

## Effect of Viability on Seed Germination, Growth and Graft-take in Avocado (*Persea americana* Mill.) under Hill Zone of Karnataka

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**ABSTRACT:** The study was carried out during the year 2021-22 under normal poly house condition at department of fruit science, College of Horticulture, Mudigere, on effect of viability on seed germination, growth and graft- take in avocado under hill zone of Karnataka. Experiment was laid out in Completely Randomized Design with seven treatments, replicated thrice. In this experiment, avocado seeds were sown at an interval of five days from 0 days of extraction to 30 days. Avocado seeds sown on zero day after extraction recorded minimum number of days for initiation of germination (14.34), 50 per cent germination (24.33), complete germination (36.34), maximum germination per cent (93.33), germination vigour index (1.33), rootstock height (45.87 cm), number of leaves (18.64) and rootstock diameter (8.77 mm). Primary root length (23.52 cm), number of secondary roots (71.70), volume of roots (28.60), fresh weight (5.66 g) and dry weight (7.90 g) also found maximum in seeds sown on zero day after extraction. In graft parameters, seeds sown at five days after extraction recorded maximum graft height (44.72 cm) and sprout length (11.26 cm). Seeds sown on zero day after extraction recorded maximum number of sprouts (7.20), number of leaves (19.50), graft success percentage (86.67) and graft survival percentage (84.72).

**Keywords:** Viability, Germination, Graft success percentage, Graft survival percentage.

### INTRODUCTION

Avocado (*Persea americana* Mill., 2n (4x) = 40) belonging to the family Lauraceae. It is regarded as an important contribution of the New World to the human diet. It is known as a butter fruit and gained importance as one of the most nutritive fruit. Demand for the fruit increased over the past few years and now it has become an important fruit in international trade. Avocado is one of the most nutritive among fruits.

It is regarded as an important contribution of the New World to the human diet (Popenoe, 1920). It is the fruit containing all the elements like carbohydrates (5.10 g/100g), proteins (1.70 g /100g), fats (26.4 g / 100g) and also wide spectrum of vitamins (A, B complex and C) and minerals (K, P, Mg, S, Cl, Ca, and Fe). Since it is a rich source of fat, it generates 245 calories of energy (per 100g). Hence, Rainey *et al.* (1994) consider it as a nutrient dense food.

In India, avocado is commonly propagated through seeds. The viability of seeds of avocado is quite short (2 to 3 weeks) but this can be improved by storing the seed in dry peat or sand at 5 °C. Removal of seed coat before sowing hastens germination. Since, avocado seed is recalcitrant in nature it loses its viability when stored for longer time. Raja *et al.* (2003) showed that

reduction in germination with fall of moisture content. So, it became necessary to know how viability of seed effect germination, seedling growth and how it influences on graft growth, success and survivability.

Presently there is huge demand for planting materials for commercial cultivation and farmers are facing problems in getting good planting materials. The study will help nursery men and other agencies to produce large scale multiplication of planting and it also solves the problem of planting materials to some extent

### MATERIALS AND METHODS

The experiment was carried out in a low polyhouse oriented in North South direction, College of Horticulture, Mudigere, Karnataka which is situated in hilly region (Zone-9 and Region V) of Western Ghats of Karnataka State at 13°25'N latitude and 75°57'E longitude at an altitude of 980 m above mean sea level. Fully matured avocado fruits were collected from Central Horticultural Experimental Station (CHES), Chettalli, Kodagu district during month of first week of September 2021.

Vigorously growing two month old root stocks of uniform size were selected from all the treatments and then used for grafting.

Single clone tree was selected for scion material which is located in farmer's field near Mavinamara village, Mudigere, having higher yield and quality. The selected scions were free from pest and diseases.

The number of treatments were 7 with 3 replications. Total number of seeds sown per treatments were 30. Treatments were as follows T<sub>1</sub>: sowing seeds on zero day after extraction, T<sub>2</sub>: sowing seeds on five days after extraction, T<sub>3</sub>: sowing seeds on ten days after extraction, T<sub>4</sub>: sowing seeds on fifteen days after extraction, T<sub>5</sub>: sowing seeds on twenty days after extraction, T<sub>6</sub>: sowing seeds on twenty five days after extraction, T<sub>7</sub>: sowing seeds on thirty days after extraction. Germination and rootstock growth parameters were observed.

## RESULTS AND DISCUSSION

The findings were considerably interpreted and listed in Table 1 and 2 based on the observations recorded in the present research.

### **Viability of avocado seeds and its effect on germination, growth and grafting**

**Days taken for initiation and 50 per cent germination.** Minimum number of days taken for initiation (14.34) and 50 per cent (24.33) germination were recorded in seeds sown on zero day of extraction. Whereas, maximum number of days (29.42 and 43.44) were recorded in seeds sown at thirty days after extraction.

Avocado seeds are recalcitrant in nature and as storage period increases it leads to loss of moisture and results in desiccation. Seeds of zero day after extraction has recorded maximum germination due to higher moisture content. Increased storage period results in reduced vigour and finally death of seeds (Devi *et al.*, 2016).

**Days taken for complete germination.** Minimum number of days taken for complete germination (36.34) were recorded in seeds sown on zero day of extraction. Whereas, maximum number of days (54.03) were recorded in seeds sown at thirty days after extraction. Storage period influenced the number of days taken for complete germination. Moisture content in seeds leads to the activation of oxidative enzymes which are necessary for conversion of stored food reserves in seed into simpler molecules and for translocation of these simpler substances into the embryo for emergence of radicle and plumule and there by increases the rapid germination (Bose *et al.*, 1986).

**Germination percentage and germination vigour index.** Maximum germination percentage and germination vigour index were recorded in seeds sown on zero day after extraction (93.33 and 1.33). Whereas, minimum was observed in seeds sown at thirty days after extraction (70.00 and 0.89). This might be due to storage period and moisture content of seeds. According to Abbas *et al.* (2013) loss in seed viability and vigour were found to be associated with increased electrolyte leakage as the moisture content reduced below 30 per cent. It may also due to the presence of high moisture, absence of dormancy Krishnaswamy (1990).

**Rootstock height (cm).** Maximum rootstock height (46.52 cm) was found in seeds which were sown on zero day of extraction. Whereas, minimum (33.73 cm) was recorded in seeds sown at thirty days after extraction.

Freshly harvested seeds are having high vigour and viability which promoted good photosynthetic rate and accumulation of biomass results in faster growth apart from that, fresh seeds are observed to have high quality of GA<sub>3</sub> which is well known for inter nodal cell elongation, thereby leading to increase in seedling height, as reported by Wanyama *et al.* (2006) in cape gooseberry. Further these results are supported by Gowda *et al.* (2011) in jamun.

**Rootstock diameter (mm) and number of leaves.** Maximum rootstock diameter and number of leaves were found in seeds which were sown on zero day of extraction (8.77 mm and 19.50). Whereas, minimum values were recorded in seeds sown at thirty days after extraction (7.54 mm and 19.50). It might be due to the seed storage period and overall performance in relation to germination and better growth parameters as reported by Prajapati *et al.* (2017) in Acid Lime.

The seeds sown on zero day of extraction shown better performance in terms of days taken for initiation, 50 per cent and complete germination and germination percentage and also in other rootstock growth parameters.

**Primary root length (cm), number of secondary roots and volume of roots (ml).** Primary root length, number of secondary roots and volume of roots (23.52 cm, 71.70 and 28.60 ml, respectively) were recorded in the treatment zero day after extraction (T<sub>1</sub>). Whereas, minimum values (21.17 cm 56.53 and 22.67 ml, respectively) were recorded in the treatment of thirty days after extraction (T<sub>7</sub>).

This might be due to freshly extracted seeds have more vigour, high moisture and more nutrient reserve resulted healthy and vigorous seedling. This could be due to higher germination capacity of the fresh seed, which resulted in normal seedlings with longer root. The above findings are in conformity with Deepika and Yadav (2014) in karonda, Khopkar *et al.* (2017) in pummelo.

**Fresh weight (g) and dry weight (g).** At 120 days after sowing, maximum fresh weight and dry weight were recorded in zero day after extraction (35.66 and 7.90 g). Minimum values (26.74 and 4.23 g) were recorded in thirty days after extraction.

This could be due to higher germination capacity of the fresh seed, which resulted in normal seedlings with longer shoot. A trend of decrease in shoot length was observed with delay in sowing of seeds after extraction. This may be due to decreased mobilization of reserve substances during the germination of the stored seeds. The increased fresh and dry weight of seedling may be due to the enhanced root and shoot length. The above findings are in conformity with Dhakal and Pandey (2001); Prajapati *et al.* (2017) in Acid Lime.

**Graft height (cm), sprout length (cm), number of sprouts and number of leaves**

Maximum graft height and sprout length (44.72 cm and 11.26 cm) were recorded in five days after extraction. Whereas, minimum (35.71cm and 8.81cm) was recorded in seeds of thirty days after extraction.

Maximum number of sprouts and number of leaves (2.42 mm, 7.20 and 19.50 respectively,) were recorded in seeds of zero days after extraction. Minimum (1.98mm, 5.99 and 17.31) were recorded in seeds sown at thirty days after extraction.

This may be due to vigour of rootstocks and high vigour index confounded to high graft growth. This increase in the graft growth might be due to increased photosynthesis, which could be further related to more number of leaves, sprouts as reported by Barman *et al.* (2016) in Rangpur Lime. The results are in conformity

with Gagandeep and Malhi (2006); Niranjana *et al.* (2014) in mango.

**Graft success percentage and graft survival percentage.** Maximum graft percentage and graft survival percentage were recorded in seeds of five days after extraction (95.23 and 84.72), minimum were recorded in seeds sown at thirty days after extraction (46.67 and 53.33) at 90 and 180 days after grafting, respectively.

This variation in graft success and survival depending upon the rootstock and age of the scion may be related to the change in the translocation pattern of photosynthates and assimilation through the phloem which in turn affected the growth of rootstocks due to effect on root growth and absorption of various nutrients and water as reported by Padma and Reddy (1995); Barman *et al.* (2006) in Rangpur Lime.

**Table 1: Investigation on viability of avocado seeds and its effect on germination and growth of rootstock.**

Treatments	Germination parameters						Rootstock growth parameters		
	Days taken for			Germination per cent	Germination vigour index	Extent of Polyembryony	Rootstock height (cm)	Rootstock diameter (mm)	Number of leaves
	Initiation of germination	50 per cent Germination	Complete germination						
T <sub>1</sub> - 0 DAE	14.34	24.33	36.34	93.33	1.33	2.67	45.87	8.77	18.64
T <sub>2</sub> - 5 DAE	16.67	27.23	40.68	90.00	1.25	3.33	45.23	8.61	18.25
T <sub>3</sub> -10 DAE	18.67	29.53	41.71	86.66	1.24	1.67	44.84	8.42	17.86
T <sub>4</sub> -15 DAE	21.02	33.35	44.80	83.33	1.19	3.00	43.12	8.28	17.37
T <sub>5</sub> -20 DAE	27.67	35.23	48.74	76.66	1.08	2.00	42.15	8.06	16.94
T <sub>6</sub> -25 DAE	29.04	40.19	49.17	73.33	0.97	1.67	39.86	7.79	16.47
T <sub>7</sub> -30 DAE	29.42	43.44	54.03	70.00	0.89	2.33	39.23	7.54	15.26
S.Em±	0.99	1.26	2.21	2.81	0.04	0.64	0.38	0.23	0.2
CD @ 5%	2.73	3.83	6.71	8.54	0.12	NS	1.17	0.72	0.62

**Table 2: Investigation on viability of avocado seeds and its effect on root, biomass and graft parameters.**

Treatments	Root parameters			Biomass (g)		Graft parameters					
	Primary root length(cm)	No. of secondary roots	Volume of roots (ml)	Fresh weight (g)	Dry weight (g)	Graft height (cm)	Sprout length (cm)	Number of sprouts	Number of leaves	Graft percentage	Graft survival percentage
T <sub>1</sub> - 0 DAE	23.52	71.70	28.60	35.66	7.90	43.98	11.16	7.20	19.50	86.67	84.72
T <sub>2</sub> - 5 DAE	23.12	70.13	28.02	33.31	7.60	44.72	11.26	7.13	19.30	80.00	83.66
T <sub>3</sub> -10 DAE	22.84	68.36	27.96	32.09	7.49	41.12	10.95	6.94	18.83	73.33	81.94
T <sub>4</sub> -15 DAE	22.16	65.92	27.67	30.01	6.24	42.90	10.60	6.81	18.27	56.67	73.81
T <sub>5</sub> -20 DAE	21.75	62.27	26.64	29.79	5.91	39.25	10.42	6.74	18.08	53.33	72.70
T <sub>6</sub> -25 DAE	21.17	57.12	24.89	28.95	4.56	37.61	10.08	6.36	17.78	50.00	67.22
T <sub>7</sub> -30 DAE	20.03	56.53	22.67	26.74	4.23	35.71	8.81	5.99	17.31	46.67	53.33
S.Em±	0.26	2.77	0.61	0.76	0.47	0.67	0.17	0.09	0.28	6.78	6.43
CD @ 5%	0.81	7.24	1.85	2.32	1.43	2.03	0.53	0.30	0.87	20.57	19.50



**Plate 1.** Investigation on viability of avocado seeds and its effect on growth and grafts a. growth of rootstock in T<sub>1</sub> b. growth of rootstock in T<sub>2</sub> c. graft growth in T<sub>1</sub> d. graft growth in T<sub>2</sub>

**CONCLUSION**

The seeds sown on zero day after extraction shown better performance in terms of days taken for initiation, 50 per cent and complete germination, germination percentage, rootstock height, diameter and number of leaves, graft success percentage and survival percentage.

**FUTURE SCOPE**

Studies can be taken for storage of seeds under different container and condition to extend seed viability.

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**Conflict of interest.** None.

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