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Effect of seed cut-length on germination behavior and seedling growth of avocado (*Persea americana*)

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Abstract

The present investigation entitled “Effect of seed cut-length on germination behavior and seedling growth of avocado (*Persea americana*)” was carried out to find out the most suitable treatments for Germination Behavior and Seedling growth for Avocado. The research work was carried out during 2022-2024 in Shade net conditions at Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.), India. The experiment was aimed to determine the effect of various treatments on germination and seedling growth parameters such as – Days to germination, Plant height at 2 MAP, Number of leaves at 2 MAP and Chlorophyll content. The whole research was conducted in Completely Randomized Design (CRD) with three replications and eight treatments. The treatments consisted T₀ (Control), T₁ (2 cm cut off the seed tip), T₂ (0.5 cm cut off the seed base), T₃ (2 cm cut off the seed tip + 0.5 cm cut off the seed base), T₄ (Seed coat removal), T₅ (Seed coat removal + 2 cm cut off the seed tip), T₆ (Seed coat removal + 0.5 cm cut off the seed base) & T₇ (Seed coat removal + 2 cm cut off the seed tip + 0.5 cm cut off the seed base). From the present investigation, it was found that Treatment (T₆) proved best among all treatments, with respect to days to germination (16.22), plant height at 2 MAP (48.96 cm), number of leaves at 2 MAP (11.05) & chlorophyll content (43.48).

Keywords: *Persea americana*, seed cut-length, germination behavior, seedling growth, plant height

1. Introduction

Avocado (*Persea americana*) is from the family Lauraceae and belongs to the genus *Persea*. Avocado has been grown in the tropical region as far back as 10000 BC. Avocado evolved in the tropics to highland subtropics areas of Mexico, Guatemala and Honduras. Avocado is a common fruit in the tropical and subtropical regions but this fruit is not common in India and is an expensive fruit for common Indian, this exotic fruit entered in India by the way of travelers from Sri Lanka, to Wayanad in Kerala, Kodaikanal in Tamil Nadu & Coorg in Karnataka in 19th century. The Avocado in the number of 3 to 4 plants is grown in homesteads for family consumption in the Southern part of India. In the eastern Himalayan state of Sikkim, avocado has been introduced successfully in hill ranges with an altitude of 800 to 1600 meters. In avocado growing areas of Sikkim, temperatures range from 12 to 30°C with an average annual rainfall of 2000 millimeters.

The word avocado comes from the Spanish aguacate, which derives from the Nahuatl (Mexican) word *ahuacatl*. Avocados are also called alligator pear. In India, it is also known as “Makhanphal”. Avocado is a medium-sized fruit (differ in variety), an evergreen tree in the Lauraceae family. It is native to the Americans and was first domesticated by Mesoamerican tribes more than 5000 years ago. Avocado is a major tropical fruit originated in Tropical America, the species consist of three races Mexican, Guatemalan and West Indian, Both the Mexican and Guatemalan races are grown successfully in Sikkim. Avocado grows at elevations as high as 2500 meter, planting in collar areas has produced slower growth and development of trees and fruit. Although this exotic fruit grows in a very diverse climate.

Avocado is the most nutritious fruit as compared to other common fruits and the most important contribution of the new world to the human diet, the pulp is rich in proteins.

One-half of an avocado (100 g) provides 160 calories, 2 g of protein, 8.5 g of carbohydrates, and 14.7 g of fat. Avocados are an excellent nutritional source of magnesium, potassium, vitamin C,

vitamin E and vitamin K.

Avocado is mainly used fresh, in sandwich filling or in salads. It can also be used in ice creams and milkshakes and the pulp may be preserved by freezing. Three antifungal compounds have been isolated from the peel extracts of immature fruits of the Green cultivar.

Avocados have a high amount of healthy and plant based fat. Avocados are unusual among fruits because they are high in fat. This means they contain a higher amount of energy (calories) than other fruits and vegetables. Avocado fruit is an alternative option of dairy products like butter and ghee (clarified butter) for vegans, the type of fat in an avocado fruit is mainly unsaturated (specifically, monounsaturated) which, when eaten in place of high-saturated-fat foods, can help maintain healthy cholesterol levels. Avocados are a great source of several vitamins, minerals, healthy fats and fiber. Avocados also contain a fair amount of niacin, riboflavin, copper, magnesium, manganese, carotenoids (lutein, zeaxanthin) and antioxidants. Eating two servings of avocado each week (one avocado) can cut the risk of developing coronary heart disease by 21 per cent, according to research published in the Journal of the American Heart Association.

2. Materials and Methods

2.1 Geographical location of the experimental site

The experiment was carried out in shade net conditions at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. All types of facilities necessary for research including inputs, irrigation facilities and labors were provided from the Department of Horticulture.

2.2 Climatic conditions of the experimental area

Prayagraj is located in the south-east part of Uttar Pradesh, India. Prayagraj falls under agro-climatic zone IV which is named as “middle Gangetic plains” the site of experiment was located at 98 meters from sea level at 25.57° N latitude 81.51° E longitude has a typical subtropical climate with extremes of summer and winter. The area of Prayagraj district comes under the subtropical belt in South East of Uttar Pradesh, which experiences extremely hot summers and fairly cold winters. The maximum temperature of the location reaches up to 46 °C – 48 °C and seldom falls down as low as 4 °C – 5 °C during winter. The average rainfall in this area is around 1027 mm annually with maximum concentration during July to September with few showers and drizzles in winter also.

The annual mean temperature is 26.1 °C and the monthly mean temperature is 18 °C – 29 °C. It has three seasons: a hot, dry summer, a cool, dry winter and a hot, humid monsoon. Summer lasts from March to May which is hot and dry. The hot and extremely humid monsoon season is from June to September. The monsoon begins in June and lasts till August, high humidity levels prevail well into September. Rain from the Arabian sea branches off the southwest monsoon concentrating in the months of June to September. Winter runs from December to February with the temperature rarely dropping to the freezing point.

2.3 Experimental details

Experiment was carried out in Completely Randomized Block Design (CRD), with eight treatments, replicated thrice. The treatment details are given below in Table 1.

Table 1: Treatment Details

Treatment Symbol	Treatment Combination
T ₀	Control
T ₁	2 cm cut off the seed tip
T ₂	0.5 cm cut off the seed base
T ₃	2 cm cut off the seed tip + 0.5 cm cut off the seed base
T ₄	Seed coat removal
T ₅	Seed coat removal + 2 cm cut off the seed tip
T ₆	Seed coat removal + 0.5 cm cut off the seed base
T ₇	Seed coat removal + 2 cm cut off the seed tip + 0.5 cm cut off the seed base

Materials

1. Avocado seeds (72 Seeds)
2. Plastic glasses (72 glasses)
3. Plant nursery bags 5*8 inches of 300 gauge thickness (72 nursery bags)
4. FYM, Garden soil & Sand in 1:1:1 proportion as a media
5. Wooden Toothpick (216 Toothpicks) in case of 3 Toothpick per seed
6. Knife (For cutting of tip and base portion of seed)
7. Water (For germination)

Methods

Seeds were cut according to different treatments and 3 to 4 toothpicks were inserted into the avocado seeds for ease of suspending over a glass of water such that the end of the seed just touches the water and helps in the initiation of root.

Observations were recorded on days to germination, plant height at 2 MAP, Number of leaves at 2 MAP & Chlorophyll content.

The data collected on different parameters were subjected to statistical analysis of variance technique as described by Panse and Sukhatme (1967) [17]. The method of “Analysis of Variance” for Completely Randomized Design was used and treatment effects of all the characters were studied by employing ‘F’ test. Five percent level of significance was used to test the “null hypothesis” for significance of results. The critical difference was calculated where the difference among the treatments was found significantly by ‘F’ test. The C.V. percent was also worked out.

3. Results and Discussion

3.1 Effect of different treatments on days to germination

The data recorded on the number of days to germination in avocado seedlings varies significantly with respect to different treatments.

It is evident from the statistical analysis that significantly least days to germination (14.16 days) was found in treatment, T₃ (2 cm cut off the seed tip + 0.5 cm cut off the seed base), which was statistically at par with treatment, T₆ (Seed coat removal + 0.5 cm cut off the seed base). However, the highest days to germination (22.22 days) was observed in treatment, T₂ (0.5 cm cut off the seed base).

Similar days to germination (18 days) was reported in avocado seedlings by Anusha *et al.*, (2019) [18].

Similar days to germination (18 days) was reported in avocado seedlings by Adjei *et al.*, (2011) [2].

The data pertaining to effect of different treatments on days to germination is shown in Table 1 graphically represented in Figure 1

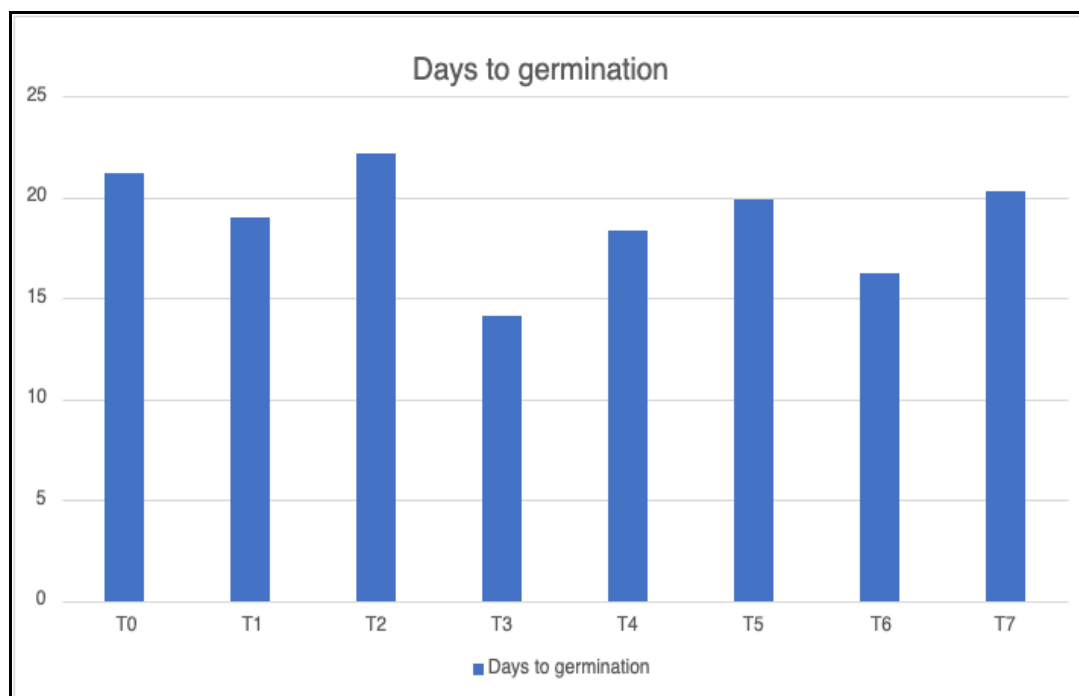


Fig 1: Effect of different treatments on days to germination in avocado

3.2 Effect of different treatments on plant height at 60 DAT

It is evident from the statistical analysis that significantly superior plant height at 60 DAT (48.96 cm) was found in treatment, T₆ (Seed coat removal + 0.5 cm cut off the seed base), which was statistically at par with treatment, T₅ (Seed coat removal + 2 cm cut off the seed tip) and treatment, T₄ (Seed coat removal). However, minimum plant height (37.43 cm) was observed in treatment, T₀ (Control).

3.3 Effect of different treatments on number of leaves per plant at 60 DAT

It is evident from the statistical analysis that significantly superior number of leaves per plant at 60 DAT (11.05) was found in treatment, T₆ (Seed coat removal + 0.5 cm cut off the seed base), which was statistically at par with treatment, T₀ (Control). However, the minimum number of leaves per plant (7.33) was observed in treatment, T₇ (Seed coat removal + 2 cm

cut off the seed tip + 0.5 cm cut off the seed base).

Similar number of leaves/plants (18.15) at 90 DAT was reported in avocado seedlings by Subash *et al.*, (2023) ^[15].

Similar number of leaves/plants (11.05) was reported in avocado seedlings from (40-60) gram avocado seeds by Mejia *et al.*, (2022) ^[12].

3.4 Chlorophyll content

It is evident from the data that a significantly highest chlorophyll content (43.48) was found in treatment, T₆ (Seed coat removal + 0.5 cm cut off the seed base), which was statistically at par with treatment, T₇ (Seed coat removal + 2 cm cut off the seed tip + 0.5 cm cut off the seed base) and treatment, T₄ (Seed coat removal). However, the minimum chlorophyll content (24.55) was observed in treatment, T₁ (2 cm cut off the seed tip).

Similar highest chlorophyll content (41.59) SPAD was reported in avocado seedlings by Esgrina *et al.*, (2024) ^[6].

Table 2: Effect of different treatments on days to germination of avocado (*Persea americana*)

Treatment Symbol	Treatment Combination	Days to germination
T ₀	Control	21.22
T ₁	2 cm cut off the seed tip	19.00
T ₂	0.5 cm cut off the seed base	22.22
T ₃	2 cm cut off the seed tip + 0.5 cm cut off the seed base	14.16
T ₄	Seed coat removal	18.33
T ₅	Seed coat removal + 2 cm cut off the seed tip	19.88
T ₆	Seed coat removal + 0.5 cm cut off the seed base	16.22
T ₇	Seed coat removal + 2 cm cut off the seed tip + 0.5 cm cut off the seed base	20.33
	F-test	S
	S.E.m. (+)	1.59
	C.D. at 5%	4.82
	C.V.	14.59

Table 3: Effect of different treatments on vegetative growth parameters of avocado (*Persea americana*) at 2 MAP

Treatment Symbol	Treatment Combination	Plant Height (cm)	Number of leaves	Chlorophyll Content
T ₀	Control	37.43	11	29.79
T ₁	2 cm cut off the seed tip	39.72	9.77	24.55
T ₂	0.5 cm cut off the seed base	41.41	9.33	32.58
T ₃	2 cm cut off the seed tip + 0.5 cm cut off the seed base	42.75	8.44	29.15
T ₄	Seed coat removal	47.08	8.55	35.72
T ₅	Seed coat removal + 2 cm cut off the seed tip	47.45	8.44	29.99
T ₆	Seed coat removal + 0.5 cm cut off the seed base	48.96	11.05	43.48
T ₇	Seed coat removal + 2 cm cut off the seed tip + 0.5 cm cut off the seed base	43.08	7.33	35.76
	F-test	S	S	S
	S.Em. (±)	1.79	0.74	3.02
	C.D. at 5%	5.41	2.25	9.14
	C.V.	7.13	13.99	16.05

4. Conclusion

- From the present investigation entitled “Effect of seed cut-length on germination behavior and seedling growth of avocado (*Persea americana*)”, it is concluded that treatment, T₆ (Seed coat removal + 0.5 cm cut off the seed base) was best in terms of Plant height (48.96) cm, Number of leaves (11.05), Chlorophyll content (43.48), at two month after planting.
- Treatment, T₃ (2 cm cut off the seed tip + 0.5 cm cut off the seed base) had the earliest germination in 14.16 days.
- Therefore T₆ (Seed coat removal + 0.5 cm cut off the seed base) can enhance germination & seedling growth in avocado.

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6. Competing Interests

Authors have declared that no competing interests exist.

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