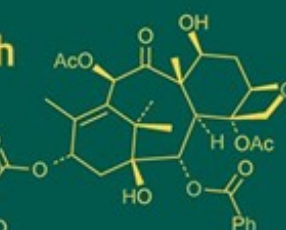
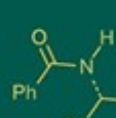
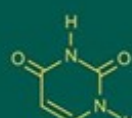


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 NAAS Rating (2026): 5.29
 Indexing: Embase
 IJABR 2026; SP-10(9): 1843-1851
www.biochemjournal.com
 Received: 25-06-2026
 Accepted: 01-08-2026
 Published: 21-09-2026

The names and affiliations of all authors are provided below, following the references.

Effect of different growing media on germination and seedling growth of acid lime (*Citrus aurantifolia* Swingle) cv. Phule Sharbati

Utkarsh Kumar Sonboir¹, UB Deshmukh², Sangeeta³, Medha Saha⁴, Namita Singh⁵, Yamini⁶, Sachin Girre⁷

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i9S.10089>

ABSTRACT

The present study entitled “Effect of different growing media on germination and seedling growth of acid lime (*Citrus aurantifolia* Swingle) cv. Phule Sharbati” was conducted during the year 2025-26 at Pt. Kishori Lal Shukla, College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh. The experiment was laid out in a Completely Randomized Design with 11 treatments and each are replicated thrice, comprising different growing media viz., vermicompost, cocopeat, neem cake, mustard cake, farmyard manure, rice husk and soil is use as base media for all the treatments. The treatment T_6 - Soil + Cocopeat + Vermicompost (1:1:1) was found best with regards to minimum number of days taken to 1st seed germination (16.30 days), days taken to 50 percent germination (20.50 days), highest germination percentage (86.17%) as well as growth parameters viz., maximum height of seedlings (24.53 cm), fresh and dry weight of shoot (8.33 g and 4.47 g, respectively), fresh and dry root weight of root (2.47 g and 1.51 g, respectively), stem diameter (3.83 mm) and maximum root length (19.54 cm) at 120 DAS. In T_3 - Soil + FYM (2:1) recorded the highest root to shoot ratio (0.381) at 120 DAS and T_{10} - Soil + Cocopeat + Mustard Cake, marks the maximum number of leaves per plant (24.70) and the highest root diameter (3.13 mm) at 120 DAS. Whereas, the T_0 - Control (Soil) was recorded the lowest values for all germination, growth and survival parameters at 120 DAS.

Keywords: Growing media, Germination, Seedling growth, Vermicompost, Cocopeat, Mustard Cake, Farmyard manure

Introduction

Citrus fruits are classify under succulent (fleshy) fruits, having a leathery and glandular pericarp, the locules of these fruits contain juicy sacs developed from the placental hair of the endocarp and this type of fruits is known as Hesperidium (Singh, 2002) [1]. *Citrus* belongs to Rutaceae family which consists of over 160 genera and more than 2,000 species, are majorly found in tropical and subtropical areas and a few citrus species are adapted to temperate regions (Kubitzki *et al.*, 2011) [2]. *Citrus* is divided into four groups: lime and lemons belong to the acid group, the orange group consists of sweet oranges and the 3rd group of mandarins and the last group is of pummelo and grapefruit (Bose *et al.*, 2021) [3]. Northeastern India is a home of acid lime (*Citrus aurantifolia* Swingle) having a chromosome number of $2n = 18$. Acid lime are the natural cross of *Papeda* × *Citrus medica* (Chadha, 2019) [4]. The seed of acid lime is polyembryonic in nature which means ovules consist of more than one embryo germination percentage varies between 58 and 70% and it takes 3 weeks to germinate. The polyembryonic seeds are true to type of their parents, due to which it is best method of propagation of acid lime. In this study cv. Phule Sharbati was sown in different growing media for determining the best media for germination, growth as well as survival of acid lime seedlings. Growing media are as soil, vermicompost, cocopeat, neem cake, mustard cake, farmyard manure and rice husk. Vermicompost in combination with soil and cocopeat increase soil texture and porosity, improve water-holding capacity and also enhance the microbial activity in the rhizosphere (Prajapati *et al.*, 2017) [5]. Mustard cake, along with cocopeat is excellent for seed germination, seedling growth and survivability of seedlings because it is rich in organic matter and NPK (4:1:1). The rice husks possess favorable physicochemical properties for the germination, growth and development of the roots to grow fruit plants but take time to decompose due to high C:N ratio (85:1), silica and lignin content. (Caso *et al.*, 2009; Ghasal *et al.*, 2025) [6]. Neem cake is a great organic additive to growing medium for seedlings because it offers natural pest and disease control (particularly neem's fungicidal properties) and improves soil structure and aeration, but due to the presence of azadirachtin, it acts as a natural nitrification inhibitor, which holds ammonium in the soil (Abeka *et al.*, 2022) [7]. Farm yard manure has a good amount of nutrients that is partially decomposed, and it makes nutrients available gradually. Nainar *et al.* (2021) [8] show better germination, stronger root development,

Corresponding Author:
Utkarsh Kumar Sonboir
 Research Scholar,
 Department of Fruit
 Science, Pt. Kishori Lal
 Shukla College of
 Horticulture and Research
 Station, Rajnandgaon,
 MGUVV, Durg,
 Chhattisgarh, India

more chlorophyll, and generally healthier, more robust seedlings in media soil, FYM, vermicompost, and cocopeat in equal proportions produced higher results.

Materials and Methods

Location

The experiment was conducted under a shade net house of Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon in the year 2025-26. It is situated in the fertile plains of Chhattisgarh, located at 21.10° N latitude and 81.03° E longitude, with an altitude of 307 meters above mean sea level. These geographical coordinates place the experimental station in a subtropical climatic zone favorable for citrus cultivation and other related research work. The average rainfall in this region is 1,274 mm. Maximum Temperature range in the summer is 45°C and minimum temperature 10°C during winter.

Layout of experiment

The experiment was laid out in a Completely Randomized Design (CRD) comprising 11 treatments, each replicated 3 times. The arrangement of treatments was done in accordance with the principles of CRD to ensure uniformity and to minimize experimental error. Acid lime seeds were sown in polythene bags of 6×12 inch size filled with different growing media and its combinations. Per polythene bag, single seed was sown at 1.2 cm depth. Each treatment per replication carries 20 polybags labelled with appropriate tags, totally 220 polythene bags in a single replication and in an experiment total 660 polybags were sown. The bags were arranged according to the experimental layout, and treatments were allocated to replications using the principles of randomization.

Treatment details

The experimentation comprising of 11 treatment combinations viz., T₀ - Control (Soil), T₁ - Soil + Neem Cake (2:1), T₂ - Soil + Cocopeat + Neem Cake (1:1:1), T₃ - Soil + FYM (2:1), T₄ - Soil + Cocopeat +

FYM (1:1:1), T₅ - Soil + Vermicompost (2:1), T₆ - Soil + Cocopeat + Vermicompost (1:1:1), T₇ - Soil + Rice husk (2:1), T₈ - Soil + Cocopeat + Rice husk (1:1:1), T₉ - Soil + Mustard Cake (2:1), T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1). In this experiment various combination of organic growing media is used in a definite proportion. Vermicompost is enrich in nutrients and humus, also known as worm castings, worm humus or worm manure (Lavanya *et al.*, 2022) [9] their compost is an odourless, clean, organic material containing adequate quantities of (N:P:K = 1.5:0.8:1.5) and several micronutrients essential for plant growth (Gohil *et al.*, 2022) [10]. Rice husks have favorable physicochemical properties for the germination, growth and development of the roots, to grow fruit plants (Caso *et al.*, 2009). It is low-cost and renewable bio-based water adsorbent which helps in seed germination. Mustard cake, along with cocopeat is an excellent component of growing media for seed germination, seedling growth and survival. Because it is rich in organic matter and NPK (4:1:1) (Ghasal *et al.*, 2025) [6]. It is used to fertilize various crops and increases the humus content of the soil. The composition of neem cake is 5.2% N, 1.0% P and 1.4% K. Farm Yard Manure is basically prepared from cow manure, cow urine, waste straw and other dairy waste. FYM is a rich source of nutrients (N:P:K = 0.55:0.28:0.52) and helps in improve and maintain soil fertility (Patil *et al.*, 2015).

Observations recorded

The observations were recorded at 30, 60, 90 and 120 days after sowing viz., germinations parameters are days taken to 1st seed germination, days taken to 50 percent germination and germination percentage. Seedling growth parameters are height of seedlings and number of leaves per plant are observed at 30, 60, 90 and 120 days after sowing, rest of parameters like diameter of stem and root, fresh and dry weight of root and shoot, length of root is observed only at 120 days. Root : shoot ratio is calculated through formula:

$$\text{Root : Shoot ratio} = \frac{\text{Dry weight of roots (g)}}{\text{Dry weight of shoots (g)}}$$

Result and discussions

The data were observed, explored and recorded during the investigation were analyzed statistically to understand the differences among the effect of different growing media combinations. The average value of plant response of all treatments was calculated and compared to identify significant results. The findings of present experiment are presented under the following headings:

Days taken to 1st seed germination

The data collected during the experiment were analysed and has been shown in table 1 and figure 1. Among all the treatments, T₆ - Soil + Cocopeat + Vermicompost (1:1:1) took significantly minimum number of days (16.3 days) to germinate, which was significantly superior over all other treatments and was followed by T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) (17.5 days), T₉ - Soil + Mustard Cake (2:1) (19.6 days), T₄ - Soil + Cocopeat + FYM (1:1:1) (20.8 days) and T₅ - Soil + Vermicompost (2:1) (21.3 days), whereas T₄ and T₅ were statistically *at par* with each other at the 5% level of significance. In T₀ - Control (Soil), marks the maximum number (26.1 days) taken to 1st seed germination. Cocopeat, soil and vermicompost have been shown to promote germination and early growth by improving the physical, chemical and biological characteristics of the growing media. This media supply sufficient moisture as well as superior porosity which permits adequate moisture and gaseous exchange (aeration) between the media and seed embryo, which is essential for rapid and uniform germination of seeds. This conclusion is similar to those of Narayan

et al. (2008) [11] and Bihari *et al.* (2009) [12] in Aonla, Prajapati *et al.* (2017) [5], Nainar *et al.* (2021) [8] in acid lime.

Days taken to 50 percent germination

The data noted during the experiment were analysed and has been presented in table 1 and figure 2. The minimum number of days taken to 50 per cent germination (20.50 days) was recorded in treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1), which was significantly *at par* with T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) - (21.50 days). In contrast maximum days (31.74 days) taken to 50 percent germination has been shown in T₀ - Control (Soil). Vermicompost, soil and cocopeat combinations, might enhance the retention of more water and air which helped in quick and early enzymatic action for synthesis of metabolites for cell multiplication and increase the breakdown of the seed coat resulting in the transformation of embryo into a seedling early enough. This finding were confirmed by Haribhau *et al.* (2022) [13] and Prajapati *et al.* (2017) [5] in acid lime.

Germination percentage

The germination percentage of acid lime under different growing media has been shown in table 1 and figure 3. The maximum germination percentage (86.17%) was observed under the treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1), which was *at par* with T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) recording (83.68%) germination at 5% level of significance. The lowest germination percentage (58.50 %) was seen under T₀ - Control (Soil). The Germination percentage higher in vermicompost and cocopeat combination due to high cation exchange capacity for accumulation of nutrients and having the properties of good water holding capacity as well as being adequate por

ous, which encourages good moisture and exchange of gases between the germination media and embryo, which is essential for germination of seeds (Ramteke *et al.*, 2015) [14]. Mustard cake serves as an organic nutrient source high in N, P and S, which promotes early seed germination and seedling growth of acid lime. As a result, germination is generally high and statistically comparable to T₆, but significantly lower due to presence of glucosinolates which may cause temporary phytotoxicity during decomposition, but after decomposition it helps in seedling growth and survival.

Seedling growth parameters

Height of seedlings

The height of seedlings (cm) of acid lime at 30, 60, 90 and 120 DAS were noted in table 2 and illustrate in figure 4. The maximum height of seedlings was observed under the treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1) of (5.23 cm, 11.50 cm, 17.60 cm and 24.53 cm) at 30, 60, 90 and 120 DAS respectively, which was found to be significantly better over all other treatments. In contrast with T₀ - Control (Soil) recorded minimum height of seedlings of (1.80 cm, 4.80 cm, 8.90 cm and 15.20 cm) at 30, 60, 90 and 120 DAS. The combination of cocopeat and vermicompost is highly influence the height of seedling, because it combines ideal physical structure with high nutrient availability, promoting rapid cell division and expansion (Haribhau *et al.*, 2022) [13]. Mustard Cake contains higher nitrogen than vermicompost but then also vermicompost perform better than mustard cake initially due to presence of glucosinolates in mustard cake take time to decompose, while vermicompost is already dead and decomposed one, its nutrients easily available to plants, but later stage (after 120 days) it increases in the height as well as number of leaves of seedlings.

Number of leaves per plant

The number of leaves per plant is counted and noted in a table 3 and sketched in figure 5 at 30, 60, 90 and 120 DAS. The highest number of leaves was observed in T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) at 30, 60, 90 and 120 DAS having respective number of leaves (8.2, 13.4, 18.7, 24.7). The Mustard cake, along with cocopeat is excellent for seedling growth and survivability of seedlings because it is rich in organic matter and NPK (4:1:1). The highest nitrogen present in the mustard cake leads to formation of more number of leaves due to chlorophyll synthesis, photosynthesis, and leaf development. The combine effect of this treatments, resulting in vigorous vegetative growth and enhanced leaf production. Mustard cake enhance vegetative growth, number of leaves per plant, fruit yield and quality in Aonla. This finding was supported by Yadav *et al.* (2024) [15] in Nagpur Mandarin. While lowest number of leaves (4.7, 7.3, 10.7 and 15.2) was found in T₀ - Control (Soil) at 30, 60, 90 and 120 DAS respectively.

Diameter of stem

The diameter of stem of acid lime seedlings are measured using digital vernier caliper and the data is presented in the table 4 and figure 6. At 120 DAS highest diameter is recorded in T₆ - Soil + Cocopeat + Vermicompost (1:1:1) is (3.83 mm) and was recorded minimum in T₀ - Control (Soil) is (2.17 mm). Vermicompost, cocopeat and soil amalgamation influence the nutrient uptake and provides growth promoting substances that not only helps in vegetative growth of seedlings but also boost the shoot thickness. This finding was confirmed by Sajana *et al.* (2018) [9] in marking nut and Choudhary *et al.* (2022) [16] in Mandarin.

Length of root

At 120 DAS, the seedlings of acid lime cv. Phule Sharbati is uprooted for determining the length of root, the taproot is measured and shown in the table 4 and figure 7. The highest length of root (19.54 cm) was determined under the T₆ - Soil + Cocopeat + Vermicompost (1:1:1), which was *at par* with treatment T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) observing an average length of root (18.48 cm). Both

these treatments were statistically *at par* with T₉ - Soil + Mustard Cake (2:1) having (18.33 cm) root length at the 5% level of significance. The lowest length of root (12.87 cm) was marked under the control. Vermicompost represents a hormone like activity and increased the number of roots, which results improving nutrient absorption in addition to better growth and development of plants. All this growth length of root is due to good rhizosphere, promotes root development. The results are in consonance with the earlier report by Dhruw *et al.* (2025) [17] in papaya.

Diameter of root

The diameter of root is presented on table 4 and figure 8 at 120 DAS, among the different growing media combinations studied in the present experiment, the maximum root diameter (3.13 mm) was found under the treatment T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1), while the minimum root diameter (1.30 mm) was observed in T₀ - Control (Soil). The increased root diameter under T₁₀ may be associated with improved nutrient availability and better soil physical conditions provided by cocopeat and mustard cake, especially mustard cake influences in increases root diameter and overall root health by supplying high concentrations of nitrogen and other essential nutrients, encouraging robust structural growth. Yadav *et al.* (2024) [15] observed that increase in number of fruits per plant, fruit yield per plant and per hectare in mustard cake because due to high nitrogen which enhance the vegetative growth, due to which more number of leaves form more photosynthetic activity increase in dry matter production and more will be the diameter of root leads to increase in C:N ratio which enhance flowering and fruiting.

Fresh weight of shoot

The data shown at table 4 and figure 9, the fresh weight of shoot at 120 DAS. In comparison with the different growing media treatments, the maximum fresh weight of shoot was shown in T₆ - Soil + Cocopeat + Vermicompost (1:1:1) at (8.33 g), which was significantly best over all other treatments. While the minimum fresh weight (4.33 g) of shoot was marked under the control. The improved growth of these treatments may be attributed to better nutrient availability, improved aeration, and enhanced moisture retention capacity. Conversely, the control treatment noted the lowest shoot biomass. The impact on growth and development of plant was nutritionally, as well as biochemical and hormonal effect. Some researchers have reported that vermicompost increases biomass in various plants. This study is confirmed by Nainar *et al.* (2021) [8] and Lungariya *et al.* (2022) [18] in acid lime.

Dry weight of shoot

The maximum dry weight of shoot (4.47 g) was noted and mention in the table 4 and represented in figure 10 under the treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1) which was found best overall the treatments followed by T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) with dry weight of (4.17 g). Moreover, the minimum dry weight of shoot (2.27 g) was observed in T₀ - Control (Soil). The present study agreement with Ramteke *et al.* (2015) [14] that vermicompost and cocopeat treated growing media also reported higher leaf chlorophyll content which might certainly improve the photosynthetic rate, dry matter production and their by more fresh and dry weight of shoot.

Fresh weight of root

Table 4 and figure 11 presents data on the fresh weight of roots in acid lime seedlings at 120 DAS, as influenced by different growing media treatments. The maximum fresh weight of root (2.47 g) was founded under the treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1) followed by T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) which was found to be significantly better over all other treatments. Whereas, the minimum fresh weight of root (0.45 g) was noted in T₀ - Control (Soil). The enhanced fresh weight of root under T₆ may be attributed to improved physical properties of the growing media such as better aeration, higher moisture retention, and increased nutrient availability. Also vermicompost and cocopeat retain high moisture

which tends to maintain sufficient moisture in a plant cells. The present result is in conformity with the earlier report of [Prajapati et al. \(2017\)](#) [5] and [Jangde et al. \(2020\)](#) in acid lime.

Dry weight of root

The data of dry weight of root at 120 DAS, are collected in the [Table 4](#) and sketch on figure 12. The maximum dry weight of root (1.51 g) was recorded under the treatment T₆ - Soil + Cocopeat + Vermicompost (1:1:1) which was found to be significantly superior over all other treatments, followed by T₁₀ - Soil + Cocopeat + Mustard Cake (1:1:1) of (1.40 g) and T₉ of (1.22 g) of dry weight of root. The increased dry matter accumulation in roots under T₆ may be attributed to improved nutrient availability, enhanced microbial activity, and better physical properties of the growing media such as aeration and moisture retention, which promote root growth and efficient assimilation of nutrients, ultimately leading to higher root biomass ([Ramteke et al., \(2015\)](#) [14] in papaya, [Jangde et al., \(2020\)](#) and [Nainar et al. \(2021\)](#) [8] in acid lime.

Root: shoot ratio

The data presented in the [table 4](#) and illustrate in [figure 13](#), recorded the root shoot ratio of acid lime seedlings at 120 DAS. The maximum root : shoot ratio (0.381) was recorded under the treatment T₃ - Soil + FYM (2:1), which was followed by T₆ (0.338) which was statically *at par* with T₁₀ (0.336), T₈ (0.336), T₉ (0.331), T₅ (0.327) and T₂ (0.323) showed non-significant differences with each other at the 5% level of significance. Whereas, the minimum root : shoot ratio (0.158) was shown in T₀ - Control (Soil), which was significantly poorer to

all other treatments. In T₃ - Soil + FYM (2:1) stimulates higher dry matter production due to high carbohydrate, cellulose and lignin content in farm yard manure and low fresh weight as compare to T₆ - Soil + Vermicompost + Cocopeat (1:1:1) having high fresh weight due to high water holding capacity and high moisture retention in his treatment leads to higher fresh weight and low root shoot ratio than farm yard manure and soil media. Similar results were obtained by [Prajapati et al. \(2017\)](#) [5] in acid lime.

Conclusions

According to the present research findings, germination parameters *viz* minimum days taken to 1st seed germination, minimum days taken to 50 percent seed germination and maximum germination percentage, seedling growth parameters like height of seedlings and number of leaves at 30, 60, 90 and 120 DAS diameter of stem, fresh and dry weight of root and shoot were confirmed maximum in T₆ – Soil + Vermicompost + Cocopeat (1:1:1).

Both germination and seedling growth parameter T₆ – Soil + Vermicompost + Cocopeat (1:1:1) noted as best media it is due to good water holding capacity, high humus content and easily available nutrient present in this media.

Acknowledgement

We thank the college Pandit Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon for rendering all necessary facilities required for fulfillment of this research work. germination percent of acid lime cv. Phule Sharbati.

Table 1. Effect of different growing media on days taken to 1st seed germination, days taken to 50 percent germination and

Notations	Treatments	Days taken to 1 st seed germination	Days taken to 50 percent germination	Germination percentage
T ₀	Control (Soil)	26.1 ^h	31.74 ^g	58.50 ^h
T ₁	Soil + Neemcake (2:1)	25.0 ^g	29.16 ^f	69.34 ^g
T ₂	Soil + Cocopeat + Neemcake (1:1:1)	24.5 ^{fg}	27.50 ^e	75.68 ^{def}
T ₃	Soil + FYM (2:1)	23.3 ^e	27.67 ^e	77.83 ^{cd}
T ₄	Soil + Cocopeat + FYM (1:1:1)	20.8 ^d	25.34 ^d	73.67 ^{ef}
T ₅	Soil + Vermicompost (2:1)	21.3 ^d	26.66 ^e	72.50 ^{fg}
T ₆	Soil + Cocopeat + Vermicompost (1:1:1)	16.3 ^a	20.50 ^a	86.17 ^a
T ₇	Soil + Rice Husk (2:1)	23.6 ^e	29.34 ^f	76.34 ^{de}
T ₈	Soil + Cocopeat + Rice Husk (1:1:1)	23.7 ^{ef}	27.83 ^e	78.82 ^{cd}
T ₉	Soil + Mustard Cake (2:1)	19.6 ^c	23.67 ^c	80.83 ^{bc}
T ₁₀	Soil + Cocopeat + Mustard Cake (1:1:1)	17.5 ^b	21.50 ^{ab}	83.68 ^{ab}
	C.D. @ 5%	0.87	1.18	3.25
	SE(m) ±	0.29	0.40	1.10
	SE(d)	0.41	0.56	1.55
	C.V.	2.33	2.62	2.51

*The superscript letter indicates that the treatment means with same letters are *at par* at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

(continued on next page)

Table 2. Effect of different growing media on height of seedlings (cm) of acid lime cv. Phule Sharbati

Notations	Treatments	Height of seedling (cm)			
		30 DAS	60 DAS	90 DAS	120 DAS
T ₀	Control (Soil)	1.80 ⁱ	4.80 ^g	8.90 ^j	15.20 ⁱ
T ₁	Soil + Neemcake (2:1)	2.77 ^h	8.13 ^{ef}	13.03 ^g	19.80 ^f
T ₂	Soil + Cocopeat + Neemcake (1:1:1)	3.01 ^g	9.63 ^c	13.70 ^f	20.20 ^e
T ₃	Soil + FYM (2:1)	3.37 ^f	8.43 ^{de}	14.97 ^e	19.77 ^f
T ₄	Soil + Cocopeat + FYM (1:1:1)	3.80 ^d	9.80 ^c	15.40 ^d	21.60 ^d
T ₅	Soil + Vermicompost (2:1)	3.61 ^e	8.83 ^d	16.10 ^c	20.20 ^e
T ₆	Soil + Cocopeat + Vermicompost (1:1:1)	5.23 ^a	11.50 ^a	17.60 ^a	24.53 ^a
T ₇	Soil + Rice Husk (2:1)	2.80 ^h	7.77 ^f	11.70 ⁱ	17.63 ^h
T ₈	Soil + Cocopeat + Rice Husk(1:1:1)	3.11 ^g	8.13 ^{ef}	12.67 ^h	18.70 ^g
T ₉	Soil + Mustard Cake (2:1)	4.03 ^c	10.17 ^c	15.90 ^c	21.80 ^c
T ₁₀	Soil + Cocopeat + Mustard Cake (1:1:1)	4.81 ^b	10.70 ^b	16.64 ^b	22.60 ^b
C.D. @ 5%		0.18	0.51	0.63	0.81
SE(m) ±		0.06	0.17	0.21	0.27
SE(d)		0.08	0.24	0.30	0.39
C.V.		3.10	3.36	2.58	2.36

*The superscript letter indicates that the treatment means with same letters are *at par* at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

Table 3. Effect of different growing media on number of leaves per plant of acid lime seedlings cv. Phule Sharbati

Notations	Treatments	Number of leaves per plant			
		30 DAS	60 DAS	90 DAS	120 DAS
T ₀	Control (Soil)	4.7 ⁱ	7.3 ⁱ	10.7 ^g	15.2 ^h
T ₁	Soil + Neemcake (2:1)	5.6 ^g	8.4 ^h	13.5 ^f	16.7 ^g
T ₂	Soil + Cocopeat + Neemcake (1:1:1)	6.8 ^c	10.3 ^e	15.2 ^{de}	19.2 ^{ef}
T ₃	Soil + FYM (2:1)	5.9 ^f	9.7 ^f	14.7 ^e	18.7 ^f
T ₄	Soil + Cocopeat + FYM (1:1:1)	6.6 ^d	10.9 ^d	16.2 ^{cd}	22.3 ^{cd}
T ₅	Soil + Vermicompost (2:1)	6.3 ^e	10.5 ^e	16.6 ^{bc}	21.8 ^d
T ₆	Soil + Cocopeat + Vermicompost (1:1:1)	7.8 ^b	12.9 ^b	17.6 ^b	23.8 ^b
T ₇	Soil + Rice Husk (2:1)	5.2 ^h	9.1 ^g	15.4 ^{de}	19.0 ^{ef}
T ₈	Soil + Cocopeat + Rice Husk(1:1:1)	5.4 ^g	9.6 ^f	15.7 ^{cde}	19.8 ^e
T ₉	Soil + Mustard Cake (2:1)	7.1 ^c	11.4 ^c	16.6 ^{bc}	22.7 ^{bc}
T ₁₀	Soil + Cocopeat + Mustard Cake (1:1:1)	8.2 ^a	13.4 ^a	18.7 ^a	24.7 ^a
C.D.		0.49	0.59	1.05	0.87
SE(m) ±		0.16	0.20	0.35	0.29
SE(d)		0.23	0.28	0.50	0.41
C.V.		4.57	3.38	3.97	2.52

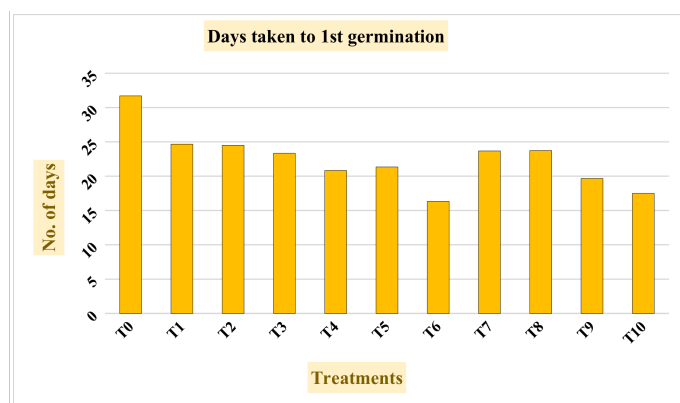
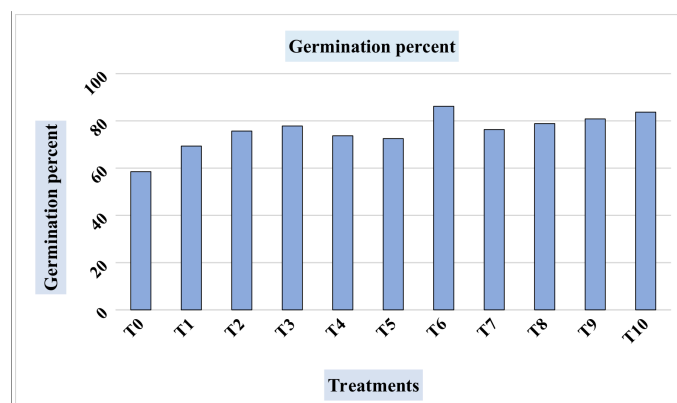
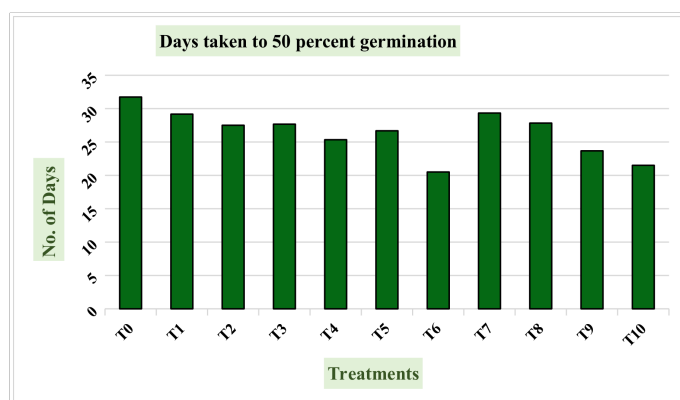
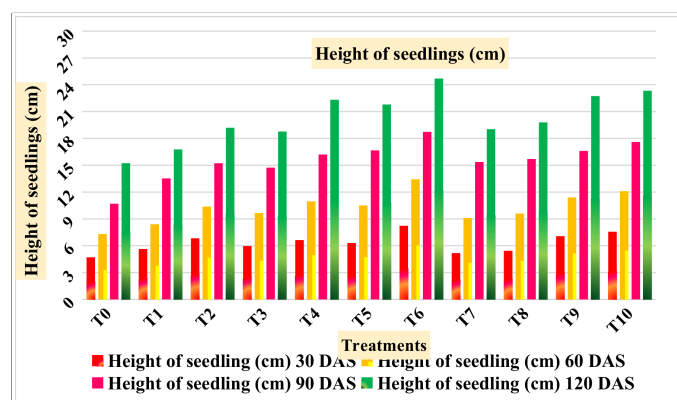
*The superscript letter indicates that the treatment means with same letters are *at par* at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

(continued on next page)

Table 4. Effect of different growing media on growth parameter of shoot and root of acid lime cv. Phule Sharbati seedlings

Notations	Treatments	Diameter of stem	Diameter of root	Length of root	Fresh weight of shoot	Dry weight of shoot	Fresh weight of root	Dry weight of root	Root : Shoot ratio
T ₀	Control (Soil)	2.17 ^g	1.30 ⁱ	12.87 ^e	4.33 ^g	2.27 ^g	0.45 ^h	0.36 ^h	0.158 ^e
T ₁	Soil + Neemcake (2:1)	2.48 ^{ef}	1.90 ^g	16.63 ^{cd}	5.17 ^f	2.63 ^f	1.30 ^g	0.77 ^g	0.295 ^d
T ₂	Soil + Cocopeat + Neemcake (1:1:1)	2.67 ^d	2.13 ^f	17.07 ^c	5.90 ^e	2.90 ^e	1.47 ^f	0.94 ^e	0.323 ^{bc}
T ₃	Soil + FYM (2:1)	2.60 ^{de}	2.43 ^e	16.57 ^{cd}	5.40 ^f	2.60 ^f	1.67 ^e	0.99 ^e	0.381 ^a
T ₄	Soil + Cocopeat + FYM (1:1:1)	2.81 ^c	2.77 ^{bc}	17.81 ^{bc}	6.90 ^{cd}	3.83 ^c	1.77 ^{de}	1.14 ^d	0.297 ^d
T ₅	Soil + Vermicompost (2:1)	2.48 ^{ef}	2.57 ^d	17.30 ^{bc}	6.60 ^d	3.50 ^d	1.90 ^{cd}	1.14 ^d	0.327 ^{bc}
T ₆	Soil + Cocopeat + Vermicompost (1:1:1)	3.83 ^a	2.83 ^b	19.54 ^a	8.33 ^a	4.47 ^a	2.47 ^a	1.51 ^a	0.338 ^b
T ₇	Soil + Rice Husk (2:1)	2.34 ^f	1.6 ^h	15.48 ^d	5.33 ^f	2.73 ^{ef}	1.40 ^{fg}	0.86 ^f	0.317 ^c
T ₈	Soil + Cocopeat + Rice Husk(1:1:1)	2.43 ^f	1.83 ^g	16.83 ^c	5.57 ^{ef}	2.93 ^e	1.67 ^e	0.98 ^e	0.336 ^b
T ₉	Soil + Mustard Cake (2:1)	2.86 ^c	2.67 ^{cd}	18.34 ^{ab}	7.20 ^c	3.70 ^c	1.93 ^c	1.22 ^c	0.331 ^{bc}
T ₁₀	Soil + Cocopeat + Mustard Cake (1:1:1)	3.60 ^b	3.13 ^a	18.48 ^{ab}	7.87 ^b	4.17 ^b	2.17 ^b	1.40 ^b	0.336 ^b
	C.D. @ 5%	0.13	0.12	1.16	0.40	0.19	0.12	0.05	0.026
	SE(m) ±	0.04	0.04	0.39	0.13	0.06	0.04	0.01	0.009
	SE(d)	0.06	0.05	0.55	0.19	0.09	0.06	0.02	0.013
	C.V.	2.86	3.13	4.02	3.80	3.51	4.54	2.83	4.944

*The superscript letter indicates that the treatment means with same letters are *at par* at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

**Figure 1.** Effect of different growing media on days taken to 1st seed germination of acid lime cv. Phule Sharbati**Figure 3.** Effect of different growing media on germination percent of acid lime cv. Phule Sharbati**Figure 2.** Effect of different growing media on days taken to 50 percent seed germination of acid lime cv. Phule Sharbati**Figure 4.** Effect of different growing media on height of acid lime seedlings (cm) cv. Phule Sharbati

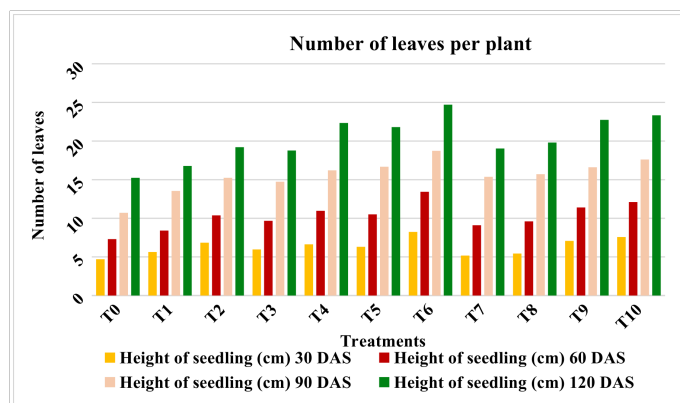


Figure 5. Effect of different growing media on number of leaves per plot of acid lime cv. Phule Sharbati

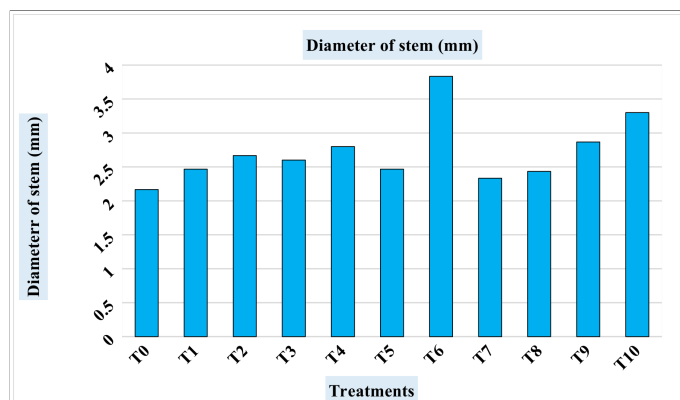


Figure 6. Effect of different growing media on diameter of stem (mm) of acid lime cv. Phule Sharbati

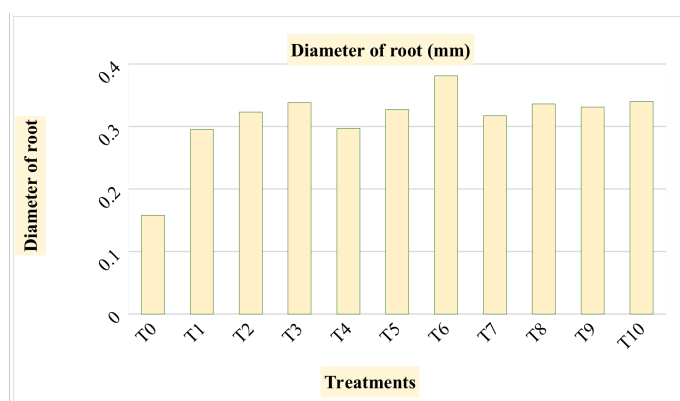


Figure 7. Effect of different growing media on diameter of root (mm) of acid lime cv. Phule Sharbati

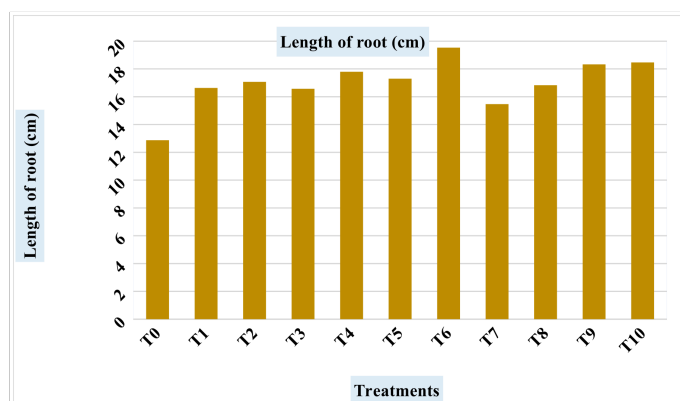


Figure 8. Effect of different growing media on length of root (cm) of acid lime cv. Phule Sharbati

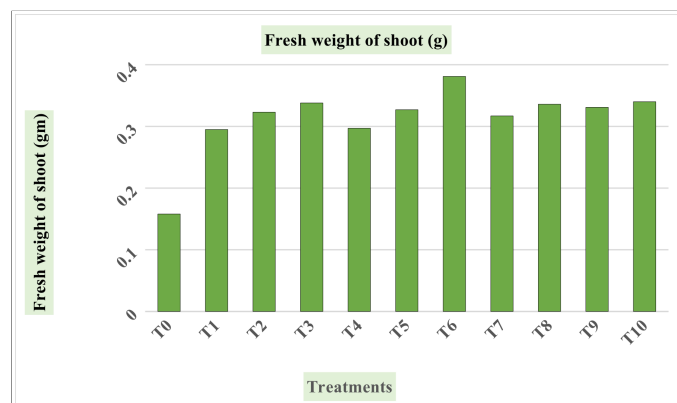


Figure 9. Effect of different growing media on Fresh weight (g) of shoot of acid lime cv. Phule Sharbati

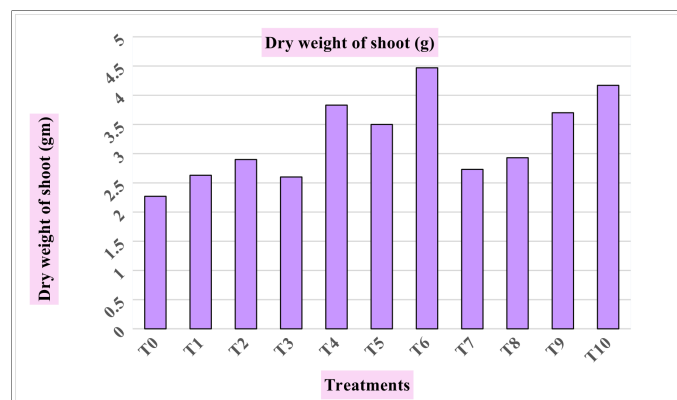


Figure 10. Effect of different growing media on dry weight of shoot (g) of acid lime cv. Phule Sharbati

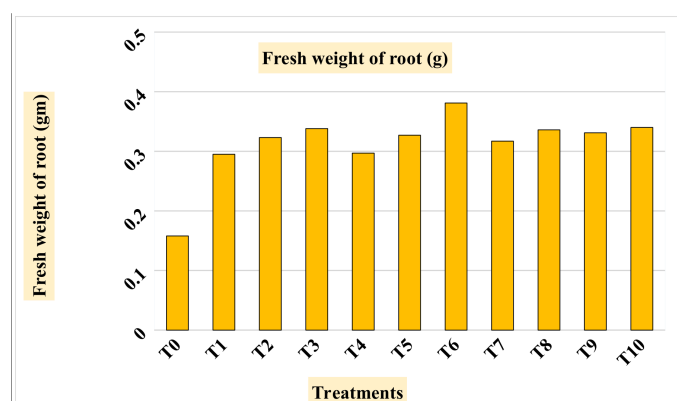


Figure 11. Effect of different growing media on fresh weight of root (g) of acid lime cv. Phule Sharbati

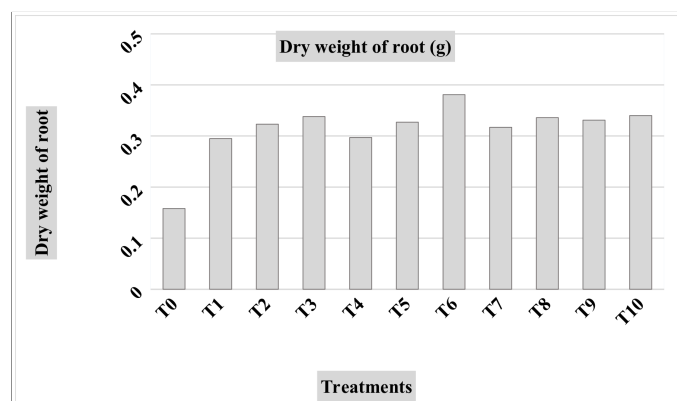


Figure 12. Effect of different growing media on dry weight of root (g) of acid lime cv. Phule Sharbati

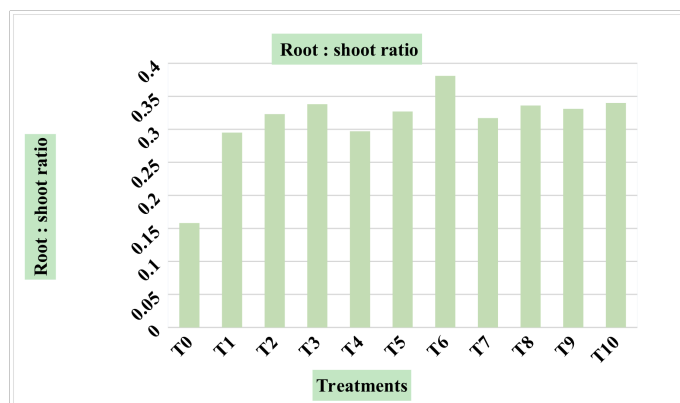


Figure 13. Effect of different growing media on root: shoot ratio of acid lime cv. Phule Sharbati

References

- Singh J. Basic horticulture. Hyderabad: Kalyani Publishers; 2002.
- Kubitzki K, Kallunki JA, Duretto M, Wilson PG. Rutaceae. In Kubitzki K, editor. The families and genera of vascular plants. Flowering plants. Eudicots (Sapindales, Cucurbitales, Myrtaceae). Springer. 2011;4(10):276–356.
- Bose TK, Parthasarathy VA, Mitra SK, Ghosh B, Chakraborty I, Sanyal D. Fruits: Tropical and subtropical. 4th Edition. Daya Publishing House Pvt. Ltd. New Delhi. 2021;1(4):11-19.
- Chadha KL. Limes and lemons. In Handbook of Horticulture, Published by Directorate of Information and publication of Agriculture, ICAR, Krishi Anusandhan Bhavan, New Delhi. 2019:110-021.
- Prajapati DG, Satodiya BN, Desai AB, Nagar PK. Influence of storage period and growing media on seed germination and growth of acid lime seedlings (*Citrus aurantifolia* Swingle) cv. Kagzi. Journal of Pharmacognosy and Phytochemistry. 2017;6(4):1641-1645.
- Ghasal PC, Choudhary J, Dutta D, Bhanu C, Meena AL, Kumar L, Singh R. Effect of mustard oilcake integration in organic nutrient management on the performance of wheat during conversion period. Indian Journal of Agronomy. 2025;(70):92-96.
- Abeka H, Lawson IY D, Nartey E, Adjadeh T, Asuming-Brempong S, Bindraban P, Atakora WK. Effectiveness of neem materials and biochar as nitrification inhibitors in reducing nitrate leaching in a compost-amended Ferric Luvisol. Frontiers in Soil Science. 2022;(2):1023743.
- Nainar P, Muthulakashmi S, Manivannan LM. Effect of growing media on seed germination and seedling growth of acid lime (*Citrus aurantifolia* Swingle). International Journal of Current Microbiology and Applied Sciences. 2021;10(8):110-122.
- Lavanya G, Abi M. Production of Vermicompost from Domestic Waste with Cow Dung by using *Perionyx* Excavatus. International Journal of Trend in Scientific Research and Development. 2022;6(4):1207-1215. Sajana S, Munde GR, Shirsath AH. Effect of growing media on seed germination and seedling growth of marking nut (*Semecarpus anacardium*). Plant Archives. 2018;2(18):19-26.
- Gohil RB, Panchal RR, Raval VH, Rajput KN. Isolation of plant growth promoting bacteria from fermented panchagavya and their effect on *Trigonella foenum graecum*. Agricultural Research Journal. 2022;59(4):794.
- Narayan S, Singh AK, Prasad VM. Effect of growing media on seed germination, rate of seed germination, transplanting success and seedling mortality in aonla. (*Emblica officinalis* G). The Allahabad Farmer. 2008;64(1):77-80.
- Bihari M, Narayan S, Kumar R. Effect of growing media on seed germination, rate of seed germination, transplanting success and seedling mortality in Aonla (*Emblica officinalis* Garten). Journal of Interacademia. 2009;13(4):408-411.
- Haribhau KA, Paikra MS, Deshmukh UB, Ramteke LK, Nishad D, Taram M, Rathore A. Effect of GA3 and growing media on seed germination, growth and vigour of Rangpur lime (*Citrus limonia* Osbeck). The Pharma Innovation. 2022;11(12):3056-3061.
- Ramteke V, Paithankar DH, Kamatyanatti M, Baghel MM, Chauhan J, Kurrey V. Seed germination and seedling growth of papaya as influenced by GA3 and propagation media. International Journal of Farm Sciences. 2015;5(3):74-81.
- Yadav VK, Singh V, Suman M, Kumar S, Sharma Y. Effect of organic substances on yield and economic feasibility of mandarin. Plant archives. 2024;24(2):1531-1535.
- Choudhary B, Sharma TR, Pandey SK, Paradkar VK. Effect of rootstock and growing media on seedling growth and success of micro budding technique of Mandarin (*Citrus reticulata* Blanco). Pharma Innovation Journal. 2022;11(12):6315-6322.
- Dhruw BK, Deshmukh UB, Paikra MS, Singh J, Nishad D, Gupta N, Sahu V. Influence of different growing media on seed germination of papaya (*Carica papaya* L.). International Journal Advanced Biochemical Research. 2025;10(6):1601-1603.
- Lunagariya RJ, Jat RK, Solanki SM. Effects of seed soaking and growing media on germination and survivability of acid lime (*Citrus aurantifolia* Swingle). International Journal of Plant & Soil Science. 2022;34(23):1720-1728.
- Caso C, Chang M, Rodríguez-Delfín A. Effect of the growing media on the strawberry production in column system. In International Symposium on Soilless Culture and Hydroponics. 2008;843:373-380.
- Jangde A, Deshmukh UB, Paikra MS, Chandrakar MK. Effect of gibberellic acid and different growing media on seed germination of acid lime. Pharma Innovation. 2024;13(6):01-03.

How to cite this article: Sonboir UK, Deshmukh U, Sangeeta, Saha M, Singh N, Yamini, et al. Effect of different growing media on germination and seedling growth of acid lime (*Citrus aurantifolia* Swingle) cv. Phule Sharbati. *International Journal of Advanced Biochemistry Research*. 2026;SP-10(9):1843-1851. doi: <https://www.doi.org/10.33545/26174693.2026.v10.i9S.10082>

Authors

Utkarsh Kumar Sonboir

Research Scholar, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

UB Deshmukh

Assistant Professor, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Sangeeta

Assistant Professor, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Medha Saha

Assistant Professor, Department of Floriculture and Landscaping, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Namita Singh

Assistant Professor, Department of Genetics and Plant Breeding, College of Horticulture and Research Station, Arjunda, Balod, MGUVV, Durg, Chhattisgarh, India

Yamini

Teacher, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Sachin Girre

Research Scholar, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, MGUVV, Durg, Chhattisgarh, India