EFFECTS OF DIFFERENT GROWTH MEDIA ON THE GROWTH AND YIELD OF TOMATOES (*LYCOPERSICON ESCULENTUM* L)

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Abstract

Tomato (Lycopersicon esculentum L) belongs to the family of Solanaceae and it is a popular cultivated vegetable in the world and is famous for its nutritive and medicinal value. Soil is the conventional medium for crop growth, however, soil pose serious limitations to Tomato plant growth such as unsuitable Temperature reactions, un-favourable soil poor drainage and degradation as well as pest and diseases causing organisms. The objective of the study was to determine the effects of different growing media on the growth and yield of Tomatoes. The experiment was laid out in a Complete Randomized Design (CRD). The four growing media used were Cocoa peat, Rice husk, Sawdust and Soil. The growth media were placed in different polythene bags. The tomato seeds were then planted on the different growth media, using four treatments and four replicates. The parameters and data collected in the experiment are; Plant height, Number of leaves, Number of branches, Stem girth, Days to 50% flowering, Number of fruits per plant, Length of fruit. All data generated were statistically analyzed. The results of this study revealed that different growth media responded differently when grown in different growing media. The results showed that there were significant ($P < 0.05$) differences in the growth and yield of tomato among the different tomato plants grown in the different media. From the result obtained, the tallest plant height (38.75) and the highest number of leaves (68.75) was attained in Soil respectively, followed by Coco peat (43.00) which had the second highest number of leaves while the shortest plant height (23.15) and the lowest number of leaves (36.25) was recorded in Rice husk. The highest number of branches (18.50) was obtained by coco peat while the lowest number of branches (18.50) was obtained in Rice husk. The highest stem girth (18.50) was obtained in plants grown in Coco peat**.** The fastest to attain 50% flowering (60.25) was observed in Soil while the least to attain 50% flowering (21.00) was observed in Rice husk. The media with the highest number of fruit (7.25) and length of fruit (3.57) was attained in Soil respectively. Therefore, for effective use and better growth performance and yield of Tomato, it is recommended that Soil is most appropriate for optimum growth and yield without any deleterious effect**.**

Keywords: Tomato, Growth Media, Quality, Yield

Introduction

Tomato (*Lycopersicon esculentum* L) which belongs to the family of Solanaceae, is one of the three important annual fruit vegetables of tropical region, which originated in the South and Central America. Tomato is one of the most popular consumed vegetable in the world. Tomato plants are mainly propagated by two ways i.e. through seed and by cutting

(Veershetty, 2004). It is tasty and easily digestible and its bright colour stimulates appetite like other vegetable. Tomato plays a vital role in human diet because it supplies some of the nutrient in other food materials. Tomato fruit is rich in minerals, calories and a good source of ion and vitamin A, B and C. (Biwasi, 1999). Tomatoes have been reported to be an important source of nutrient antioxidant lycopene and other forms of cancer as well as heart diseases (Barker and Bryson, 2006). The antioxidants component of tomatoes has been reported to influence by the cultivars, growing conditions, harvesting stage and ripening on and off vine (Mathowa *et al.,* 2016).

The term growing media is used to describe the material used in a container to grow a plant and influence the growth of the plant (Unal, 2013). The growing of plants vegetable without soil is called Hydroponics. It is the art of growing plants in a growing medium other than soil (Harris, 1987), by adding dissolved mixtures of essential plant nutrient elements in water as suggested by Gericke in 1930. It can also be defined as the science of growing plants using a solution of suitable nutrients instead of soil (Wahome *et al.,* 2011; Eshun & Apori, 2011). The production of greenhouse crops involves a number of cultural inputs. Among these, perhaps the most important is the type of growing medium used. Due to the relatively shallow depth and limited volume of a container, growing media must be amended to provide the appropriate physical and chemical properties necessary for the plant (Eshun &Apori, 2011). The significance of a hydroponic system in tomato production is that it enables the growers to manage water and nutrient supply and optimize the plant growth in a small production area that is generally sub-optimal for plant growth, yield and quality (Niederwieser, 2001; Harris, 1974).

Soilless production may alleviate some of these problems, while giving the farmer better control over part time farming operations (Wahome *et al.,* 2011). Soilless production of vegetables, as compared with traditional field and greenhouse production in soil, allows the efficient use of water and nutrients by the crop. In soilless production system, many types of growing media or substrates such as saw dust, rice husk and coco peat have been used to grow many kinds of crops (Suhaimi *et al.,* 2012). Therefore, the objective of the study was to determine the effects of different growing media on the growth and yield of tomatoes, specifically, the study will identify the most suitable and effective growing media resulting in high yield of tomatoes.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out in the Green house in Chaha campus of Federal College of Animal Health and Production Technology Vom, Jos.

Experimental materials

The following materials were used for this study; Tomato seeds (Roma), growth media (Cocoa peat, Rice husk, Sawdust and Sand), Polythene bags, measuring tape, book, pen, measuring ruler, pencil.

Source of the Tomato Seeds

The tomato seeds were obtained from Agricultural Service Training Centre (ASTC), Jos South LGA Plateau state.

Collection and Preparation of the Various Growth Medias

The different growth media were freshly sourced for in Bukuru market, Jos after which were mixed with manure before the tomato seedlings were put.

Experimental Design and Procedure

The experiment was laid out in a Complete Randomized Design (CRD) using four treatments and replicated four times. The different growth media were mixed with poultry manure and water. The growth media were placed in different polythene bags. The tomato seeds were then planted on the

different growth media, using four treatments and three replicates and were randomized. The experiment was conducted for a period of two months with the data being recorded and taken at intervals.

Experimental layout

Treatment	**R_1**	**R_2**	**R_3**	**R_4**
T1	T_1R_1	T_3R_2	T_4R_3	T_2R_4
T2	T_4R_1	T_1R_2	T_3R_3	T_3R_4
T3	T_3R_1	T_4R_2	T_2R_3	T_1R_4
T4	T_2R_1	T_2R_2	T_1R_3	T_4R_4

Data Collection

Data collected in the experiment include: Days to first germination, Plant height, Number of leaves, Number of branches, Stem girth, Days to 50% flowering, Number of fruits per plant and Length of fruit. Data were collected for 2. 4. 6 and 8 weeks respectively. Plant height of the plants was measured and recorded 2. 4. 6 and 8 weeks respectively after sowing. It was measured from the plant stem crown to the growing point of the plant. A measuring tape was used to measure the height and then put on a ruler (cm) to get the exact height score. Number of leaves and branches were counted from the second week after sowing down to the end of the experiment. Stem girth was measured using a small rope tied around below the growing point of the main root and the rope was put on a measuring ruler (cm) to get the exact diameter. The stem girth was also measured from the second week after planting till the ninth week. Number of fruits were counted and the numbers were recorded. Length of fruits was measured using a measuring ruler

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using the statistical package SPSS 25.0 software (SPSS, 2017). Means which showed significant differences ($P \leq 0.05$) were separated using Least Significant Difference (LSD) at 5 % level of significance.

RESULTS AND DISCUSSION

Table 1: Effect of different growing media on days to germination of tomato plants

	Growing media			
Parameter	Coco peat	Saw dust	Rice husk	Soil
Days to Germination	7.25^{a}	7.25^{ab}	8.25^{a}	6.25^{b}

Legend: Means that do not share a letter across the row are significantly different from each other at ($P \leq 0.05$)

Table 1 shows that there is a significant difference in the germination days of the tomato plants ($P \leq 0.05$). The record shows that growing media soil (6.25) germinated faster than the other growing medias while Coco peat and Saw dust (7.25 respectively) germinated

afterwards. The least germination days was recorded in Rice husk (8.25)

Table 2: Effect of different growing media on the plant height (cm) of tomato plants weeks after sowing

	Weeks			
Growing media	2	4	6	8
Coco peat	8.17[a]	14.00[a]	33.50[a]	38.75[a]
Saw dust	3.00[b]	13.77[a]	20.25[a]	33.25[a]
Rice husk	3.00[b]	10.85[a]	21.00[a]	23.15[a]
Soil	9.50[a]	18.45[a]	31.97[a]	33.25[a]

Legend: Means that do not share a letter within the same column are significantly different from each other at ($P \leq 0.05$)

Table 2 shows a significant difference ($P < 0.05$) in the plant height of tomato plant grown in the different growth media at week 2. The tallest plants (9.50) was attained in Soil while the shortest (3.00) plants was obtained in Saw dust and Rice husk (Yasmeen *et al.,* 2012).

There was no significant difference ($P \leq 0.05$) in the plant height of the tomato plant grown in the different growth media at week 4. The tallest plants (18.45) was attained in Soil while the shortest (10.85) plants was obtained in Rice husk (Yasmeen *et al.,* 2012).

There was no significant difference ($P \leq 0.05$) in the plant height of tomato plant grown in the different growth media at week 6. The tallest plants (33.50) at this week was attained in Coco peat compared to other growing media while the shortest (21.00) plants was obtained in Rice husk. Coco peat provides adequate nutrients and enhances both the physical and biological properties and the water holding capacity of soil (Meena *et al.,* 2017).

In week 8, there was no significant difference in the plant height of tomato plant grown in the different growth media. The tallest plants (38.75) was attained in Soil while the shortest (23.15) plants was obtained in Rice husk. The findings obtained in this study is not in conformity with the findings reported by Wahome *et al.,* (2010) that the highest plant heights after 9 weeks was recorded in Saw dust as compared to Coco peat.

Organic matter contents of the planting medium have a profound effect on its biological, chemical and physical properties due to the availability of chemical elements upon decomposition (Yasmeen *et al., 2012* and Chamani, *et al.,* 2008). The highest plant height that was obtained in Coco peat could probably be attributed to a better physical environment, better fertility and accumulation of better nutrients. This finding disagrees with

the previous repor that tallest gladiolus plants were obtained in sawdust grown plants when compared to cocopeat, sand and soil (Wahome *et al.,* 2010).

Table 3: Effect of different growing media on the Number of leaves of Tomato plants weeks after sowing

	Weeks			
Growing media	2	4	6	8
Coco peat	1.75[b]	23.50[a]	43.00[a]	63.00[a]
Saw dust	2.50[b]	18.25[a]	35.50[a]	50.50[a]
Rice husk	2.25[b]	14.50[b]	28.00[a]	36.25[a]
Soil	10.75[a]	25.75[a]	42.75[a]	68.75[a]

Legend: Means that do not share a letter within the same column are significantly different from each other at ($P \leq 0.05$)

Table 3 shows significant differences ($P \leq 0.05$) in the number of leaves of tomato plant grown in the different media at week 2. The highest number of leaves (10.75) was recorded in Soil while the lowest number of leaves (1.75) was obtained in Coco peat. There was also a significant difference ($P \leq 0.05$) in the number of leaves of tomato plant grown in the different media at week 4. The highest number of leaves (25.75) was attained in Soil while the lowest number of leaves (14.50) was attained in Rice husk. There were no significant differences ($P \leq 0.05$) in the number of leaves of tomato plant grown in the different growth media at week 6 and 8 respectively. The highest number of leaves was attained in Coco peat (43.00) and Soil (68.75) for week 6 and 8 respectively while the lowest number of leaves was attained in Rice husk (28.00 and 36.25) for the both weeks respectively.

Masuku and Xaba (2013) reported that the highest number of leaves was recorded in Saw dust compared to Soil which is in disagreement with the results obtained from this study as the findings here showed that Soil and Coco peat recorded the highest number of leaves weeks after planting. High water holding capacity and high nutrient retention capacity induced higher vegetative growth in hydroponics culture (Wahome *et al.,* 2011).

Table 4: Effect of different growing media on the Number of Branches of tomato plants weeks after sowing

	Weeks			
Growing media	2	4	6	8
Coco peat	6.50[a]	5.50[a]	9.00[a]	18.50[a]
Saw dust	2.250[b]	4.75[ab]	8.00[a]	11.75[a]
Rice husk	2.00[b]	3.75[a]	7.25[a]	8.25[a]
Soil	3.50[b]	5.75[a]	9.25[a]	15.00[a]

Legend: Means that do not share a letter within the same column are significantly different from each other at ($P \leq 0.05$)

Table 4 shows that there was a significant difference ($P \leq 0.05$) in the number of branches of tomato plant grown in the different growth media at week 2. The highest number of branches was recorded in Coco peat (6.50) while the lowest number of branches was obtained in Rice husk (2.00). There was a significant difference ($P \leq 0.05$) in the number of branches of tomato plant grown in the different media at week 4. The highest number of branches was attained in soil (5.75) while the lowest number of branches was obtained in rice husk (3.75). There were no significant differences ($P \leq 0.05$) in the number of branches of tomato plant grown in the different media both at week 6 and 8. The highest number of branches for both weeks were obtained in Soil (9.25) and Coco peat (18.50) respectively while the lowest number of branches was obtained in rice husk (7.25 and 18.50) respectively for both weeks.

Table 5: Effect of different growing media on the Stem girth of tomato plants weeks after sowing

	Weeks			
Growing media	2	4	6	8
Coco peat	1.00[a]	2.05[a]	2.72[a]	3.00[a]
Saw dust	0.50[a]	1.95[a]	2.32[a]	2.47[a]
Rice husk	0.32[a]	1.45[a]	1.77[a]	1.97[a]

Soil	0.75[a]	2.22[a]	2.47[a]	3.97[a]

Legend: Means that do not share a letter within the same column are significantly different from each other at (P≤ 0.05)

Table 5 shows that were no significant (P > 0.05) differences in the stem girth of the tomato plant grown in the different growth media at week 2, 6 and 8 respectively. The highest Stem girth for week 2, 6, and 8 was attained in Coco peat (1.00, 2.72, and 3.00) respectively while the highest Stem girth at week four was recorded in Soil (2.22). The lowest Stem girth was attained in Rice husk (0.32, 1.45, 1.77, and 1.97) in all weeks i.e 2, 4, 6 and 8 respectively.

The highest stem girth in this study was obtained in plants grown in Coco peat followed by plants grown in Soil, Saw dust and finally Rice Husk. Growing media containing organic matter like Coco peat can stimulate root growth and provide high water holding capacity (Wahome *et al.,* 2011; Meena *et al.,* 2017). The high stem diameter observed in tomato grown in Coco peat compared to sand and soil can be attributed to the fact that Coco peat provides adequate nutrients and enhances both the physical and biological properties and the water holding capacity. (Rahimi, *et al.,* 2013). Findings from previous research reported that lowest stem girth was obtained in tomato plants grown in soil (Joshi and Vig, 2010).

Table 6: Effect of different growing media on days to 50% flowering of tomato plants

	Growing medias			
Parameter	Coco peat	Saw dust	Rice husk	Soil
Days to 50% flowering	60.00[a]	46.75[a]	21.00[a]	60.20[a]

Legend: Means that share a letter across the row are significantly different from each other at (P≤ 0.05)

Table 6 revealed that there were no significant (P > 0.05) differences in the days to 50% flowering of the tomato plant grown in the different growth media. The fastest to attain 50% flowering (60.25) was observed in Soil while the least to attain 50% flowering (21.00) was observed in Rice husk.

Table 7: Effect of different growing media on the number of fruit and length of fruit of Tomato plants

Growing media	Number of fruits	Length of fruits (cm)

Coco peat	4.75^{ab}	2.57^{ab}
Saw dust	0.00^{b}	1.40^{bc}
Rice husk	0.00^{b}	0.37^{c}
Soil	7.25^{a}	3.57^{a}

Legend: Means that do not share a letter within the same column are significantly different from each other at ($P \leq 0.05$)

In Table 7, there was a significant ($P < 0.05$) difference in the number of fruits of the tomato plant grown in the different media. The media with the highest number of fruit (7.25) was attained in Soil while the media with the lowest number of fruit (0.00) attained in Saw dust and rice husk respectively. The highest number of fruits was observed in Soil which is in conformity with Marinou *et al.,* (2013) who reported that highest number of fruits was recorded in Soil than Sawdust and other growing medias. The highest number of fruits observed in the tomato grown in Soil in this study could be attributed to a good physical environment and good fertility. The growing media with the highest number of flowers resulted to the highest number of fruits. The differences in the number of fruits in the different highest marketable yield among the cultivars maybe associated with genotype of the different cultivars was obtained in Inga but was not different cultivars (Fentik, 2017). There was significant ($P < 0.05$) differences in the length of fruits (cm) of the tomato plant grown in the different media. The media with the highest length (3.57) was attained by soil while the media with the lowest length (0.37) was obtained by Rice husk.

Conclusion

This study was designed to evaluate the effect of different growth media on the growth performance and yield of tomato, the different growth media had different effect on the growth performance as Soil and Coco peat performed better than other growth media because of its high mean values in plant height, number of branches number of leaves, stem girth, days to 50% flowering, the highest number of fruits and also the highest fruit length respectively.

Recommendation

This study recommends that:

1. Coco peat and Soil growth media should be advocated among farmers to grow tomatoes because they were identified to be the most suitable and effective growing medium for Tomato production in terms of both the growth and yield performance.
2. It is also recommended that further research should be carried out to know the Post -harvest durability of the fruits harvested from the different growth media.

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