INDIAN JOURNAL OF
ARID HORTICULTURE
2017, Vol. 12 (1-2):1-15

Effect of cocopeat, peat moss and perllite in growing bags and trays on tomato (*Lycopersicon esculentum* Mill.)

R. H. Dahiya* and Akshaya Bhati*
Department of Agriculture Science, Jayoti Vidhyapeeth Women's University, Jaipur
(Received: 20.02.2018; Accepted: 27.04.2018)

Abstract

One of the most important things in successful vegetable transplant production is to grow strong and healthy transplants. The role of plant growing media is become important in modulating physiological responses that will eventually lead to producing high quality seedlings. Aim of this study was to evaluate tomato (*Lycopersicon esculentum* Mill.) and transplant growth in various soilless growing media. Seven growing media were formulated using peat moss and cocopeat as the organic components and perlite as the inorganic components. To facilitate interpretations, seedling height, stem diameter, number of true leaves, elative leaf chlorophyll content, stem fresh weight, stem dry weight, root fresh weight, and root dry weight of 6-week old transplant grown in different growing media were compared. The results of the study have shown that the use of different growing media highly affected growth and quality of tomato transplant.

Key Words: *Tomato, cocopeat, perlite, transplant production, soilless*

Introduction

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop. It is botanically a berry fruit, it is considered vegetable for culinary purposes. The fruit is rich in lycopene, which has beneficial health effects. The plants typically grow to 1–3 meters in height and have a weak stem that often sprawls over the ground.

Soilless agriculture offer a way to overcome the shortage of the normal amount of water needed to grow plants. Agriculture without soil, in fact, historically dates back to several hundred years BC since the civilization of ancient Egyptian, the Chinese and other cultures (Prasad and Maher ,2004). Soilless media is a valuable resource in your greenhouse production management systems. It supports plant life and is a source of water, nutrients and air. Growing media supports the plant from germination to the time of transplanting. The production of container-grown vegetables plants has expanded in recent years, due to the advantages of this method with respect to direct sowing techniques or the production of seedlings in traditional nurseries (Castillo *et al.*, 2004). One method of ensuring success in vegetable production is to establish healthy and vigorous seedlings that do not deteriorate in the new environment but immediately resume their growth. Growing quality transplants offers a number of benefits, such as shorter growing season and more efficient use of land, improved crop uniformity, more accurate prediction of harvest dates, facilitating the use of a wider range of herbicides, extends the growing season, more efficient use of expensive hybrid seed. By using transplants, producers can also insure a good stand of vegetable plants without the uncertainty of direct seeding or the added cost of field thinning (Hannan, 2016).The lack of appropriate cultural practices during growing season is one of the barriers to successful vegetable production. Mistakes, which made during transplant production, are multiplied through the rest of the season and will significantly affect yield and quality. Production could be much higher than the amount above if we can reduce the losses due to poor growing media and poor seedlings. The growth medium used in vegetable transplants is a determining factor given its close correlation with plant development. Growing media influences seed germination, seedling emergence, seedling growth and quality of seedlings in a nursery (Corti *et al.* 1998; Wilson *et al.* 2001; Baiyeri ,2004; Sahin *et al.* 2005; Agbo and Omaliko, 2006).

Materials and Methods

Vegetative material

Tomato seeds (*Lycopersicon esculentum* Mill., variety Pusa Ruby was used for the experiments.Pusa Ruby is a indeterminate type tomato variety. An Early maturity (60-65 days) variety suitable for autumn, winter and spring summer.

Growing Media

Three growing media were formulated using peat moss and coconut pith as the organic components and perlite as the inorganic components.

Growing Medium Composition (ratio by volume	Growing Media
1	Peat
2	Coconut peat
3	Perlite
4	Peat + Perlite (1:1)
5	Coconpeat + Perlite (1:1)
6	Coconut coir + Perlite + Peat (1:1:1)

7 Coconut coir + Perlite + Peat (2:1:1)

The experiment was carried out at an automated and heated polycarbonate-covered Greenhouse in University Campus Farm, Jasyoti Vidhyapeeth Women's University, Jaipur. The greenhouse experiment investigated the effects growing media on tomato. Tomato seeds were sown (two-seed/cell) into 45-cell plastic trays (cell volume 75 cm^3) and poly bags filled with growing media in different ratios of growing media.

Irrigation

Irrigation of seedlings was manually performed using a sprinkler nozzle connected to a hose and performed daily or twice a day according to the environmental conditions using enough water to avoid stress in the cultivated seedlings. Seedlings were fertilized with18-18-18 N-P-K soluble fertilizer at a rate of 100 $mg.L^{-1}$ N once a week. The growth period of the seedlings in the nursery was 6 weeks, until reaching commercial transplanting size.

Fig 2. Tomato seedlings in pro-trays

Fig 3 . Six-week old tomato seedlings

Observation Determined in the Seedlings

Ten plants per treatment were randomly chosen from each replicate to determine seedling growth parameters. Plant growth measurements of the 6-week-old tomato plants included seedling height, stem diameter (measured below cotyledons), number of true leaves, relative leaf chlorophyll content with a chlorophyll meter

SPAD, leaf area using LI-3100C portable area meter . The growing medium was then separated from the roots, and plant organs (shoots and roots) were separately weighted to determine fresh weights. The samples were then dried in a forced air oven (105 °C) for 24 h and recorded as dry weights.

Results and Discussion

Seedling Height (cm)

Effect of different media on seedling height of six-week old tomato seedlings are given in Table 1. The data related to seedling height shows that the growing media number 1, 6 and 7 gave the tallest tomato seedlings. Grunert *et al.* (2008) reported that tomato plants grown in the peat rooted more easily than those grown in the peat or mineral wool but the total yield was similar for all media. The growing media number 4 gave the shortest tomato seedlings. This might due to high bulk density of the media according to Grunt *et al.* (2008).

Root Length (cm)

Effect of different media on root length of six-week old tomato seedlings is given in table 1. The results showed that the media number 7higher value that the mixture media (peat moss + perlite + cocopeat) which is 12.04 cm compared other media exception for media number 1,4,5and 6 (11.23,11.89,1.18and11.83 cm respectively). The lowest root length value was obtained from media number 2 and 3which were 9.37 and 6.85 cm respectively.

Table 1. Effects of different growing media on seed ling height (cm) and root length (cm) of six week-old tomato seedlings under the greenhouse conditions

Growing Media		Seedling Height (cm)	Root Length (cm)
1	Peat moss	8.38	11.23
2	Cocopeat	5.54	9.37
3	Perlite	6.34	6.85
4	Peat moss + Perlite (1:1)	6.07	11.89
5	Cocopeat + Perlite (1:1)	5.56	11.18
6	Peat moss + Perlite + Cocopeat (1:1:1)	6.68	11.83
7	Peat moss + Perlite + Cocopeat (2:1:1)	7.22	12.04

Leaf Number

Effects of different media on leaf number of six-week old tomato seedlings are given in table 2. The results of the study showed that media number 1 peat moss and media mixture number 7 gave highest value of the leaf number (3.84 and 3.22, respectively). The lowest root leaf number value was obtained from media number 3 which is 2.93 These results were supported by the findings of Raiz *et al.* (2008) who reported that maximum number of leaves was obtained in the media mixture. The possible reason was nutritional contribution of the treatment that produced maximum number of leaves.

Leaf Area (cm^2)

Effects of different media on leaf Area of six-week old tomato seedlings are given in table 2. The results of the study showed that media number 1 peat moss and media mixture number 7 gave highest value of the leaf number (37.65 and 38.89, respectively). Leaf area value recorded in the medium number 3was the lowest which is 25.02 cm2. This might be the reason that it doesn't hold moistures well as other growing mediums (Anonymous 2017b).

Table 2. Effects of different growing media on leaf number and leaf area (cm^2) of six week-old tomato seedlings under the greenhouse conditions

Growing Media		Leaf Number	Leaf Area (cm2)
1	Peat moss	3.84	37.65
2	Cocopeat	2.95	33.44
3	Perlite	2.93	25.02
4	Peat moss + Perlite (1:1)	3.02	29.24
5	Cocopeat + Perlite (1:1)	3.15	36.91
6	Peat moss + Perlite + Cocopeat (1:1:1)	3.15	37.00
7	Peat moss + Perlite + Cocopeat (2:1:1)	3.22	38.89

Stem Diameter (mm)

Effects of different media on stem diameter of six-week old tomato seedlings are given in table 3. The table shows that the media number 1 and 7 gave highest stem diameter values (3.21and 3.28 mm, respectively).On the other hand stem diameter value recorded in the medium number 3 was the lowest which is 1.59 mm. This might be the reason that it doesn't hold moisture as well as other growing mediums (Anonymous 2017b).

Relative Leaf Chlorophyll Content (SPAD)

Effects of different media on chlorophyll content of six-week old tomato seedlings are given in table 3. It shows that the media number 3 and 4 showed highest relative leaf chlorophyll content values (36.40 and 42.79 SPAD, respectively). On the other hand, the lowest relative leaf chlorophyll content (29.69SPAD) was obtained from the growing media number 2.

Chlorophyll level gives an indirect estimate of the nutrient status, since most of the nitrogen is incorporated to the leaf chlorophyll (Filella *et al.*, 1995; Moran *et al.*, 2000).

Shoot Fresh Weight (g)

Effects of different media on shoot fresh weight of six-week old tomato seedlings are given in table 4. The data shows that the medium numbers 1and 7 were recorded in high shoot fresh weight values (3.14 and 2.68 g, respectively). The media number 3 had the lowest value which was 2.47 g. It may be because the media 3 has low nutrient and ion exchange capacity than the other growing media, therefore would cause weak growth or severe wilting in the crop (Anonymous 2016).

Shoot Dry Weight (g)

Effects of different media on shoot dry weight of six-week old tomato seedlings are given in table 4. The data shows that the medium numbers 1 and 7 were recorded in high shoot fresh weight values (0.18 and 0.16 g, respectively).On the other hand, the lowest shoot dry weight (0.12) was obtained from the growing media number 3. It may be because the media 3 has low nutrient and ion exchange capacity than the other growing media, therefore would cause weak growth or severe wilting in the crop (Anonymous 2016).

Table 3. Effects of different growing media on stem diameter (mm) and relative leaf chlorophyll content (SPAD) of six week-old tomato seedlings under the greenhouse conditions

Growing Media		Stem Diameter (mm)	Chlorophyll (SPAD)
1	Peat moss	3.21	36.40
2	Cocopeat	2.31	29.69
3	Perlite	1.59	36.82
4	Peat moss + Perlite (1:1)	2.23	34.70
5	Cocopeat + Perlite (1:1)	2.23	31.35
6	Peat moss + Perlite + Cocopeat (1:1:1)	2.46	29.75
7	Peat moss + Perlite + Cocopeat (2:1:1)	3.28	42.79

Table 4. Effects of different growing media on shoot fresh weight (g) and shoot dry weight (g) of six week-old tomato seedlings under the greenhouse conditions

Growing Media		Shoot Fresh Weight (g)	Shoot Dry Weight (g)
1	Peat moss	3.14	0.18
2	Cocopeat	2.62	0.15
3	Perlite	2.47	0.12
4	Peat moss + Perlite (1:1)	2.56	0.14
5	Cocopeat + Perlite (1:1)	2.53	0.13
6	Peat moss + Perlite + Cocopeat (1:1:1)	2.58	0.14
7	Peat moss + Perlite + Cocopeat (2:1:1)	2.68	0.16

Root Fresh Weight (g)

Effects of different media on root fresh weight of six-week old are given in table 5which shows in media number 7 had the highest value of root fresh weight which is 1.50 g. On the other hand, the lowest the root fresh weight value was recorded for medium number 3 which is 0.81 g. This might be due to physically impact of the media on the roots (Neelam and Ishtiaq, 2001).

Root Dry Weight (g)

Effects of different media on root dry weight of six-week old tomato seedlings are given in table 5which shows in media number 7 had the highest value of root fresh weight which is 0.11 g. On the other hand, the lowest the root fresh weight value was recorded for medium number 3 which is 0.05 g. This might be due to physically impact of the media on the roots (Neelam and Ishtiaq, 2001).

It can be clear that using different growing media for cultivation of vegetable transplants is important, in particular for the first of growing stage which in this stage the plant depends on the types of media to obtain nutrients. If soil based media used vegetable transplants usually face many problems such as diseases and pests affecting their growth. In addition, utilizing variety of growing media for different plant growing will give different result as in the research illustrated that combination of peat moss + perlite + cocopeat (2:1:1) media has may be the greatest value than other media. However, Only peat moss media also has the positive impact as well. The reason is refer to many aspects one of them is water holding capacity, pH, EC and other factors such as easily be controlling with easy service.

Table 5. Effects of different growing media on root fresh weight (g) and root dry weight (g) of six week old Tomato seedlings under the greenhouse conditions

Growing Media		Root Fresh Weight (g)	Root Dry Weight (g)
1	Peat moss	1.00	0.07
2	Cocopeat	0.98	0.07
3	Perlite	0.81	0.05
4	Peat moss + Perlite (1:1)	1.15	0.08
5	Cocopeat + Perlite (1:1)	0.91	0.06
6	Peat moss + Perlite + Cocopeat (1:1:1)	0.90	0.06
7	Peat moss + Perlite + Cocopeat (2:1:1)	1.50	0.11

References

Agbo, C.U. and Omaliko, C.M. 2006. Initiation and growth of shoots of *Gongronema latifolia* Benth stem cuttings in different rooting media. *African Journal of Biotechnology*, 5(5): 425- 428

Aniel, J., Cantliffe, J. Z., Astellanos, C. and Paranjpe, A. 2007. Yield and Quality of Green house-grown Strawberries as Affected by N Level in Coco Coir and Pine Bark Media. *Proceeding of the Florida State Horticulture Society*, 120: 157-161

Anonymous. 2014. Commercial Production of Vegetable Transplants. The University of Georgia, Fort Valley State University, the U.S. *Department of Agriculture Bulletin*, 1144

Baiyeri, K.P. 2004. Evaluation of nursery media for seedling emergence and early seedling growth of two tropical tree species. Moor *Journal of Agricultural Research*. 4(1): 60- 65.

Castillo, J.E., Herrera, F., López-Bellido, R.J. and Fernández, E.J. 2004. Municipal solid waste (msw) compost as a tomato transplantmedium. *Compost Science & Utilization*, 12(1): 86-92.

Corti, C., Crippa, L., Genevini, P.L. and Centemero, M. 1998. Compost use in plant nurseries: hydrological and physicochemical characteristics. *Compost Science and Utilization*, 6(1): 35- 45

Fitella, I., Serrano, L., Serra, J. and Peñuelas, J. 1995. Evaluating wheat nitrogen status with canopy reflectance indices and discriminant analysis. *Crop Sci.*, 35(5): 1400 – 1405.

Grunert, ●., Perneel, M. and Vandaele, S. 2008. Peat-based organic grow bags as a solution to the mineral wool waste problem. *Mires and Peat*, 3: 1–5.

Hannan, J. 2016. Seasonal Notes. Iowa Produce.org e-Newsletter. February 2016, p.8

Neelam, A. and Ishtiaq, M. 2001. Response of *Eucalyptus camaldulensis* seedlings to different soil media. *Sarhad Journal of Agriculture*, 17(1): 75-79.

Prasad, M. 1997. Physical chemical and microbiological properties of coir cocopeat. *Acta Horticulture*, 40: 21–27.

Raiz, A., Arshad, M., Younis, A., Raza, A., and Hameed, M. 2008. Effect of different growing media on the growth and flowering of *Zinnia elegans* cv. Blue point. *Pakistan Journal Botany*. 40: 1579-1585.

Sahin, U., Ercisli, S., Anapali, O. and Esitken, A. 2005. Effect of pumice amendment on physical soil properties and strawberry plant growth. *Journal of Central European Agriculture*, 6(3): 361- 366.

Wilson, S.B., Stoffella, P.J. and Graetz, D.A. 2001. Use of compost as a media amendment for containerized production of two subtropical perennials. *Journal of Environmental Horticulture*, 19(1): 37-42.