Effect of different soilless substrates on yield of Iceberg lettuce

RAJESH KUMAR, ANIL KUMAR GODARA and VIKAS KUMAR SHARMA

Precision Farming Development Center, Department of Horticulture
CCS Haryana Agricultural University, Hisar 125004 Haryana, India
Email for correspondence: rajesh22berwal@gmail.com

 Received: 12.11.2021/Accepted: 04.12.2021

ABSTRACT

The present investigations were carried out to study the effect of different combinations of substrates on growth and yield of Iceberg lettuce in PVC pots at Precision Farming Development Centre, CCS Haryana Agricultural University Hisar, Haryana during the year 2018. Four substrates namely cocopeat, perlite, vermiculite and vermicompost were used to create the different treatments in different proportions (by volume) for lettuce production. The results indicated that plants grown in cocopeat + perlite + vermicompost in the ratio of 2:1:1 produced maximum number of leaves (20.06), plant height (23.80 cm), plant spread (30.60 cm), yield (145.60 g/plant) and root weight (11.60 g) whereas the maximum root length (31.00 cm) was observed in case of treatment comprising cocopeat + perlite (2:1).

Keywords: Substrates; cocopeat; perlite; vermicompost; lettuce; yield; plant growth

INTRODUCTION

Lettuce (*Lactuca sativa*) is one among the most consumed vegetables across the world. The commercial importance and production of lettuce, which is the most popular of the local salad crops, is increasing in India. It is an important vegetable commodity and in demand by the local markets throughout the year. This popularity has led to an increase in lettuce production and consumption in urban areas (Maboko and Du Plooy 2008). It is normally consumed raw and has a high nutrient value being rich in calcium, iron and vitamin A. It is a good source of vitamins and often prescribed to weight conscious consumers (Niederwieser and Denner 2001, Maboko 2007).

Due to high content of biologically active compounds in it, the lettuce should be permanently present in our diet. It is traditionally cultivated in soil but recently alternative soilless cultivation techniques have been considered. Although the cultivation in soil is inexpensive yet it brings about some risks like soil borne diseases, insects and pests. Soilless systems are suited to produce with short culture cycles and without use of pesticides. Plant nutrition can be better controlled in these systems and soil contamination is avoided.

Nowadays market demands for high quality vegetables therefore the increased interest of lettuce producers is alternative substrates. A number of factors including plant genotypes and environmental growing conditions can impact the production and quality of lettuce. The aim of this study was to determine the effect of different growing media in hydroponic growing systems on growth and yield of lettuce.

MATERIAL and METHODS

The experiment was carried out in a naturally ventilated greenhouse at Precision Farming Development Centre, Department of Horticulture, CCS Haryana Agricultural University, Hisar, Haryana. In this study, Iceberg lettuce cultivar was used during the year 2018-19. The plants were cultivated in winter with hydroponic cultivation system on different growing media. Four substrates cocopeat, perlite, vermiculite and vermicompost were used to create the different treatments in different proportion (by volume) for plant propagation. The six-substrate mixtures with five replications/treatments (5 plants/replication) were arranged in single rows on a greenhouse trough. The treatments were S_1 (Cocopeat), S_2 [(Cocopeat + perlite (2:1)], S_3 [Cocopeat + perlite (3:1)], S_4 [Cocopeat +

vermiculite (3:1)], S_5 [Cocopeat + perlite + vermicompost (2:1:1)], S_6 [Cocopeat + perlite + vermiculite (3:1:1)]

The data were analysed according to the procedure for analysis of completely randomized design (CRD) as given by Panse and Sukhatme (1967). The overall significance of difference among the treatments was tested using critical differences (CD) at 5 per cent level of significance. The results were statistically analysed with the help of a windows-based computer package OPSTAT (Sheoran et al 1998).

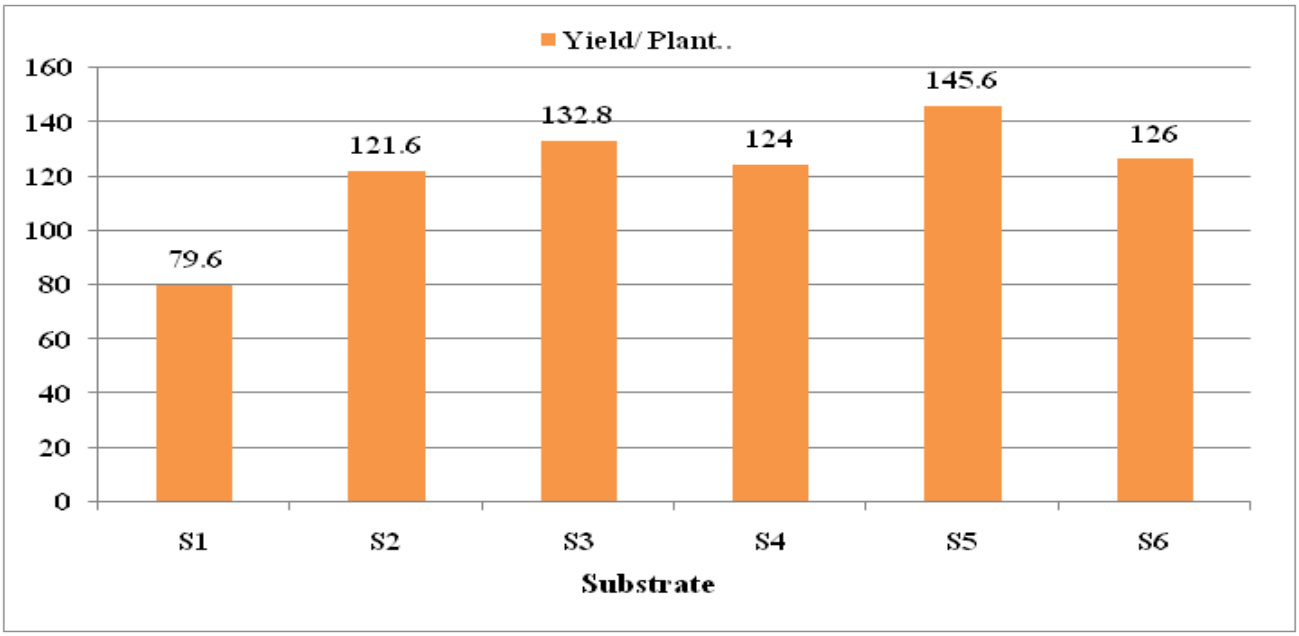
RESULTS and DISCUSSION

The results indicated a significant influence of the substrate on the growth and yield of lettuce (Table 1, Fig 1). The maximum number of leaves (20.06), plant height (23.80 cm), plant spread (30.60 cm), yield (145.60 g/plant) and root weight (11.60 g) were recorded in the plants grown in S_5 (Cocopeat + perlite + vermicompost, 2:1:1) whereas the maximum root length (31.00 cm) was observed in S_2 (Cocopeat + perlite, 2:1). The minimum number of leaves (16.20), plant height (19.00 cm), plant spread (24.30 cm), yield (79.60

Table 1. Effect of different soilless substrates on growth of lettuce

Substrate	Number of leaves	Plant height (cm)	Plant spread (cm)	Root length (cm)	Fresh root weight (g)
S_1	16.20	19.00	24.30	27.00	8.40
S_2	18.00	21.00	29.30	31.00	9.40
S_3	16.20	23.00	29.80	26.80	9.60
S_4	17.60	21.00	28.20	24.60	10.80
S_5	20.06	23.80	30.60	22.60	11.60
S_6	18.80	19.80	29.00	23.60	8.80
Mean	17.81	21.27	28.53	25.93	9.77
$CD_{0.05}$	1.71	1.39	2.69	3.06	1.61

S_1: Cocopeat, S_2: Cocopeat + perlite (2:1), S_3: Cocopeat + perlite (3:1), S_4: Cocopeat + vermiculite (3:1), S_5: Cocopeat + perlite + vermicompost (2:1:1), S_6: Cocopeat + perlite + vermiculite (3:1:1)



S_1: Cocopeat, S_2: Cocopeat + perlite (2:1), S_3: Cocopeat + perlite (3:1), S_4: Cocopeat + vermiculite (3:1), S_5: Cocopeat + perlite + vermicompost (2:1:1), S_6: Cocopeat + perlite + vermiculite (3:1:1)

Fig 1. Effect of different soilless substrates on yield (g)/plant of lettuce

g/ plant) and fresh root weight (8.40 g) were found in the plants transplanted in cocopeat alone (S_1).

The present study indicated that all the combinations of soilless substrates significantly increased the growth and yield of lettuce compared to cocopeat alone. The variation in the vegetative growth might be due to the properties of different materials used as growing substrates that exhibited direct and indirect effects on plant growth. The present results are in line with earlier findings of Verdonck et al (1981). Schie (1999) reported that the cocopeat is an organic material with medium ion absorption capacity. It also has aerial porosity and better capacity of water and nutrient maintenance (Por-Hossein et al 2009, Godara and Sharma 2016). Perlite is considered as a substrate with excellent features in soilless cultivation since it has high water absorption capacity and increases watering efficiency (Inden and Torres 2004).

Vermicompost consists of available forms of nutrition for plant uptake such as nitrates, exchangeable phosphorus, potassium, calcium and magnesium and increases the water retention capacity (Fernandes and Cora 2004), known as a medium that is one of the effective factors in plant growth and yield (Cantliffe et al 2007, Sharma and Godara 2019). The use of different organic and inorganic substrates in appropriate proportion optimizes water and oxygen holding and allows the plants to have better nutrient uptake for sufficient growth and development (Hesami et al 2012).

REFERENCES

Cantliffe DJ, Paranjpe AV, Stoffella PJ, Lamb EM and Powell CA 2007. Influence of soilless media, growing containers and plug transplants on vegetative growth and fruit yield of Sweet Charlie strawberry grown under protected culture. Proceedings of the Florida State Horticultural Society **120:** 142-150.

Fernandes C and Cora JE 2004. Bulk density and relationship air/water of horticultural substrate. Scientia Agricola **61(4):** 446-450.

Godara AK and Sharma VK 2016. Influence of substrate composition on roots and their categories of strawberry plants grown in different containers. Research Journal of Agricultural Sciences **7(2):** 330-335.

Hesami A, Khorami SS, Amini F and Kashkooli AB 2012. Date-peat as an alternative in hydroponic strawberry production. African Journal of Agricultural Research **7(23):** 3453-3458.

Inden H and Torres A 2004. Comparison of four substrates on the growth and quality of tomatoes. Acta Horticulturae **644:** 205-210.

Maboko MM 2007. Leafy lettuce grown in a hydroponics system. Undercover Farming **3(3):** 8.

Maboko MM and Du Plooy CP 2008. Evaluation of crisphead lettuce cultivars (*Lactuca sativa* L) for winter production in a soilless production system. African Journal of Plant Science **2(10):** 113-117.

Niederwieser JG and Denner F 2001. Guide to hydroponic vegetable production. Roodepoort Vegetable and Ornamental Plant Institute, Agricultural Research Council, Pretoria, South Africa.

Panse VG and Sukhatme PV 1967. Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi, India, 155p.

Por-Hossein L, Ebadi A and Mostufi Y 2009. Effect of nutrient solutions EC levels and type of media on strawberry growth and yield in hydroponic system. Abstracts, Sixth Iranian Congress of Horticultural Science, Guilan, Iran, pp 311.

Schie WV 1999. Standarization of substrates. Acta Horticulturae **481:** 71-78.

Sharma VK and Godara AK 2019. Growth responses of strawberry (*Fragaria* × *ananassa* Duch) plants grown at different planting density using PVC pipe under protected cultivation. Bangladesh Journal of Botany **48(1):** 1-7.

Sheoran OP, Tonk DS, Kaushik LS, Hasija RC and Pannu RS 1998. Statistical software package for agricultural research workers. In: Recent advances in information theory, statistics and computer applications (DS Hooda and RC Hasija, eds), Department of Mathematics Statistics, CCS Haryana Agricultural University, Hisar, Haryana, India, pp 139-143.

Verdonck O, De Vleeschauwer D and De Boodt M 1981. The influence of the substrates on plant growth. Acta Horticulturae **126:** 251-258.