EFFECTS OF DIFFERENT GROWING MEDIA ON THE GROWTH AND YIELD OF CUCUMBER (*Cucumis sativus L.*)

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ABSTRACT

This study investigates the effects of different growing media on the growth and yield of cucumber plants (*Cucumis sativus*), focusing on potential sustainable alternatives to traditional soil. The treatments include soil, coco peat, rice husk, sawdust, and combinations thereof (coco peat with rice husk, coco peat with sawdust, and rice husk with sawdust). A completely randomized design was used to minimize variability and enhance the reliability of results. Key growth parameters such as: the number of fruits, number of flowers, and fruit weight were recorded throughout the cucumber growth cycle to assess each medium's impact. The results indicated that the type of growing medium significantly influences the growth performance and productivity of cucumber plants. Among the treatment involved, combinations like coco peat with rice husk yielded favorable outcomes, enhancing both the number and weight of fruits compared to soil alone. The high-water retention capacity of coco peat, combined with the aeration provided by rice husk, likely contributed to these improved growth metrics. Conversely, single media such as sawdust showed limited support for optimal growth, underscoring the importance of a balanced medium for nutrient retention and moisture control.

This research trial showed the potential of non-soil media for cucumber cultivation, offering practical and sustainable options for growers, particularly in areas where soil quality is poor or where resources are limited. Additionally, it suggests that media combinations can improve yield, benefiting both commercial agriculture and small-scale farms. Based on these findings, recommendations for cucumber cultivation include the use of coco peat and rice husk mixtures to optimize growth and sustainability. Future studies may explore the long-term impacts of these media on soil health, nutrient content, and cost-effectiveness in various agricultural settings.

Keywords: Growth media, nutrient retention, performance, productivity

INTRODUCTION

Cucumber (*Cucumis sativus L.*) is an important commercial vegetable which is also used as salad, it belongs to the family Cucurbitaceae. Cucumber, is one of the most significant exotic vegetables and the fourth most extensively farmed vegetable in the world (FAO, 2020a). Because of its many health advantages, it is one of the most significant vegetables cultivated domestically in Nigeria. Cucumber can be consumed raw, processed into juice, served as a post-meal dessert, or mixed with other foods. Empirical research suggests that Nigeria's demand and output markets for cucumbers could boost agricultural productivity, economic empowerment, and food security (Anthony *et al*., 2021). Due to its economic and nutritional advantages, its production is still becoming more and more popular in Nigerian communities (Abdulkadir *et al*., 2020).

About ninety five percent of Cucumbers consist mostly of water. It is primarily grown in the summer and well-known for its juicy fruit. Seeds of this fruits contains essential oil which is helpful for brain development and body smoothness (Bhagwat *et al*., 2018). Chakraborty and Rayalu (2021) state that cucumbers aid digestion, hydration regulation, blood pressure and sugar maintenance, skin soothing, fat reduction, and weight loss. It contains low calories (16 calories per cup) and more fiber on the skin (Bhagwat *et al*., 2018). Cucumbers are good source of dietary fiber, magnesium, and potassium. It is well recognized that these nutrients can lower blood pressure, which lowers the risk of heart disease. Additionally, studies have shown that older adults with hypertension who regularly drank cucumber juice had a reduction in blood pressure. Our stomachs benefit from cucumber's cooling properties. Cucumbers' soluble fiber aids in reducing our rate of digestion. Additionally, the high-water content of cucumbers avoids constipation, softens faeces, and maintains regular bowel movements (Chakraborty and Rayalu, 2021).

Cucumber production in Nigeria has not been ranked; it is primarily grown in Jos, Plateau State, with a little amount being growing in Ohaji Egbema, Imo State, and a few other federation states. In Nigeria, although cucumbers are becoming more and more important, farmers still receive low returns from their crops because of deteriorating soil fertility brought on by repeated cropping and a lack of attention to soil amendment materials. Southern regions, where the crop is typically used more extensively, tend to have lower yields.

Nigerian farmers mostly use shifting cultivation (Lawal, 2014) to make sure the soil's basic nutrients are sufficient to sustain the growth of the crops they cultivate. However, there are drawbacks to using soil for agriculture, such as pests and diseases, competition between weeds and crops for nutrients and space, pollution of the environment, and an increase in the number of insecure people in the nation as a result of conflicts between farmers and herders. The aforementioned farming limitations have prompted a growing call for the use of alternate crop producing methods. The soilless cultivation reduces the soil related problems experienced in the conventional crop cultivation. The objective is to investigate the effects of different growing media on the growth and yield of cucumber.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the experimental site of the Department of Crop Production and Soil Science, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. Ogbomoso is located at 8°10'N and 4°10'E and the climate experiences cool and dry conditions from November to March and then warm and moist from April to October. The maximum and minimum temperature is 33 and 28°C, respectively. The humidity of this area is high (about 74%) all year round except in January when dry wind blows from the North. Annual rainfall is over 1000 mm (Olaniyi, 1997).

Treatments and experimental design

The treatments consist of seven treatments (T1: 100% Rice husk**;** T2: 100% Saw dust**;** T3: 100% Coco peat**;** T4: 50% Rice Husk + 50% Saw Dust**;** T5: 50% Coco Peat + 50% Rice Husk**;** T6: 50% Saw Dust + 50% Coco Peat**;** T7: 100% Soil) in Completely Randomized Design (CRD) and replicated three times. 400g each of coco peat, rice husk and sawdust were measured into different polythene bags. 200g each of coco peat and rice husk; 200g each of coco peat and sawdust; 200g each of rice husk and saw dust were also measured into separate polythene bags. The polythene bags were arranged on the land and spaced at 60cm.

Agronomic practices: Two seeds were sown per hole at a depth of 2cm. Supplying, thinning, weeding, staking and watering were equally carried out. 15g of Agrovet fertilizer (Foliar fertilizer) was mixed with 5 liters of water. 50 cl of the mixed fertilizer was applied to each pot at two weeks intervals using foliar application.

Data collection

Data were collected at two weeks interval. Data were collected on the vegetative parts two weeks after sowing while data were collected on the reproductive parts when flowers appeared and it was then collected again after two weeks.

Vine length was measured using a ruler calibrated in cm from the base of the plant to the tip of the plant. Data on the number of leaves was obtained by visually counting the number of leaves on the plant. Leaf length was measured using a ruler calibrated in cm from the base of the leaf (where the leaf blade meets the petiole) to the tip of the leaf. Leaf breadth using a ruler calibrated in cm by measuring the widest part of the leaf (from edge to edge, perpendicular to the length). The number of flowers and was obtained by visually counting the number of flowers. The number of fruits was also obtained by visually counting the number of fruits.

Data analysis

Data collected were analyzed using Analysis of Variance (ANOVA). The significance of the treatments effects was determined using Mean Separation with Duncan's Multiple Range Test (DMRT) at 5% probability level.

RESULTS AND DISCUSSION

Number of leaves

The study revealed significant variations in cucumber leaf production across different growing media over time. Coco peat and its mixture with rice husk promoted vigorous early growth, producing the highest number of leaves

(4.67, 5.17) at 2 and 4 weeks after sowing (WAS) respectively. However, its declined by 8 WAS, likely due to nutrient depletion.

Rice husk, which initially had the lowest leaf count, showed remarkable improvement by 6 WAS and 8 WAS, indicating its suitability for later growth stages. Soil provided moderate but consistent growth, excelling in the later phases, while sawdust and its combinations consistently underperformed, suggesting they lack the necessary nutrients or structure for optimal growth. Overall, coco peat was most effective for early vegetative growth, while rice husk and soil supported sustained development in later stages, highlighting the importance of selecting appropriate growing media to enhance cucumber growth throughout its lifecycle. Coco Peat was the most effective growing medium for leaf production during the first 6 weeks, supporting vigorous early vegetative growth. (Table 1). Similarly, Eifediyi and Remison (2010) reported the growing media and fertigation increases the number of leaves.

Vine length

Vine length, a key indicator of cucumber plant health, varied significantly across different growing media throughout the study. Coco peat combined with rice husk consistently produced the longest vines at all sampling periods (9.67 cm at 2WAS, 15.03 cm at 8WAS), outperforming other media. Coco peat alone also showed strong performance, though slightly less effective than the combination. In contrast, rice husk + sawdust produced the shortest vines, indicating poor support for growth. Soil demonstrated modest but steady vine growth, though less effective than coco peat-based media. Overall, coco peat, especially when mixed with rice husk, proved to be the most effective medium for promoting vine length, emphasizing its potential for optimizing cucumber cultivation. (Table 2).

Leaf area

Leaf area growth determines light interception and is an important parameter in determining plant productivity (Gifford *et al*., 1984; Koester *et al*., 2014). The experiment showed significant differences in cucumber leaf area across various growing media, with coco peat consistently producing the largest leaf areas at all growth stages (17.90 cm² and 85.10 cm² at 2 and 8WAS). Coco peat + rice husk also performed well, especially by 8WAS, indicating a complementary effect that enhances leaf expansion. In contrast, rice husk consistently had the smallest leaf areas, demonstrating limited support for leaf development. Sawdust showed moderate but limited improvement over time, while soil maintained consistent, moderate growth throughout. Overall, coco peat, particularly when combined with rice husk, was the most effective medium for promoting leaf area, underscoring its ability to enhance photosynthesis and overall plant growth. (Table 3).

Number of flowers

The experiment revealed significant differences in cucumber flowering across various growing media, with rice husk producing the highest number of flowers (11.50), followed by coco peat + rice husk (8.50). Coco peat alone performed moderately well (6.80), similar to soil (5.00), indicating its ability to support flowering. Sawdust, both alone and in combination with rice husk or coco peat, produced the fewest flowers (1.00), suggesting poor nutrient availability and water retention. Rice husk's superior performance, especially when combined with coco peat, highlights its ability to balance water retention and aeration, essential for flowering. While coco peat and soil also supported moderate flowering, sawdust consistently underperformed, emphasizing the importance of selecting nutrient-rich and well-aerated media for optimal flower development in cucumber plants. (Table 4).

Number of fruits

The experiment demonstrated significant differences in cucumber fruit production across various growing media, with coco peat + rice husk producing the highest yield (11.17 fruits), significantly outperforming all other treatments. This combination likely benefits from coco peat's excellent water retention and rice husk's aeration, creating optimal conditions for fruit development. In contrast, rice husk (1.00) and sawdust (1.00), both alone and in combination, consistently produced the fewest fruits, indicating poor nutrient availability and inadequate support for fruiting. Coco peat alone (3.83) and soil (3.50) produced moderate yields, suggesting they are viable but less effective than coco peat mixed with rice husk. Interestingly, while rice husk supported flowering, it failed to sustain fruit production, likely due to nutrient deficiencies or limited water retention. Sawdust's consistent underperformance highlights its unsuitability for cucumber fruiting. Overall, coco peat + rice husk was the most effective medium, emphasizing the importance of selecting growing media that balance water retention, aeration, and nutrient availability to maximize cucumber yield. (Table 5). This result confirms the study of Luitel, Adhikari, Yoon, and Kang (2012) that plants grown in cocopeat produced the highest marketable fruit number per plant and yielded the greatest marketable yield per plant.

Fruit weight

The experiment showed significant differences in cucumber fruit weight across various growing media, with coco peat producing the highest fruit weight (82.00 g), significantly outperforming all other treatments. This highlights coco peat's superior water retention and nutrient-holding capacity, which create optimal conditions for fruit development. The findings align with Alifar, Ghehsareh, and Honarjoo (2010), who reported that the highest cucumber yield and biomass were achieved using coco peat in soilless culture. In contrast, coco peat + sawdust produced a lower fruit weight (33.50 g), suggesting that sawdust may reduce water retention or nutrient availability compared to pure coco peat. Rice husk, sawdust, soil, and their combinations failed to produce any fruit, likely due to poor nutrient availability, inadequate water retention, or suboptimal root development conditions. (Table 6). The results emphasize the importance of selecting nutrient-rich, well-aerated media like coco peat to maximize cucumber yield, while highlighting the limitations of soil, rice husk, and sawdust for fruit production.

CONCLUSION

This study shows that the type of growing medium used has a strong effect on how well cucumbers grow and produce yield. Coco peat, whether used alone or in combination with rice husk, consistently produced higher results in terms of number of fruits, flower production, and fruit weight. This highlights its potential as a highly suitable growing medium due to its favorable properties, such as improved aeration, nutrient retention, and water-holding capacity. Thus, selecting an appropriate growing medium, especially coco peat or its mixtures, is key to improving cucumber yield. These results can help farmers boost productivity and provide valuable insights for better horticultural practices.

However, it is essential to note that this study spanned a single growing season, which may not fully capture the long-term effects of the media on cucumber cultivation. Further studies over multiple growing cycles are recommended to assess the sustainability of using coco peat and its combinations.

RECOMMENDATION

Based on the results of the study, coco peat or a combination of coco peat and rice husk produced the highest yield, it is recommended to focus on this medium in cucumber cultivation. This medium could be promoted for its effectiveness in enhancing fruit yield and plant health, making it suitable for farmers aiming for optimal productivity.

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Table 1: Number of leaves of cucumber planted with different growing media

	Weeks after planting			
Treatments	**2**	**4**	**6**	**8**
Rice husk	2.23c	2.50b	6.63ab	7.83a
Sawdust	3.67abc	4.67ab	2.83bc	3.17abc
Coco peat	4.50ab	6.50a	9.67a	2.67abc
Rice husk + Sawdust	2.67bc	3.67b	1.17c	1.17c
Coco peat + Rice husk	4.67a	5.17ab	4.83abc	5.50abc
Coco peat + Saw dust	2.83abc	3.00b	4.33bc	2.33bc
Soil	3.00abc	5.00ab	2.33bc	7.67ab

Mean with the same letter within the same column are not significantly different from each other at 5% probability level

Table 2: Vine length (cm) of cucumber planted with different growing media

		Weeks after planting		
Treatments	**2**	**4**	**6**	**8**
Rice husk	4.88c	4.07b	5.31d	7.11c
Saw dust	5.15c	4.75b	7.45c	8.67c
Coco peat	7.73b	7.08a	9.92b	12.37b
Rice husk + Saw dust	4.10c	3.58b	6.35cd	7.01c
Coco peat + Rice husk	9.67a	8.70a	11.69a	15.03a
Coco peat + Saw dust	4.20c	4.37b	6.78c	7.68c
Soil	5.00c	5.05b	7.52c	8.79c

Mean with the same letter within the same column are not significantly different from each other at 5% probability level

Table 3: Leaf area (cm^3) of cucumber planted with different growing media

	Weeks after planting			
Treatments	**2**	**4**	**6**	**8**
Rice husk	3.20c	1.50c	14.70d	16.50d
Saw dust	6.20bc	8.00c	24.60bcd	26.50cd
Coco peat	17.90a	42.80a	58.80a	85.10a
Rice husk + Saw dust	3.60c	5.90c	20.20cd	19.50d
Coco peat + Rice husk	11.10b	16.80b	36.40b	45.50b
Coco peat + Saw dust	5.30bc	9.00c	33.00bc	30.70bcd
Soil	5.50bc	17.90b	30.60bc	38.70bc

Mean with the same letter within the same column are not significantly different from each other at 5% probability level

Table 4: Number of flowers of cucumber planted with different growing media

Treatments	No of flowers
Rice husk	11.50a
Saw dust	1.00b
Coco peat	6.80ab
Rice husk + Saw dust	1.00b
Coco peat + Rice husk	8.50a
Coco peat + Saw dust	1.00b
Soil	5.00ab

Mean with the same letter within the same column are not significantly different from each other at 5% probability level

Table 5: Number of fruits of cucumber planted with different growing media

Treatments	No of fruits
Rice husk	1.00b
Saw dust	1.00b
Coco peat	3.83b
Rice husk + Saw dust	1.00b
Coco peat + Rice husk	11.17a
Coco peat + Saw dust	1.00b
Soil	3.50b

Mean with the same letter within the same column are not significantly different from each other at 5% probability level