003.

**Germination percentage (%):** Germination percentage differed significantly between different treatments. In general germination decreased with increase in seed storage period. Seeds sown at zero days of extraction ($T_1$) recorded significantly maximum germination (66.67 %) followed by $T_2$ (57 %), $T_3$ (44.33 %), $T_4$ (36.67 %), $T_5$ (30.33 %), $T_6$ (25.67 %) and lowest germination percentage was recorded when seeds were sown 60 days after extraction i.e.$T_7$ (20.33 %) (Table 1).The observations confirm that recently harvested seed had maximum germination percentage that declined during storage. The highest germination percentage of fresh seeds may be due to the presence of moisture and absence of dormancy, even a small decrease in moisture content will lead to a decrease significantly in seed germination (Pangou *et al.,* 2011). The decline in per cent germination with advance in storage period may be attributed to the phenomenon of aging, depletion of food reserves, and decline in synthetic activity. These results were also in accordance with Merlin and Palanisamy (2000) in jackfruit, Mathew *et al*. (2011) in ficus.

**Shoot length (cm):** Karonda seeds sown immediately after extraction attained highest shoot length of 10.87 cm which was on par with $T_2$ (10.80 cm) followed by $T_3$ (10.15 cm). The lowest plant height /shoot length was recorded in $T_7$ (8.52 cm) (Table 2).These results confirm that freshly harvested seeds showed maximum plant height. This could be due to a higher germination capacity of the fresh seed, which resulted in normal seedlings with longer shoot. A trend of decrease in plant height was observed with delay in sowing of seeds after extraction. Aging decreased plant height. This may be due to decreased mobilization of reserve substances during germination of the stored seeds (Dhakal and Pandey 2001). These results were also in accordance with Singh and Singh (1981) in papaya, Vanitha *et al.* (2005) in cocoa.

**Root length (cm):** Root length was recorded maximum in freshly extracted seeds i.e. $T_1$ (20.79 cm) which was on par with $T_2$ (20.30 cm) followed by $T_3$ (19.03 cm), while minimum root length was observed in $T_7$ (17.12 cm) (Table 2). A series of decrease in root length was noticed as the period of seed storage increased after seed extraction. The superior root growth of freshly harvested seeds could indicate that they have better initial nutrient reserves (proteins, lipids and starch) which, through storage under adverse conditions, were gradually depleted in the older seed lots as reported by Kalsa *et al.*, 2011. Earlier reports have shown that storage under adverse conditions could cause depletion of important nutrient reserves (Murthy *et al.*, 2003).

**Number of roots:** The number of roots were found maximum in seeds sown at zero days of extraction ($T_1$) (85.03) followed by $T_2$ (78.22), while $T_7$ recorded minimum number of roots (59.10) (Table 2). Fresh seeds recorded more number of roots and it subsequently decreased as the seed storage period advanced. The superiority of fresh seeds could be attributed to the amount of food material such as starch content stored in fresh seed, that will enhance root parameters and also modification in the root geometry, might be having morphological effects mediated by IAA and gibberellins (Yalleshkumar *et al*., 2007).

**Vigour index:** Among the different treatments $T_1$ (43.87) maintained more vigour followed by $T_2$ (33.63) and minimum vigour index was recorded in $T_7$ (6.06) (Table 2). The seedling vigour index gradually declines with progressive increase in seed storage period after seed extraction. This revealed that seeds sown at zero days of extraction were more vigorous followed by seeds sown at 10 days after extraction. Our result agrees with that of Kalsa *et al.,* 2011, Makawi and Gastel (2006), who reported a reduction in seedling dry mass after different periods of accelerated ageing on seeds of different varieties of lentil (*Lens culinaris* Medikus). The loss of vigour and viability in aged seed might be associated with enhanced lipid peroxidation and depressed metabolic system to limit the damage from free radical and peroxide as reported by Sung (1996) in soyabean.

**Table 1: Influence of seed storage period on initiation of germination and germination percentage of karonda.**

| Treatments | Days taken for initiation of germination | Germination percentage (%) |
|---|---|---|
| $T_1$ - Zero days of extraction | 9.28 | 66.67 (54.73) |
| $T_2$ - 10 days of extraction | 9.48 | 57.00 (49.02) |
| $T_3$ - 20 days of extraction | 10.65 | 44.33 (41.74) |
| $T_4$ - 30 days of extraction | 13.45 | 36.67 (37.26) |
| $T_5$ - 40 days of extraction | 14.66 | 30.33 (33.41) |
| $T_6$ - 50 days of extraction | 15.08 | 25.67 (30.43) |
| $T_7$ - 60 days of extraction | 15.45 | 20.33 (26.80) |
| **Mean** | **12.57** | **40.14 (39.05)** |
| **SEm±** | **0.21** | **0.49 (0.29)** |
| **CD @ 5%** | **0.65** | **1.54 (0.91)** |

**Table 2: Influence of period of seed storage on shoot length (cm) of karonda**

| Treatments | Shoot length (cm) | | Root length(cm) | | Number of roots | | Vigour index (g) | |
|---|---|---|---|---|---|---|---|---|
| | 60 DAS | 90 DAS | 60 DAS | 90 DAS | 60 DAS | 90 DAS | 60 DAS | 90 DAS |
| $T_1$- Zero days of extraction | 6.35 | 10.87 | 14.32 | 20.79 | 63.85 | 85.03 | **60** | **90** |
| $T_2$ -10 days of extraction | 5.93 | 10.80 | 13.82 | 20.30 | 62.62 | 78.22 | 11.94 | 43.87 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $T_3$ - 20 days of extraction | 5.61 | 10.15 | 13.09 | 19.03 | 58.62 | 68.31 | 8.33 | 33.63 |
| $T_4$ - 30 days of extraction | 5.50 | 9.49 | 12.97 | 18.39 | 58.35 | 67.93 | 5.19 | 20.17 |
| $T_5$ - 40 days of extraction | 5.34 | 9.23 | 12.23 | 18.18 | 57.07 | 64.52 | 3.74 | 15.29 |
| $T_6$ - 50 days of extraction | 5.12 | 9.15 | 11.64 | 17.48 | 53.43 | 61.17 | 2.82 | 10.71 |
| $T_7$ - 60 days of extraction | 4.78 | 8.52 | 11.20 | 17.12 | 49.59 | 59.10 | 2.31 | 8.03 |
| **Mean** | **5.51** | **9.74** | **12.75** | **18.75** | **57.64** | **69.18** | **5.14** | **19.68** |
| **SEm±** | **0.11** | **0.10** | **0.27** | **0.24** | **0.68** | **1.46** | **0.07** | **0.27** |
| **CD @ 5%** | **0.34** | **0.32** | **0.83** | **0.74** | **63.85** | **85.03** | **0.21** | **0.83** |

*DAS: Days after sowing*

## CONCLUSION

In the present investigation it may be concluded that fresh seeds of karonda recorded maximum germination and vigrous seedlings followed by seeds sown after 10 days of extraction and minimum were recorded in $T_7$ (seeds sown after 60 days of extraction). However, seeds sown after 10 days of extraction maintained good vigour than other stored seeds therefore karonda seeds could be stored at ambient condition for 10 days after extraction without much variation in growth parameters.

## REFERENCES


1. Banik B. C., Ghosh S.N. and Singh S.R. (2012) Research and development in karonda (*Carissa carandas*), a semi wild fruit in India, *Acta Horticulture* 948, 61-69.
2. Dhakal M.R. and Pandey A.K. (2001) Storage potential of niger (*Guizotia abyssinica*) seeds under ambient conditions, *Seed Science and Technology*, 29, 205-213.
3. Imran M.A., Begum G., Sujatha K, and Mallaiah B. (2012) Effect of adenine sulphate (ads) with cytokinins on multiple shoot production in *carissa carandas, International Journal of Pharma and Bio Sciences*, 3(1), 473- 480.
4. Kalsa K.K, Tomer R.P.S and Abebie B. (2011) Effects of storage duration and hydro-priming on seed germination and vigour of common vetch, *Journal of Science and Development*, 1(1), 65-73.
5. Makkawi M. and Gastel A.J.G. (2006) Effect of accelerated ageing on germination and vigour of lentil (*Lens culinaris* Medikus) seed, Journal *of New Seeds*, 8, 87-97.
6. Malik S.K., Chaudhury R., Dhariwal O.P. and Bhandari D.C. (2010) *Genetic resources of tropical underutilized fruits in India*, NBPGR, New Delhi, 47-54.
7. Mathew G., Skaria P.B. and Joseph A. (2011) Standardization of conventional propagation techniques for four medicinal species of genus *ficus* Linn, *Indian Journal of Natural Products and Resources*, 2(1), 88-96.
8. Merlin J. S. and Palanisamy V. (2000) Seed viability and storability of jackfruit (*Artocarpus heterophyllus*) *Seed Research*, 28(2), 166-170.
9. Murthy U.M.N., Kumar P.P. and Sun W.Q. (2003) Mechanisms of seed ageing under different storage conditions for *Vigna radiata* (L.)Wilczek: lipid peroxidation, sugar hydrolysis, maillard reactions and their relationship to glass transition, *Journal of Experimental Botany*, 54, 1057-1067.

**10.** Pangou V.S., Zoysa D.N., Maury G., Massanga A. and Yoka P.F.M.C. ( 2011) Seed storage behaviour of some indigenous values tropical trees species from Congo (Africa), *International Research Journal of Agricultural Science and Soil Science*, 1(8), 307-313.

**11.** Peter K.V. (2007) *Underutilized and underexploited horticultural crops,* New Indian publishing agency, New Delhi, 2, 313-315.

**12.** Sharma, J.K. and Singh, H.B. (1997). Relative storability of seeds of some crop species under ambient conditions. *Seed Research*. **25**: 37-40.

**13.** Sharma S. K. and Banyal S. K. (2010) Rehabilitation of marginal lands through karonda cultivation, *Intensive Agriculture, Oct-Dec* 6 – 12.

***14.*** Singh R.M. and Singh I.D. (1981) Effect of method and duration of storage on seed germination and seedling vigour in papaya (*Carica papaya* L.), *Seed Research*, 9(1), 67-72.

**15.** Sung J.M. (1996) Lipid peroxidation and peroxide scavenging in soyabean seeds during ageing, *Physiologia plantarum*, 97, 85-89.

**16.** Vanitha C., Ramamurthi K., Vijykumar A. and Sivasubramaniam K. (2005) Moist sand conditioning to minimize loss of viability in cocoa (*Theobroma cacao* linn.) seed, Natural *Product Radiance,* 4(6), 487-491.

**17.** Verma S.S., Verma U. and Tomer R.P.S. (2003) Studies on seed quality parameters in deteriorating seeds in Brassica (*Brassica campestris*), *Seed Science and Technology*, 31, 389-396.

**18.** Yelleshkumar H.S., Swamy G.S.K., Kanamadi V.C., Pati C.P., Kumar P. and Athani S.I. (2007) Studies on viability of mango stones and its effect on germination and rootstock vigour, *Journal of Asian Horticulture*, 3(3), 205-207.