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Impact of different growing media and varying pot sizes on growth of pepper (*Capsicum annuum* L.) Under greenhouse conditions

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Abstract
The objective of this study was to determine the effect of different soil media and varying pot sizes on the early growth of capsicum annum. Nine treatments were used for the study and these were replicated 3 times. The various soil media used are as follows: Topsoil, clay soil, river sand while the varying pot sizes were 1kg, 2k and 3kg. The experiment was 3x3 factorial experiment laid out in completely randomized design (CRD). Parameters assessed were leaf count, plant height (cm) and collar diameter (mm), each parameters were assessed for ten weeks. The data collected at the end of ten weeks were subjected to Analysis of Variance (ANOVA) and means were separated using Duncan test showed that plant sown in 3kg pot of topsoil (T_9) had the highest performance in the seedling height, leaf production and collar diameter with mean values 9.45 am, 6.63, 0.210mm respectively while the least was observed in (T_1) 1kg clay soil with mean values of 6.44, 3.43, and 0.164 in seedling height, leaf production and collar diameter respectively. It is therefore recommended that 3kg of polythene pot size of top soil be adopted for the raising of *Capsicum annum* seedlings at nursery stage.

Keywords: *Capsicum annum*, growing medium and nursery

Introduction

Peppers (*Capsicurn* species) are grown in many countries in the world. They are usually classified by their fruit characteristics pungency colour, fruit shape as well as their uses (Miller, 2003) [10]. It grows upright from 60- 120cm high depending on the variety *Capsicum* species can also produces from two to four year depending on the variety.

These vegetable is Biennial crop which is cultivated as annual crops. Unripe pepper exhibit colour ranging from green to dark, shapes of yellow or even brown while the red one are considered ripe. Size, shape, flavor and pungency from variety to variety but can also differ among fruits of the same bush; they are well grown in a humid climate. It requires temperature of 2l-25°c. (Dewith and Bosland, 2003) [3].

Pepper are known to be rich in vitamin A and thus varies with the colour of the pepper that is the redder the pepper the higher the vitamin A contain (Miller, 2003) [10] Mature peppers may have as much as ten times the amount of green peppers. It is well grown in many types of soil and well-drained soil is best suitable for it. They are tolerant to slight acidic condition with a pH of 5.5 to 5.6., rainfall levels of 600-1200mm are also considered adequate. The Africa climate favours the cultivation of peppers but in the humid region most soils are sandy, highly weathered, and low in organic matter content and susceptible soil to erosion and compaction. Pepper and improper soil management however, leads to either fertility or infertility of soil which invariably affect the productivity of the soil (Romans and Rearnaekan, 2001) [15].

The world demand for *Capsicurn* has been continuously increasing recently and production increased by 40% between 1990 and 2000 with about 1.4 million heaters cultivated (FAO, 2000) [5]. *Capsicurn* is ranked in the middle range of vegetable in terms of popularity with a world annual output of 1.8million and 1.4rnillion hectares of cultivated land used for their production. Asian production of fresh production accounts for 56.4% of world production followed by southern European region with about 1 5% of world production in 2000 (Wien, 2002) [19].

Materials and Methods

The experiment was carried out within the premises of Federal College of Forestry, Jericho, Ibadan, and Oyo State. The College is situated in Ibadan South-West Local Government at latitude 7°9N and longitude 3°58E c the Greenwich meridian. It has an annual mean rainfall of about 13 0mm- 1500mm and average relative humidity of about 80% - 85% (FRIN, 2011) [6].

Sample Preparation: The seeds were extracted from the fruits the extracted seeds were washed with tap water in the process of washing the non-viable seeds seen floating were discarded while that of the viable seeds remained at the lower part of the water.

The river sand was collected from a nearby steam in the college. The top soil and clay soil was collected from the nearby forest plantation which is about 5km away from the nursery site. The soils were air dried and later sieved with 2 mm sieve to remove clods and debris. The samples of the

soil collected were taken to the laboratory for particle size analysis in order to determine their textural classes, (Table 1). River sand was used to raise seedlings in a germination box and watering was done twice daily to enhance seed germination. Sprouting of seeds was first noticed on the sixth day after sowing. After germination 27 healthy seedlings were carefully selected and transplanted into polythene pots filled with the different treatments of the growth media. There were nine treatments, T_1:1Kg of clay soil, T_2: 2kg of clay soil, T_3: 3kg of clay soil, T_4: 1kg of River sand, T_5: 2kg of River sand, T_6: 3kg of River sand, T_7: 1kg of Top soil, T_8: 2kg of Top soil and T_9: 3kg of Top soil respectively.

Experimental design: The experiment was a 3x3 factorial experiment carried out in a Completely Randomized Design (CRD) with three replications. Parameters measured are: plant height (cm), stem diameter and number of leaves.

Statistical Analysis

Data collected were subjected to one-way analysis of variance (ANOVA) procedure for Completely Randomized Design (CRD) and the significant levels for the mean separations were assigned according to Duncan's Multiple Range Test ($P \leq 0.05$).

Result and Discussion

Characterization of the nursery soils

The soils used in this study exhibited the result (Table1), revealed that the top soil, river sand and clay soil substrate have a slightly acidic pH which seems to be best to promote the availability of plant nutrients for the growing medium.

Table 1: Physio-Chemical Properties of Top Soil, River Sand and Clay Soil used for the Experiment.

Properties		Composition	
	Topsoil	River Sand	Claysoil
PH	6.57	5.88	4.90
Sand%	84.6	94.6	36.0
Clay%	7.8	7.8	58.0
Silt%	7.6	1.4	6.0
Ca (me/l00g)	13.11	12.27	1.4
Mg (me/l00g)	2.04	l.79	1.15
Na (me/b0g)	0.81	0.04	0.17
K (me/l00g)	0.48	0.26	0.16
H+A1	0.03	0.04	0.18
ECEC	16.47	14.40	0.04
BASE SAT %	99.82	99.72	12.34
C %	0.35	0.21	0.01
N% Av.P(ppm)	10.50	9.45	0.08
Cu (mg/kg)	0.65	0.3	2.9
Zn (mg/kg)	0.52	0.17	0.12
Fe (mg/kg)	26.9	4.5	2.9
Mn (mg/kg)	0.80	0.15	0.12

Table 2: Analysis of Variance (Anova) for Height, Collar Diameter and leaf production

		Height	Stem diameter	Leaf production
Sources of Variation	Df	P-Value	P-Value	P-Value
Treatment	8	<0.01**	<0.0026**	0.0042**
Error	18			
Total	26			

Note:*significant at 5% level of probability

Table 3: The Result Shows the Leaf Production Mean of *Capsicum Annum* Seedling to Different Soil Media and Varying Pot Sizes

+	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	Mean
T_1	2.00	3.00	2.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	3.43d
T_2	2.00	3.00	2.00	1.00	2.00	4.00	5.00	6.00	6.00	7.00	4.03cd
T_3	2.00	2.00	3.00	3.00	2.00	3.00	4.00	5.00	6.00	7.00	4.17bcd
T_4	2.00	3.00	3.00	2.00	3.00	3.00	4.00	6.00	7.00	8.00	4.17bcd
T_5	2.00	3.00	3.00	2.00	2.00	3.00	4.00	5.00	6.00	7.00	3.63d
T_6	2.00	3.00	3.00	3.00	4.00	5.00	6.00	6.00	7.00	8.00	5.40abc
T_7	2.00	3.00	3.00	4.00	5.00	5.00	6.00	7.00	8.00	9.00	5.83ab
T_8	2.00	4.00	5.00	5.00	6.00	6.00	7.00	8.00	9.00	10.00	6.33a
T_9	3.00	4.00	5.00	6.00	7.00	7.00	8.00	9.00	10.00	11.00	6.63a

Note: means with the same letter are not significantly different from themselves.

Leaf Production Plant height

Analysis of Variance table 2 above shows that there was significant difference among the treatments at 5% level of probability at the end of 10 weeks period of assessment. The result in table 3 showed that *capsicum annum* seedling planted in 3kg of top soil (T_9) performed best with mean

value of 6.63 with respect to the numbers of leaves produced, followed by 2k of top soil 6.63cm (T_8) while plant sown in 1kg of clay soil (T_1) showed the least performance with mean value of 3.43. This implies that the 3kg of top soil is suitable for raising *capsicum annum* seedlings at the nursery stage. This was in support of the work of Oni and Bada (1991) [12] who stated that due to the presence of organic matter and the nutrient in the right proportion in it. Riaz *et al.,* (2008) [13] reported that different growing media can be used to grow zinnia while the physical and chemical properties of media, like structure, texture, pH as well as nitrogen, phosphorus and potassium are the dominant factors for the growth and development of plant. *Euonymus juponicu* grown in larger containers had a high mean relative growth rate than those grown in smaller containers (Dubik *et al.,* 1992) [4]. The consensus is that as container size increases, plant growth, leaf area and shoot dry weight are increased (Richard 1980) [14].

Table 4: The Result Shows The Mean Height Of *Capsicum Annum* Seedling on Different Soil Media and Varying Pot Size.

Treatment	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	WK8	WK9	WK10	Mean
T_1	4.60	5.10	5.50	5.80	6.00	6.30	6.70	7.30	8.20	10.30	6.44f
T_2	4.40	4.80	5.30	5.30	5.70	6.20	6.90	7.40	9.70	10.70	6.52ef
T_3	4.60	4.90	5.30	5.80	6.00	5.30	7.10	7.70	8.90	11.00	6.86ef
T_4	4.20	5.00	5.00	5.40	5.90	6.20	7.30	8.20	10.40	12.00	7.52de
T_5	4.30	5.00	5.00	5.50	5.90	6.30	7.40	8.20	10.00	12.40	7.97bc
T_6	4.30	4.30	4.60	5.10	5.60	6.60	8.00	9.00	11.70	14.00	7.90bcd
T_7	4.70	5.30	6.00	6.30	6.60	7.70	8.60	10.00	13.40	16.00	8.44abc
T_8	4.20	4.70	5.30	6.10	6.80	7.70	9.30	10.10	13.10	17.10	8.63ab
T_9	‘4.50	4.90	5.30	6.10	6.90	9.00	11.00	13.00	15.00	18.70	9.45a

Note: means with the same letter are not significantly different from themselves. Plant Height

Table 2 shows that there is significant difference among the treatments at 5% of probability assessment period of 2 to 10 weeks among the treatments. The result on plant height (table 4) indicates that plant sown in 3kg top soil (T_9) gave the highest height with the mean value of 9.45 cm followed by 2k of top soil 8.63 cm (T_8) while 1kg of clay soil (T_1) had the least performance with mean value of 6.44cm. This also implies that top soil had the highest among the treatment. This supported the findings of money (1998) which stated that topsoil had the highest nutritive value due to the presence of micro-organisms that live in it. It was reported that; Plants grown in larger containers are taller than plants grown in smaller containers of top soil (Wu Y *et al.,* 1998) [20], because they grow faster (Van Israel, 1997) due to more space and water nutrients (Scarratt, 1972) [16] grew white spruce seedlings

Table 5: The Result Show the Mean Collar Diameter of *Capsicum Annum* Seedling on Different Soil Media and Varying Pot Sizes.

Treatment	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	WK8	WK9	WK10	Mean
T_1	0.11	0.13	0.14	0.15	0.15	0.16	0.16	0.17	0.18	0.20	0.164
T_2	0.11	0.12	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20	0.174
T_3	0.11	0.12	6.13	0.13	0.16	0.17	0.18	0.19	0.20	0.23	0.165
T_4	0.11	0.12	0.14	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.181
T_5	0.12	0.12	0.13	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.123
T_6	0.12	0.13	0.14	0.14	0.16	0.17	0.18	0.19	0.20	0.24	0.186
T_7	0.12	0.12	0.14	0.15	0.16	0.17	0.19	0.20	0.24	0.30	0.199
T_8	0.12	0.14	0.14	0.16	0.16	0.18	0.19	0.20	0.24	0.33	0.210
T_9	0.13	0.14	0.16	0.18	0.19	0.22	0.28	0.30	0.36	0.40	0.268

Note: Mean with the same letter are not significantly different from themselves. Stem Diameter

Seedling Collar Diameter

From Table 2 above, ANOVA result showed no significant differences ($p \leq 0.05$) for seedling collar diameter at the end of 10 weeks in all the treatments. Result on collar diameter (table 5) indicate that *capsicum annum* planted in 3kg of top soil produced the best stem diameter with the mean value of (T_9) 0.26 8 mm Followed by 2kg of top soil (T_8) 0.210mm while plant sown on 1kg (T_1) of clay soil had the least performance with the mean value of 0.1 64mm. This means that topsoil with 3kg of topsoil played an important role among the treatment suitable for raising capsicum annum seedling at nursery stage. This support the finding of Dwatmaji *et al.* (1992) that topsoil is the best media, due to the nutritive value presence in it. These results are in agreement with the findings of (Landis, 1989, Funk *et al.*, 1980 and Kinghorn, 1974) [9, 7, 8] who reported that the shoot, root and total dry weight as well as shoot height increased significantly with increasing container volume of top soil. Sturmheit (1989) [17] also found that the northern red oak seedlings biomass was reduced as the volume of the container medium with top soil was reduced. In general, as cell size increases transplant leaf area, shoot biomass and root biomass increases (Cantliffe, 1993) [1].

Conclusion and Recommendation

Many media have been used to obtain growing media for *Capsicum Annum* seedling production. The raw materials used vary according to their local availability in the world. Different media have several gradient which could have direct and/or indirect effects on plant growth and development. Therefore based on findings obtained from the study showed that different media have significant effects on growth rate. But the result of the study indicated that top soil of 3kg of polythene pot is appropriate for raising

seedling of in the nursery, with respect to seedlings height, number of leaves and collar diameter. River sand of 21kg and 3kg of polythene pot could have performed better but due to its low nutrient content, leaves seedling planted in them were seen to turn yellow and leaves drop during the experiment, thus there was negatively affecting the leaf production, stem diameter and seedlings height. Furthermore, to raise capsicum annum seedling at the nursery stage 3kg of top soil is suitable for raising *capsicurn annum* seedling. It is therefore recommended that 3kg of top soil should be used for the raising of *capsicurn annum* at nursery stage.

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