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## RESEARCH ARTICLE

# EFFECT OF DIFFERENT GROWING MEDIAS ON GERMINATION AND SEEDLING GROWTH OF CUCUMBER IN UDAYAPUR, NEPAL

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## ARTICLE DETAILS

## ABSTRACT

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The study was carried out at Katari Municipality-4, Udayapur, in 2023 in a single factorial RCBD design in which seven treatments were used: T0 = Control (Soil 100%), T1 = Soil (85%) + VC (15%), T2 = Soil (65%) + VC (35%), T3 = Soil (80%) + VC (10) + CP (10%), T4=Soil (60%) + VC (20%) + CP (20%), T5 = Soil (40%) + VC (30%) + CP (30%), T6 = Soil (50%) + VC (30%) + CP (20%). Each treatment was replicated thrice in 21 trays with 28 cells. A long green variety of cucumber was used in the experiment. Different parameters were observed during this study, including shoot length, number of leaves, stem diameter, number of roots, leaf length, fresh weight, root length, and root-to-shoot ratio. The maximum result was found on shoot length, stem diameter, root number, leaf length, root length, and root-to-shoot ratio (17.06 cm, 0.34 cm, 9.66, 4.38 cm, 14.02 cm, 1.40) were observed in T4 [soil (60%) + VC (20%) + CP (20%)] followed by [Soil (65%) + VC (35%)] growing media to produce quality seedlings of cucumber for commercial cultivation. The main objective of this study was to determine suitable growing medium for germination and seedling quality of cucumber to produce healthy seedlings. Different growing materials, varieties, and locations affect cucumber germination and other growth factors. It is advisable to undertake comparable research using sand, local compost, perlite, and peat moss as the growing media.

## KEYWORDS

Cocopeat, Cucumis sativus, Growth media, Organic cultivation, Vermicompost.

## 1. INTRODUCTION

Cucumber belongs to the "Cucurbitaceae" family and ranges from 100 masl to 1800 masl in Nepal (Khanal et al., 2020). Cucumber is an annual, warm-season crop that rises in tropical and subtropical conditions worldwide and is considered to have a high potential for processing (Sharma et al., 2018). Cucumbers are grown mainly for their young, tender fruits, which are consumed raw as salad and by making pickles (Mukherjee et al., 2013). Cucumber helps maintain hydration, relieve constipation, and minimizes the risk of cardiovascular diseases as well as many types of cancer (Mallick, 2022). Cucumber species are indigenous to India, where only two botanical varieties have been discovered: the domesticated cucumber, *Cucumis sativus* var. *sativus*, and the wild cucumber, *Cucumis sativus* var. *Hardwicke* (Sebastian et al., 2010). The cultivation of cucumbers seems to have spread rapidly from India to Western Asia, and then to Southern Europe (Lv et al., 2012). The climatic requirement for the cultivation of cucumber is an average air temperature of 15-24°C, full sun condition, at least 8 hours of direct sunlight each day, slightly acidic, good drainage and adequate water-holding capacity, optimum pH: 5.5-7 (Gosai et al., 2020). In Nepal, total area of cultivation is 9,978 ha with the production and productivity of 152,862 Mt/ha and 15.32 Mt/ha and in case of Udayapur, cucumber is grown in an area of 82 ha, with the production and productivity of 1,134 Mt/ha and 13.83 Mt/ha respectively (MoALD, 2021). The Shahini 1 variety, which is 36 days of maturity has 68 (mt/ha) cultivated in Terai (Krishi Diary, 2020).

Growing media are materials in which plants are grown, and these media should have large particles with adequate pore spaces between the particles for better crop growth of crops (Bilderback et al., 2005). Lightweight, good porosity, well-drained but with optimum water-holding capacity, slightly acidic with optimum cation exchange capacity, constant volume, constant volume when dry or wet, and so on are favorable

characteristics of good growing media (Miller and Jones, 1995). To increase high production in any commercial farming, the quality of seedlings is the key element with good root development and a balanced shoot-to-root ratio, which is obtained through the use of a proper mixture of growing media (Gruda, 2013).

The availability of a much finer structure and larger surface area provides stronger absorbability and retention of nutrients compared to conventional compost and is widely used in different agricultural practices (Zaller, 2007). In greenhouse and field studies, different forms of vermicompost have been reported to be beneficial for plant growth and development of plants (Ievinsh, 2011). The beneficial effects of vermicompost include protection against pathogens, activation of growth, and increased overall crop productivity, but are not limited to stimulation of seed germination (Singh et al., 2003; Lazcano et al., 2009; Peyvast et al., 2008; Atiyeh et al., 2001).

In soil, it may act both as a soil conditioner and an organic fertilizer that affects soil properties and also enhances the availability of mineral nutrients that help improve the growth of seedlings (Marinari et al., 2000). The presence of humic-like substances in vermicompost can produce hormone-like effects on plants, which generally stimulates the growth and yield of various crops (Atiyeh et al., 2002). To determine the quality of seedlings grown different soil media, this study was conducted. This will help farmers to apply appropriate planting methods and develop better quality.

## 1.1 Effect of Growing Media on Germination of Cucumber Seed

Growing media refer to media that support plant growth and development. It is a substance through which roots grow and extract water and nutrients (Lata et al., 2018). The selection of a good growth medium is important for high quality seedling production. A good growth medium provides adequate anchors or support for the plant and a reservoir for

nutrients and water for plant growth (Lata et al., 2018). Soil: -Soil is a loose material that covers the Earth and is composed of organic materials and inorganic particles. It is important in agriculture because it provides structural support, minerals and nutrients to plants that are needed for better growth and development. Soils vary widely in physical and chemical properties, such as texture, color, depth, and porosity (Keesstra et al., 2016).

Cocopeat: - Elastic cellular cork-like pithy material forms the non-fibrous tissue of the husk, generally known as coco peat or coir pith, which accounts for 50-60% of the total weight of the husk (Kumarasinghe et al., 2015). Every 10,000 husks generates approximately one ton of coir pith in the coir industry (Nagarajan et al., 1985). Coco fiber is imported from a tropical country where it is considered a waste material, and it holds 8-9 times more water than its weight, with the resistance attributed to bacterial and fungal growth; it helps to provide easy porosity and good aeration for growing roots (Kaushal and Kumari, 2020). Additionally, coco peat is 100% organic, natural, biodegradable, and is a by-product of the coconut fiber extraction process (Aswath et al., 2004).

Vermicompost:- Vermicomposting is a simple technology for converting biodegradable waste into organic matter using earthworms (Sherpa et al., 2013). It is mainly composed of C, H, and O, and contains nutrients such as NO<sub>3</sub>, PO<sub>4</sub>, Ca, K, Mg, S and micronutrients that have similar effects on growth and productivity, such as inorganic fertilizers applied to the soil (Singh et al., 2008). Vermicompost is a vital growth medium because it enhances nutrient availability for plants, improves soil structure, and promotes better drainage. Vermicompost is rich in nutrients and teeming with microorganisms that help sustain healthy soil. It has been proven to boost plant growth and protect against diseases and insect pests. The consistent application of vermicompost over the years has improved soil conditions, leading to higher yields and the maintenance of soil fertility in organic farming (Kadam and Kamble, 2020).

## 1.2 Effect of Growing Media on Germination Percentage, Seedling and Root Length

Regular supply of water and nutrients to plants in the growing medium affects the germination percentage and growth of different plant parameters of the plants (Mathowa et al., 2017). The germination percentage of different growing media such as coir pith, vermicompost, and the combination of coir pith and vermicompost in plants was 99%, followed by minimal germination % (Rekha et al., 2018). Growing media not only affects the germination percentage but also affects the shoot and root length of the plant nursery. Maximum shoot growth and root length were reported for the coir pith followed by a combination of the coir pith and vermicompost (Vivek, 2017).

## 1.3 Effect of Growing Media on Stem Diameter, Plant Height

Growing media play a crucial role in affecting plant height and stem diameter in seedlings where quality growing media consistently supply the necessary water and nutrients, thereby promoting optimal plant growth. According to a previous study, the maximum stem diameter and plant height were found in garden soil treated with 18 kg/ bag + vermicompost 2 kg/ bag growth media (Lata et al., 2018).

## 2. RESEARCH MATERIALS AND METHODS

### 2.1 Description of the Study Area

The experiment was conducted in the field at Udayapur from March 23, 2023, to April 19, 2023, with a long green variety. The geographical location of the research site was 260 581 01.111 N, 860 221 24.611 E with an elevation of 360m. The average temperature in March in the Udayapur District of Nepal ranges from 13°C to 27°C, with a mean temperature of approximately 20°C. Averaging at approximately 24°C, the temperature in April ranged from 17°C to 31°C.

### 2.2 Experimental Treatments and Design

The design was laid out in Randomized complete block design (RCBD) where 3 replications of each treatment was done, and the treatment were T0= Control (Soil 100%), T1= Soil (85%) + VC (15%), T2= Soil (65%) + VC (35%), T3= Soil (80%) + VC (10%) + CP (10%), T4=Soil (60%) + VC (20%) + CP (20%), T5= Soil (40%) + VC (30%) + CP (30%), T6= Soil (50%) + VC (30%) + CP (20%) During the experiment 21 seed trays were used, and each seed tray consisted of 28 cells. The treatment was randomly distributed in each tray, and data were collected.

### 2.3 Data Collection

The data were taken of germination percentage, number of primary roots, root length, and shoot length were measured from the tip to the crown

portion, and shoot diameter was measured using a Vernier caliper, no. of leaves per plant, fresh weight was measured using a digital weighing machine, and the root shoot ratio. From March 23rd to May 19th, the germination rate of each seedling was measured every five days. From 11 DAS on April 4th up to 19th May or 26 DAS, seedling characteristics such as shoot length, shoot diameter, and number of leaves were taken as observation parameters. The data collection involved destructive methods.

### 2.3.1 Germination Percentage

The emergence of radicals and plumules, that is germination, can be calculated by regular observation of sown seeds using the following formula (K et al., 2014).

Germination percentage (%) = (no. of seeds germinated/No. of seeds maintained for germination) × 100.

### 2.3.2 Root to shoot length ratio.

It was estimated by dividing root length into shoot length

## 2.4 Layout of Experiment Design

R1	R2	R3
T3	T6	T6
T4	T2	T5
T0	T4	T2
T2	T5	T3
T6	T1	T1
T1	T3	T0
T5	T0	T4

## 2.5 Media Preparation and Seed Sowing

In this study, a 28-cell tray was used for seed sowing, and all cells were assigned to one treatment for seedling growth. Each tray represented a single treatment. Initially, each cell was half-filled with growth medium, the seeds were sown, and the remaining medium was used to cover the seeds. Each treatment involved 56 seeds, with two seeds sown in each cell.

## 2.6 Statistical analysis

The collected data were tabulated and processed in Microsoft Excel 2016. The recorded data on different parameters were analyzed using R- stat 4.2.2. The means were separated using the least significance difference test (LSD) at a 5% significance level, with reference to (Williams and Abdi, 2010). ANOVA was performed to test for significant differences between parameters.

## 3. RESULT AND DISCUSSION

The supply of water and oxygen to the growing plant can be greatly influenced by the physical composition of the growing medium, which may further affect the anchorage, nutrients, and water-holding capacity of the seedling (Baiyeri and Ndubizu, 1994). The combined application of the coir pith and vermi compost had a significant effect on seedling's growth parameters because of the synergistic combination of both factors in improving the physical conditions of the medium and nutritional factors (Sahni et al., 2008). The production of cucumbers is comparatively low, because of various problems such as weed growth, moisture stress, poor seed germination, hindered emergence, high mortality rate, slow seedling growth, excessive rainfall, nutrient loss through leaching, poor management practices, and insect-pest incidence at the nursery stage, which lead to heavy losses. Thus, the performance research analysis of variance and mean treatment performance were as follows: -

Growing media influence seed germination and the emergence and growth of seedlings in a nursery because it is a reservoir of moisture and plant nutrients (Baiyeri and Mbah, 2006; Gower, 1987). In addition, it influences the performance of seedlings before they are transplanted into the field (Adediran, 2005). Growing media with a high ratio of vermicompost, coco peat, and soil have good water holding capacity and moisture supply as

well as sufficient porosity, which permits adequate moisture and gaseous exchange between media and seed, which helps better seedling emergence (Vivek, 2017). Parameter measures at four different ages in different growth media. Maximum growth parameters such as shoot length, stem diameter, number of roots, leaf length, root length, and root/shoot ratio (17.06cm, 0.34cm, 9.66, 4.38cm, 14.02cm, and 1.40, respectively) were observed at 11, 16, and 21 days, respectively, in soil (60%) + VC (20%) + CP (20%) growth media. Similarly, the remaining growth parameters, such as the number of leaves (4.4) and wet fresh weight (1.85 g), were observed in 26 and 16 old seedlings grown in soil (65%) + VC (35%), medium respectively. A maximum stem diameter of 0.34 cm was also observed in soil (65%) + VC (35%) at 16 days of age. The maximum germination percentage was 100 percent with medium growth in soil (60%) + VC (20%) + CP (20%), soil (65%) + VC (35%) and Soil (85%) + VC (15%). The lowest number of days to emergence was observed in the T4 growth medium in 4-day-old seedlings.

The higher values of shoot length (17.06 cm), number of leaves and maximum stem diameter observed in the soil (60%) + VC (20%) + CP (20%), followed by the soil (65%) + VC (35%) growth media might be due to the synergistic combination of both factors in improving the physical conditions of the media and nutritional factors (Sahni et al., 2008). The availability of a much finer structure and larger surface area provides strong absorbability and retention of nutrients (Nkurunziza et al., 2022). The number of leaves in turmeric where increased activity of enzymes such as chitinases and proteases, which break down organic-rich compounds, may contribute to heightened soil microflora and microfaunal populations (Kadam and Kamble, 2020). This, in turn, improves the availability of macro and micronutrients, especially when vermicompost, FYM, and organic and inorganic fertilizers are applied. Similar results have been reported previously (Lata et al., 2018; Nkurunziza et al., 2022; Tuzel et al., 2015; Bhardwaj & Sood, 2016; Nkurunziza et al., 2022). A higher number of roots (9.66), root length (14.02 cm), maximum leaf length (4.38cm) and wet fresh weight were observed in [soil (60%) + VC (20%) + CP (20%)], followed by the soil (65%) + VC (35%) growth media, because organic materials and cation exchange capacity increase the absorption and storage of nutrients and water, and also by creating suitable conditions for plant root growth (Khalaj, 2011). The combination of sand + soil+ coco peat+ vermicompost (1:1:1:1) was the best growth medium for the germination and growth of *Angelica glauca* in nurseries (Bhardwaj and Sood, 2016). Similar results were reported by (Lata et al., 2018).

#### 4. CONCLUSION

The growth of healthy seedlings is one of the most important factors in improving vegetable productivity. The growth medium plays an essential role in the growth and development of any plant species and is one of the factors influencing growth; that is, the edaphic factor acts as a precursor for the early stages of plant life. Among the seven different types of growing media, soil (60%) + VC (20%) + CP (20%) was the best growing medium, followed by soil (65%) + VC (35%) and soil (50%) + VC (30%) + CP (20%). This study was conducted to investigate the effects of different growing media on the germination and quality of cucumber seedlings. The multilocation and characteristics of yield on different cucumber media should be performed for further research.

#### DECLARATIONS

#### AUTHOR CONTRIBUTION STATEMENT

Bhupendra Roka Magar, Bijaya Khanal, Swastika Subedi, Rachana Tandan Chhetri, Tika Thapa Magar: Conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools or data; and wrote the paper. Januka Dahal: Conceived and designed the experiments. All authors have approved the final version of the manuscript.

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#### DATA AVAILABILITY STATEMENT

Data will be made available on request. For the data available contact corresponding author.

#### DECLARATION OF INTEREST'S STATEMENT

The authors declare no conflict of interest.

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