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STUDIES ON SEED STORABILITY, GERMINATION AND SEEDLING VIGOUR OF KARONDA (*CARISSA CARANDAS* L.)

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ABSTRACT
A study was conducted to know the storage potential, germination and vigour index parameters of karonda seeds. The investigation was 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 with three replications in Randomized Block Design. The results revealed sighnificantly higher germination (66.67 %),plant height (10.87 cm), number of leaves (31.97) and vigour index (43.87 g)with seeds sown at zero days of extraction, followed by seeds sown after 10 days of extraction. Seeds sown at zero days of extraction gave 50 percent germination in 11 days and completion of germination in 23.67 days. After 10 days of extraction it took 14.33 days and 28.67 days for 50 percent germination and completion of germination respectively. The seeds sown after 10 days of extraction (10 days stored seeds) upheld good germination and seedling vigour therefore, karonda seeds could be stored for 10 days after extraction from fruits at ambient condition with good seed vaibility and vigour.

INTRODUCTION

Carissa carandas Linn. known as *Karaunda*, '*Bengal currant*' or' *Christ's thorn'* (Imran *et al*., 2012) belonging to the family apocynaceae has origin in India. Karonda 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). It is very hardy shrub, flourishes well on lands with high temperatures and wide range of soils. The crop is grown for making beautiful juvenile hedge and because of the presence of axillary spines it can be a very good bio-fence (Sharma and Banyal, 2010). The *C. carandas* (L.) has been recognized to cure various diseases (Imran *et al.,* 2012). It can be exploited on a commercial scale as a fruit for the processing industries as it is rich source of iron (39.10mg/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 (Kumar *et al* ., 2007).

Karonda is usually propagated by seeds. Seeds are sown immediately after extraction from the fruit as longevity of seeds is short (Kumar *et al*., 2007). Studies at NBPGR have led to categorization of seed storage behaviour as intermediate. The seed longevity can substantially be increased by storing them in well defined conditions (Sharma and Singh, 1997). Storage potential of seed is mainly a genetic factor but is influenced by several other factors like environment, cultivar differences and period of storage (Reddy, 1985).Information on seed germination behaviour, viability and longevity of seeds under ambient conditions is needed to determine their storability. To the best of knowledge, limited work has been reported regarding germination and storage of karonda seeds. Also there stands a huge demand of quality planting material of karonda seedlings. Therefore, this study was planned and executed with the objective to study the seed storage duration, germination and seedling growth of karonda.

MATERIALS AND METHODS

The study was carried out during 2012 at Agricultural Research Institute, Rajendranagar, Hyderabad. The experimental was 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 in RBD and replicated thrice. The fully ripe were collected in the month of August. The ripe fruits were soaked in water for overnight so that the fruit pulp 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 and were shade dried. The required seeds were then kept in butter paper bags and stored at room temperature except for the first treatment where seeds were sown immediately after extraction. These stored seeds were taken out treatmentwise at 10 days interval for further seed germination studies. Various parameters *viz*., germination percentage, days taken for 50 percent germination, days taken for completion of germination, plant height (cm), number of leaves, vigour index (g) were recorded. The data on plant height (cm), number of leaves, vigour index (g) were recorded at 30, 60, 90 days interval after sowing.

The germination percentage and vigour index (g) were worked out using following formulas:

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

Vigour index (g) = Dry weight of seedling (g) x Germination percentage

Seedling vigour index was computed by adopting the formula as suggested by Abdul-Baki and Anderson (1973) and expressed in whole number.

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. Statistical analysis of the data was done by following the (ANOVA) as given by Panse and Shkhatme (1989).

RESULTS AND DISCUSSION

The seed storage duration influenced the days taken for 50 per cent germination and showed significant difference among the treatments. Among treatments Zero days of extraction took only 11.00 days to reach 50 per cent germination followed by T_2 (14.33 days), T_3 (18.67 days) and T_4 (21.33 days). After 60 days of extraction (T_7) maximum number of days taken (23 days) for 50 percent germination. The ability of seeds to get 50 per cent germination was reduced considerably with increase in period of seed storage. This could be attributed to loss of moisture from seed during seed storage as compared to freshly harvested seeds. Decline in germination percent, seedling vigour index and seedling dry weight with increased storage period were also observed by Yalleshkumar *et al*. (2007) in Mango and Tubic *et al*. (2010). Roberts (1972) found that seed deteriorate during storage due to the damage in cell membrane and other chemical changes in the seed system such as the protein and nucleic acid accumulation. Some physiological and biochemical changes leading to seed deterioration have been related to increased activity of enzymes (catalase, peroxidase, *etc*.), lipid autoxidation (Koostra and Harrington, 1969) and accumulation of toxic metabolites, free radicle damage, decreased protein synthesis, breakdown in mechanism triggering germination, reduced respiration, changes in polar lipids, decreased contents of glyco and phospholipids, ultra structural damage to cell and its organelles, accumulation of cytotoxic and mutagenic compounds etc.These results were in accordance with (Abbas *et al*., 2003) who reported that the time taken by seeds for 50 per cent germination was also increased with the passage of desiccation period in Jamun.

Seeds sown at zero days of extraction had taken minimum (23.67 days) number of days for completion of germination while maximum days for completion of germination was observed in T_7 when sowing was done at 60 days after extraction (31.33 days). The increased period of completion

Table 1: Effect of Seed storage duration on Days taken for fifty percent germination, Days taken for completion of germination and germination percentage (%)

Treatments	Days taken for 50% germination	Days taken for completion of germination	Germination percentage(%)
T_1- Zero days of extraction	11.00	23.67	66.67(54.73)
T_2 - 10 days of extraction	14.33	28.67	57.00(49.02)
T_3 - 20 days of extraction	18.67	29.00	44.33(41.74)
T_4 - 30 days of extraction	21.33	29.67	36.67(37.26)
T_5 - 40 days of extraction	22.00	30.00	30.33(33.41)
T_6- 50 days of extraction	22.33	30.33	25.67(30.43)
T_7 - 60 days of extraction	23.00	31.33	20.33(26.80)
Mean	18.95	28.95	40.14(39.05)
SEm±	0.45	0.75	0.49(0.29)
CD @ 5%	1.41	2.30	1.54(0.91)

The values in parenthesis (Table1) are angular transformed values.

Table 2: Effect of Seed storage duration on plant height (cm), number of leaves and vigour index (g) **of karonda seedlings**

Treatments	Plant height (cm) Days after sowing			Number of leaves Days after sowing			Vigour index (g) Days after sowing		
	30	60	90	30	60	90	30	60	90
T_1- Zero days of extraction	3.33	6.35	10.87	6.02	15.36	31.97	2.80	11.94	43.87
T_2 -10 days of extraction	3.16	5.93	10.80	5.89	15.07	31.95	2.28	8.33	33.63
T_3 - 20 days of extraction	3.09	5.61	10.15	5.89	14.17	28.15	1.60	5.19	20.17
T_4 - 30 days of extraction	3.03	5.50	9.49	5.51	13.91	28.10	1.28	3.74	15.29
T_5 - 40 days of extraction	2.69	5.34	9.23	5.08	13.77	22.02	0.91	2.82	10.71
T_6 - 50 days of extraction	2.65	5.12	9.15	4.95	13.36	19.87	0.67	2.31	8.03
T_7 - 60 days of extraction	2.51	4.78	8.52	4.43	12.49	19.39	0.47	1.69	6.06
Mean	2.92	5.51	9.74	5.39	14.01	25.92	1.43	5.14	19.68
SEm±	0.09	0.11	0.10	0.24	0.32	0.61	0.02	0.07	0.27
CD @ 5%	0.28	0.34	0.32	0.74	0.97	1.89	0.06	0.21	0.83

of germination in aged seeds might be due to dessication of seeds during storage period. These results were in close conformity with the findings of Vinayachandra and Chandrashekar (2011), who reported that the time required for maximum germination also increased with the period of desiccation. As the moisture content of seed gradually declined to the critical level, the germination percentage decreased and the germination period lengthened.

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 %). 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 reason for decline in viability in seeds in moisture pervious material *i.e.* paper bags stored at ambient conditions may be increase rate of respiration with fluctuating seed moisture coupled with high ambient temperature as reported by Yogeesha *et al.,* 2008 in papaya. According to Vasudevan *et al*. (2012) there was reduction in enzyme activity on seed ageing which might be due to changes in phospholipid and membrane damage due to peroxidative changes associated with ageing. These changes resulted into rapid loss of viability from 99% to 2%. Our results were also in accordance with Prasad *et al*. (1996) and Khidrapure *et al*. (2014).

The freshly harvested seed (T_1) was exceled over other treatment in increasing plant height (Table 1). The seeds sown at zero day of extraction (T_1) attained highest plant height of 10.87 cm which was at par with T_2 (10.80 cm) at the end of the season. The lowest plant height was recorded in T_7 (8.52 cm). The higher plant height of fresh seeds could be due to a higher germination capacity of the fresh seed, which resulted in normal seedlings with longer shoot. Decrease in plant height was observed with delay in sowing of seeds after extraction. This may be due to decreased mobilization of reserve substances during germination of the stored seeds (Dhakal and Pandey, 2001). These results were in close conformity with the results of Singh and Singh (1981) in papaya, Srimathi *et al*. (2003) in jamun,Vanitha *et al*. (2005) in cocoa, Rosa *et al*. (2011) in coffee, Priya and Rao (2008) in *Entada pursaetha*.

Maximum number of leaves (31.97) were observed in seeds sown at zero days of extraction (T_1) which was on par with T_2 (31.95), whereas minimum number of leaves were observed in T_7 (19.39) (Table). Observations from Table 2 confirm that the number of leaves decreased with the delay in sowing after extraction when storage period was increased. Priya and Rao (2008) reported that gradual increase of the storage period resulted in the gradual decline in number of leaves. This might be due to decreased mobilization of reserve substances during germination of the stored seeds. These results were also in accordance with the finding of Doijode (1993), Verma *et al*. (2003) and Vanitha *et al*. (2005).

The data presented in Table 2 clearly signifies the differences in vigour index (g) of seedlings with the age of the seed. Freshly extracted seeds of T_1 recorded maximum seedling vigour *i.e.* T_1 (43.83) followed by seeds sown after 10 days of extraction (10 days old seeds) *i.e.* T_2 (33.63), Which was minimum in seeds sown after 60 days of extraction (60 days old seeds) *i.e.* T_7 (6.06).. The decline in seedling vigour index after nine months of seed storage was also reported by Dhakal and Pandey (2001) in Niger. This may be due to decreased mobilization of reserve substances during germination of the stored seeds (Shrivastava and Knoor, 1974).The decrease in physiological quality (emergence, rate of emergence, vigour, seedling growth rate) traits by aging may cause loss of membrane integrity due to lipid peroxidation (Eisvand *et al*., 2010). According to Doddagoudar *et al*. (2014), the vigour index decreased as the storage period increased which might be due to low germinationpercentage and lower seedling dry weight.Our results were also supported by Singh and Singh (1981), Verma *et al*. (2003), Yalleshkumar *et al*. (2007).

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