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Research Article

THE EFFECT OF DIFFERENT GROWING MEDIA ON THE GROWTH OF LETTUCE

Abdiwahab Abdullahi Omar*[1], Abdisalam Mohamed Abdullahi[1], Abdirahman Liban Mohamed[1], Abdisalam Ahmed Ali[1], Abdirahim Farah Omar[1], Abdullahi Ali Habarwa[1], Abdiwahab Mohamed Ali[1], Abdinor Baryare Osman[1], Ali Said Elmi[1]

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[1] *Zamzam University of Science and Technology*

* Author for Correspondence ORCID ID: https://orcid.org/0000-0002-0677-9604; Email: abdiwahab_12@hotmail.com.

Abstract

The experiment was carried out at the Zamzam University of Science and Technology's Faculty of Agriculture's Agricultural Experimental and Research Center, which is situated in the Garasbaaleey area, which is officially part of the Banadir Region. From March 2022 to May 2022, the experiment was conducted. The aim of the study was to assess the performance of different growth substrates with the lettuce seed variety known as "Optima," in a pot-growing system. Where M1 was peat moss, M2 was rice husk, M3 was sawdust, and M4 was a mixture of peat moss, rice husk, and sawdust. In the experiment, data on plant height, number of leaves per plant, leaf length, leaf breadth, root length, and fresh weight per plant were collected. According to the results, plants grown in peat moss produced with the greatest plant height, leaf width, and fresh weight per plant, while the mixture (peat, rice husk, and sawdust) produced the longest roots. Therefore the study demonstrated that lettuce (Optima) variety may be grown in an aggregate soilless system in the tropics, such as Somalia, using peat moss-based growing surfaces. The mixture can be utilized as a growing substrate for a pot-growing system in the absence of peat moss.

Keywords: Growing Media, Lettuce, Growth and Yield, Peat moss, Sawdust, Rice husk

Introduction

Hydroponics is a complex crop production technique that uses solid or liquid media without soil to grow crops. In recent years, hydroponic crop production has gained popularity all over the world. It is extremely productive and environmentally friendly. In addition to being a very exacting

and demanding technique that guarantees superior crop yield, hydroponics has also demonstrated itself as a great option for crop production (Rahman et al., 2019; Savvas, 2003). Production may be done year-round and anywhere with an indoor hydroponic system, irrespective of soil type or temperature. This method is a good choice for the year-round production of fresh vegetables and herbs in nations with a short growing season (Kang et al., 2013). The definition of hydroponics is "working with water" (Resh, 1991). Consequently, the term "hydroponic" is inappropriate for usage with organic substrates; instead, "soilless culture" should be used to describe all methods of soilless production. Yet, a lot of authors still use the term "hydroponic" as a synonym for "soilless culture" (Savvas, 2002).

Growing medium, also referred to as substrate or potting soil, is any substance other than soil that is used to cultivate plants. There are numerous materials that can be used to make a growing medium, such as sawdust, peat, rice husk, vermiculite, and perlite (Douglass et al., 2009; Rahman et al., 2019).

In terms of crop value, lettuce (Lactuca sativa L.), a plant belonging to the Asteraceae family, is commonly regarded as one of the most significant leafy vegetable crops (Sapkota et al., 2019). Lettuce is one of the most sensitive vegetable species, however, lettuce cultivation in the soil is faced some risks, such as nitrate accumulation. Therefore, to eliminate these risks, lettuce has become one of the most commonly grown vegetables in hydroponic systems. Because many benefits of soilless cultivation include the lack of soil-borne diseases, a secure substitute for soil disinfection, accurate nutrition control. Also, a number of studies have demonstrated the high yield and high quality of soilless lettuce production (Kaiser & Ernst, 2012; Qadeer et al., 2020). According to a study conducted in tropical temperature zones, a lettuce production cycle takes roughly 70 days with soil cultivation but only 30 days with soilless culture (Cometti et al., 2013).

In Somalia, lettuce is typically grown in open fields (Mohamed, 2004). Unfortunately, there hasn't yet been any significant research on lettuce cultivation in soilless culture. Therefore the purpose of this study is to fill this information gap by investigating how different growing conditions affect lettuce growth and yield.

Material and Methods

Experimental site and period

The experiment was carried out in a greenhouse at the Agricultural Experimental and Research Center in the Zamzam University of Science and Technology's faculty of agriculture, which is situated in the Garasbaaleey area, which is officially part of the Banadir Region. Garasbaaley is geographically located at longitude 45.16°E and latitude 2.04°N, in the west direction of Mogadishu-Somalia. The experiment period was from March 2022 until May 2022.

Plant materials and other materials

The lettuce variety "Optima" seeds were used in the experiment. The plastic boxes were collected from the university. The growing media were collected from Jowhar and Mogadishu. Different

types of daily instruments are also used for many purposes to complete the experiment. The lettuce seed variety originally came from Italy.

Research design and treatment

The experiment was laid out in a completely randomized design (CRD) with three replications. Four growing substrates were used in the experiment. The four growing substrates were M1 = Peat moss, M2 = Rice husk, M3 = Sawdust, and M4 = Mixture (Peat moss + Rice husk + Sawdust).

Growing environment

Twelve different plastic boxes were used for culturing the plants. Boxes were filled with different substrates according to the treatments. Lettuce seedlings at three- to four-leaf stages were transplanted into plastic containers filled with culture media, and a nutrient solution was applied to different boxes. In every box, there were four plants used as experimental units. The place was kept clean and tidy during the time of the experiment. Daily supervision was done to maintain the plants.

Sowing of seeds

The sowing was done on March 14, 2022, as nursery sowing with the trace method. The seeds were germinated on 17th March 2022. The transplant took place on April 11, 2022.

Fertilizer application & irrigation

The first N.P.K. fertilizers were applied. Two days after transplanting, the fertilizer was formulated based on the needs of the plant. All the fertilizer components were water soluble. Three grams of N.P.K. were applied every three days. Plants were fertilized with the same nutrient solution. The field was irrigated properly every day by hand using a water can.

Harvesting

Lettuce plants were harvested 39 days after transplanting. It was done by uprooting the plants by hand, slowly and carefully. The growing medium and fibrous roots adhering to the roots were removed and cleaned.

Data collection method

Data were collected from two randomly selected plants in each box on plant height, number of leaves per plant, leaf length, leaf width, root length, and fresh weight per plant.

Plant height: the data for the plant height was recorded as the distance (in cm) between the ground and the tips of the most representative leaves.
Number of leaves per plant: the data for the number of leaves per plant was recorded as counting the leaves of two randomly selected plants at harvest stages.
Leaf length: The data on leaf length per plant was recorded as the mean of the leaf length of two randomly selected plants at the harvest stage in cm.
Leaf width: The data for leaf width per plant was recorded as the mean of the leaf width of two randomly selected plants at the harvest stage in cm.

Root length: The data for root length per plant was recorded as the mean of the root length of two randomly selected plants at the harvest stage in cm.

Fresh weight per plant: The data for fresh weight per plant was recorded as the mean of two plants randomly selected at maturity stages in grams.

Data analysis procedure

The data collected on different parameters were statistically analyzed to obtain the level of significance using the Statix8 program. The mean for all the treatments was calculated and analysis of variance for all the characters were performed by F-Difference between treatment means were determined by LSD according to Gomez and Gomez (1984) at a 5% level of significance.

Result and Discussion

In this experiment, the data on growth parameters of different growing media of the lettuce crop were compared and statistically analyzed, and the thus obtained results are discussed below. The performances of parameters are presented in Table 1. The selected parameters were plant height, number of leaves per plant, leaf length, leaf width, root length, and fresh weight per plant. The selected parameters varied significantly among the growing media studied.

Table 1: Analysis of variance on six characters of four medium growth.

Treatment	PH	NL	LL	LW	RL	FW
Sawdust	23.67 b	7.33 ab	15.78 b	10.28 b	14.17 ab	14.3 b
Peat moss	32.83 a	10.50 a	19.39 a	14.28 a	10.67 b	52.8 a
Rice husk	23.17 b	6.83 b	15.16 b	10.05 b	12.33 b	16.8 b
Mixture	24.17 b	7.00 ab	16.16 ab	9.89 b	16.50 a	15.0 b
CV %	10.3	24.4	11.2	15.0	15.6	74.1
SE+_	1.550	1.115	1.078	0.966	1.208	10.59
Sign. Level	*	*	*	*	*	*

PH : Plant height, NL : Number of leaves, LL : Leaf Length, LW : Leaf Width, RL : Root Length, FW : Fresh Weight.

*= significant at 5% level
CV= coefficient variation

Plant height (cm)

The results obtained for the plant height showed that it significantly varied with different growth mediums (Table 1). Peat moss had the highest mean plant height (32.83 cm), mixture was second (24.17 cm), and sawdust was third (23.67 cm), while rice husk had the lowest (23.17cm).

Similar results were obtained by Sarkar et al. (2021), who documented that the plant height of the rice husk is the lowest when compared to other media such as sawdust and mixture.

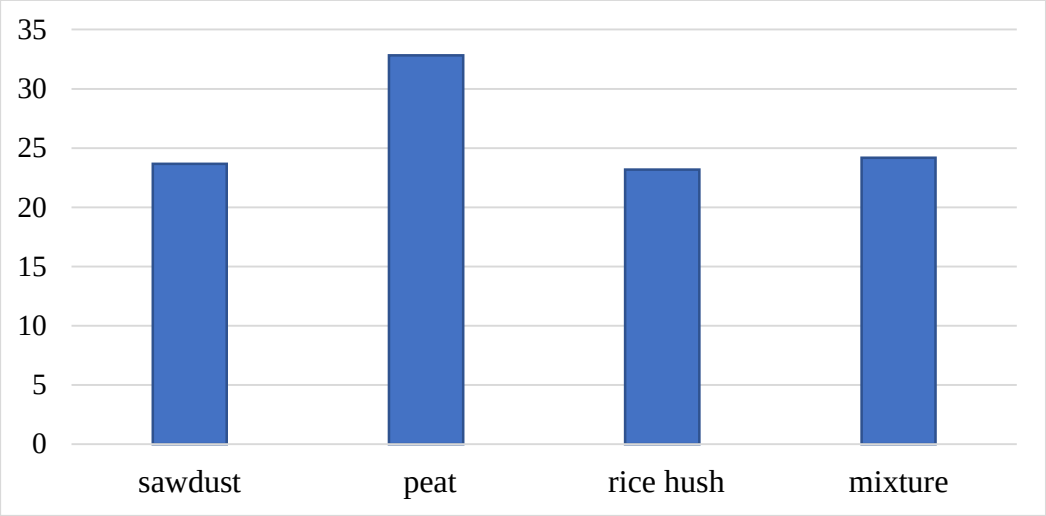

Figure 1. Plant height

Number of leaves per plant

The results for the number of leaves obtained varied significantly with different growth mediums (Table 1). The peat moss had the highest mean value of the number of leaves (10.50), followed by sawdust (7.33), and mixture was third (7.0), while the rice husk had the lowest (6.83).

The results of this study are in agreement with Sarkar et al. (2021), who discovered that plants grown in rice husk have fewer leaves than plants grown in sawdust or a mixture.

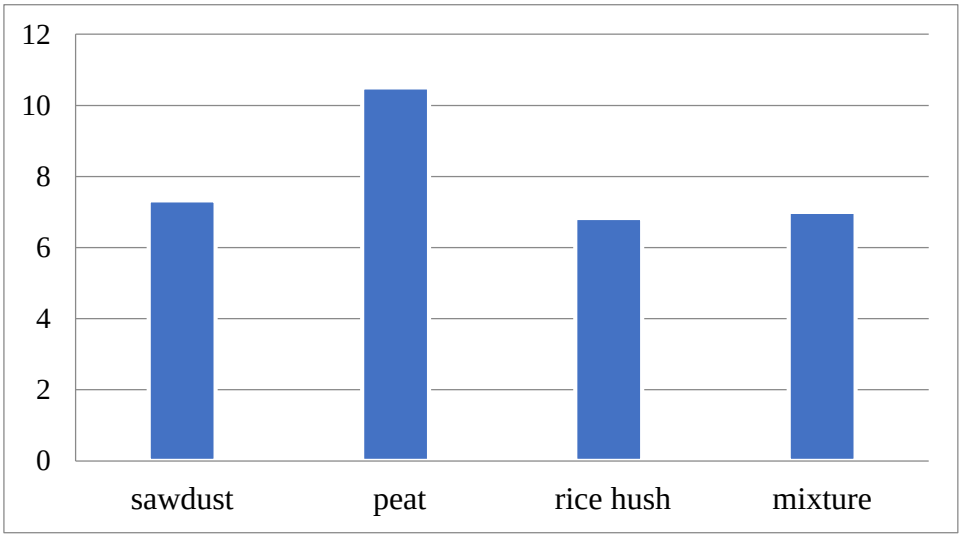

Figure 2: Number of leaves per plant

Leaf length

The results obtained for the leaf length showed a significant variation with different growth mediums (Table 1). The highest mean value of the leaf length was obtained by the peat moss (19.39 cm), followed by the mixture (16.16 cm), and the third-highest is sawdust (15.78 cm), while the weflowest value was achieved by the rice husk (15.16 cm).

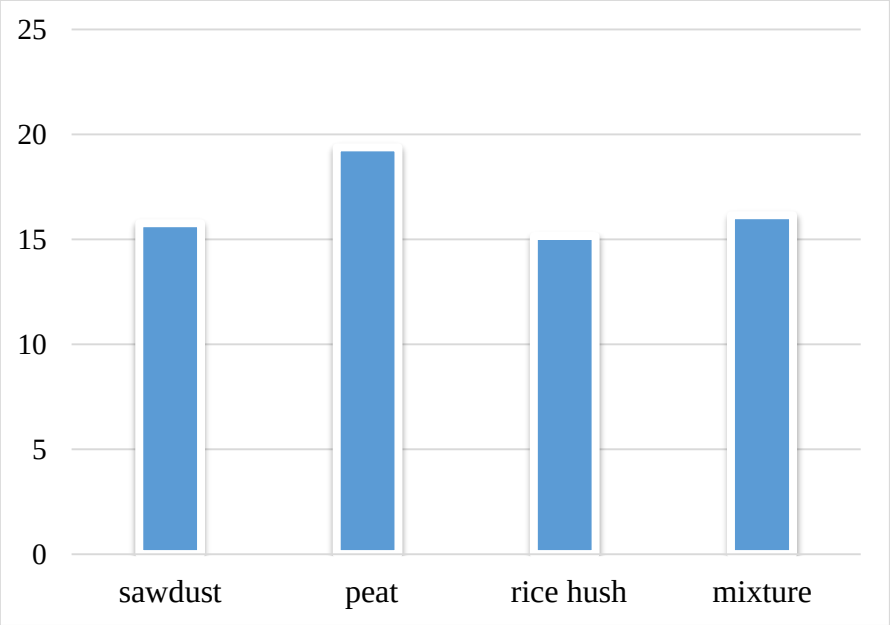

Figure 3: Leaf length

Leaf width per plant (cm)

The results obtained for the leaf width of the growth showed that it significantly varied with different growth media (Table 1). The highest mean value of the leaf width was obtained by peat moss (14.28 cm), followed by sawdust (10.28 cm), and the third-highest was rice husk (10.05 cm), while the lowest value was achieved by mixture (9.89 cm).

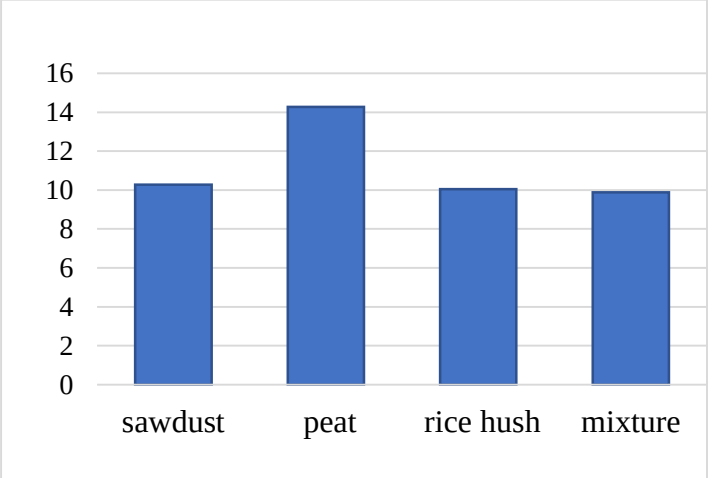

Figure 4: Leaf width per plant

Root length per plant (cm)

The results obtained the root length of the treatment showed significant variation with different growth mediums (Table 1). The mixture had the highest mean value for root length per plant (16.50 cm), followed by sawdust (14.17 cm) and rice husk (12.33 cm), while peat moss had the lowest value (10.67 cm).

According to Michael and Lieth (2008), a greater total pore space frequently causes a decrease in water retention, an increase in oxygen transport, and a greater root penetration. Due to the fact that peatmoss has a small total pore capacity, the root length of the peat moss-based growing medium therefore decreased significantly in the current experiment.

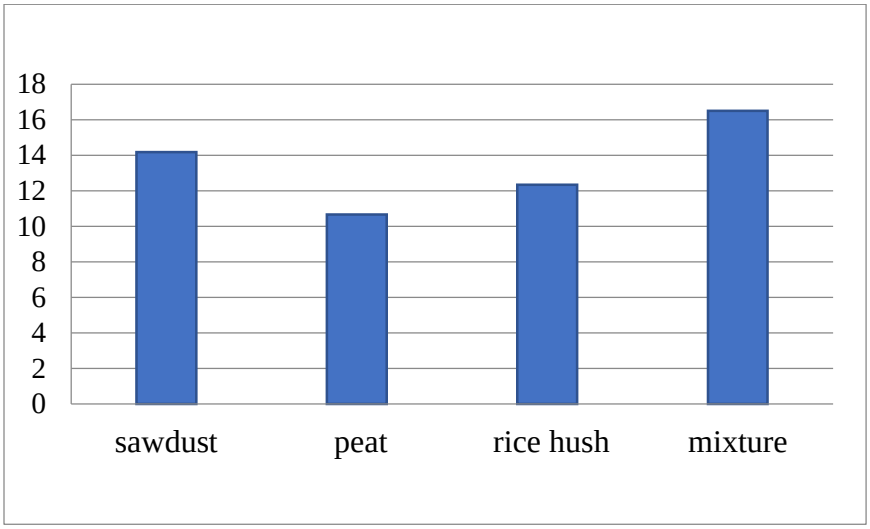

Figure 5: Root Length (cm)

Fresh weight per plant

The results obtained for the fresh weight of the treatment showed that it significantly varied with different growth mediums (Table 1). The highest mean value of the fresh weight was obtained by the peat moss (52.8g), followed by the rice husk (16.8g), and the third-highest was the mixture (15.0 g), while the lowest value was achieved by the sawdust (14.3g).

According to Michael and Lieth (2008), an increase in total pore space frequently results in a decrease in water retention, an increase in oxygen transport, and an increase in root penetration. In turn, they will have an impact on how plants grow. As a result, in the current experiment, the fresh weight of the sawdust-based growing substrate was significantly decreased.

According to Rahman et al. (2017), the fresh weight of lettuce increased as the volume of nutrients provided increased. Thus, the fresh weight of the peat moss-based growing medium had the highest mean value in this experiment.

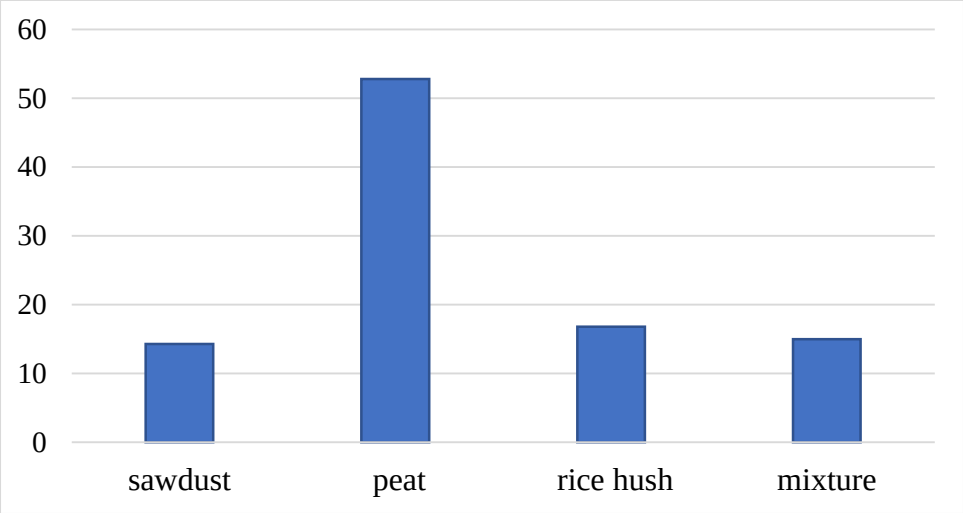

Figure 6: Fresh weight per plant

Conclusions

Peat moss was the best growing medium in terms growth parameters of lettuce, followed by a mixture, sawdust, and rice husk, respectively. Therefore, the study proved that the lettuce (Optima) variety can be cultivated utilizing peat moss-based growing surfaces in an aggregate soilless system in the tropics, such as Somalia. In the absence of peat moss, the mixture (peat moss + sawdust + rice husk) can be used as a growth substrate for a pot-growing system.

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