

ORIGINAL ARTICLE

Assess the Impact of Different Planting substrates and Different levels of Humic acid on the growth and yield of Organic greenhouse Cucumber Cultivars

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ABSTRACT

This study was carried out in 2015 in the greenhouse under organic management in Iran's Plant Protection Research Institute and under supervision of Center of Excellence for Organic Agriculture. The purpose of the experiment was find a suitable medium for cultivating a cultivar of organic Greenhouse cucumber seed called Negeen that was tested for the first time in Iran. The Factorial experiment was conducted in a completely randomized design with 3 replications and pot cultivation. The first two factors consisted of 2 different media on the market called: 1) Gilda (Coco peat, perlite and Vermicompost) and 2) Shadgol (Coco peat, leaf soil and peat moss) that we have changed their names to growth media (1) and growth media (2) in this experiment. The second factor was selected contains 2 humic acid concentrations (0 and 30 g per plant). Cucumber traits were measured including plant height, stem diameter, fruit length, fruit diameter and fruit weight. The results showed that there were significant differences among the different media treatments on plant height and stem diameter at probability level of 1% and stem fruit at probability level of 5% and medium 1 has the highest average plant height (104.99 cm), stem diameter (94.83 mm) and fruit diameter (32.07 mm). The above results showed the effect of different media on the fruit diameter, so that it has caused an increase in fruit diameter. But in the later stages of growth, coinciding with the decline in growth rate, the difference did not become significant in growth traits and yield between different cultivars because of insufficient space for the growth of plant root system and as a result the larger pots must be used to apply this method.

Keywords: Greenhouse cucumber, humic acid, yield, organic, different cultivars.

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INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of widely-consumed cucurbits in Iran which is used as fruit. Iran is the second largest producer of cucumber in the world [2]. Today, the elimination or reduction of chemical fertilizers consumption is of requirements of agriculture sustainable development in Iran in order to produce the organic products. Therefore the use of organic fertilizers is rising in Iran [1] and vermicompost is one of the widely-used organic fertilizers in Iran [3]. The fertilizer has many nutrients such as nitrate, phosphate and potassium for plant growth and it can increase the yield of plant (plant height, stem diameter and fruit diameter) [4, 5]. The use of vermicompost on medium soil of sweet pepper makes increase of plant height, leaf length and length of plant shoots [6]. The use of vermicompost in greenhouse cucumber resulted in the increase of nutrients uptake, especially nitrogen, phosphorus, potassium and calcium and it caused an increase of several traits such as plant height, stem diameter and fruit diameter [7]. Studies of Zarabi and colleagues [2] on the effect of vermicompost in the production of organic greenhouse cucumber showed that the greening and plant growth effect especially on plant height and stem diameter in vermicompost treatments and compost is much better than the soil with NPK and vermicompost can be a good choice for the organic production. Also, good production conditions can be provided with application of humic acid and its effects on the growth and development of plants to

increase the yields in vegetable and cucurbits [8]. According to Taha and colleagues in [9], the use of humic acid in vegetables may cause the significant increase in vegetative growth traits and yield. Using the compost fertilizers like vermicompost (mixed with humic acid) is able to compensate for the lack of some elements in fertilizer and also it enhances the absorption power of elements in the soil by plant [5], so we can remove the problems related to the lack of nutrients in the soil for better plant growth largely by organic fertilizers like vermicompost and humic acid with precision according to the referred contents with planning and implementing the above mentioned tests and laying the groundwork for organic crops production.

MATERIALS AND METHODS

This study was carried out in 2015 in the greenhouse under organic management in Iran's Plant Protection Research Institute located in Tehran and under supervision of Center of Excellence for Organic Agriculture to investigate the basic of organic greenhouse cucumber production in Iran. The Factorial experiment was conducted in a completely randomized design with 3 replications and pot cultivation. The purpose of the experiment was to find a suitable medium for cultivating a cultivar of organic Greenhouse cucumber seed called Negeen which was imported by the company "Behta" and was tested for the first time in the climate of Iran. This cultivar is suitable for the fall and spring cultivation and has a strong root system. The first factor consisted of two different media in the market called: 1) Gilda (Coco peat, perlite, vermiculite, compost, peat moss, leaf soil, sand and clay) and 2) Shadgol (Coco peat, leaf soil, peat moss and sand) which we have changed their names to the growth media (1) and (2) in this experiment. The use of this medium is allowed in organic systems and used for the first time for Greenhouse organic cucumber cultivation. The second factor consisted of two levels (0 and 30 g per plant) of Iranian organic humic acid with brand "Geranular Pars Humic", as production of company "Golsang Kavir Yazd" and its traits were measured such as plant height, stem diameter, fruit length, fruit diameter and fruit weight. Twelve 30 and 25 cm diameter pots were used for this experiment and they were filled with a 6 kg constant rate of media and two levels of humic acid (0 and 30 g per plant) separately at the beginning of the cultivation and they were mixed with soil of each pot individually. The seeds were transplanted in especial trays with 70% coco peat and 30% perlite and they reached to four-leaf stage after two weeks and a seedling of the above cultivar was transferred into each pot. The growth of target factors was prevented effectively to control the pests and diseases by installing the yellow and blue sticky cards and spraying the allowed materials in organic farming. The first plant height and stem diameter measurement was carried out weekly and continued to the plant's two-month period from transfer of seedling to the main medium. Fruit length, fruit diameter and fruit weight were also measured and recorded weekly in 7-week harvest from the beginning of fruiting until its completion. Meter, caliper and a digital scale were used to measure the length, diameter and weight of fruit respectively. Statistical analysis and data variance analysis and measured traits mean comparison were performed the using the software SAS.

RESULTS AND DISCUSSION

Table 1- The analysis of test variance for comparing the growth and yield rate (Negeen F1)

		Mean Square			Degree of freedom	Sources of variation
fruit weight	fruit diameter	fruit length	stem diameter	Plant height		
72/79 ^{ns}	0/708 ^{ns}	1/37 ^{ns}	0/07 ^{ns}	69/67 ^{ns}	2	repetition
486/85 ^{ns}	22/91*	0/76 ^{ns}	3/87**	309/5**	1	medium
37/60 ^{ns}	7/002 ^{ns}	3/76 ^{ns}	0/099 ^{ns}	49/38 ^{ns}	1	Humic acid
156/43 ^{ns}	3/59 ^{ns}	1/63 ^{ns}	0/007 ^{ns}	2/48 ^{ns}	2	Medium*humic acid
238/56	2/81	2/36	0/018	16/04	6	Pilot error
17/43	5/46	10/41	1/34	4/009	---	Coefficient of variation (C.V)

.probability level respectively %5probability level and non-significant at %1and ns are Significant at * ,**

The results of variance analysis table showed that there is a significant difference between treatments of different media including number 1 and 2 ones on the traits such as plant height and stem diameter in greenhouse cucumber of cultivar "Negeen" at 1% probability level and fruit diameter at 5% probability

level. While there was no significant difference between treatments for different levels of humic acid as well as interaction of medium and humic acid on all traits (Table1).

Table 2-Comparing the mean and standard deviation of the main effects of medium and humic acid on the Negeen F1 morphological traits

-----plant height-----stem diameter-----				
	Mean	Std.Dev	Mean	Std.Dev
medium				
A1	104.99a	5.90	10.64a	0.12
A2	94.83b	3.38	9.51b	0.19
Humic acid				
B1=0	97.88a	6.89	10.17a	0.56
B2=30	101.94a	6.48	9.98a	0.5

	Fruit length		Fruit diameter		Fruit weight	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
Medium						
A1	15.00a	1.1	29.31b	0.78	82.22a	7.22
A2	14.50a	1.5	32.07b	2.04	94.96a	15.58
Humic acid						
B1=0	14.19a	0.83	31.45a	2.13	86.82a	17.00
B2=30	15.31a	1.58	29.93a	1.70	90.36a	8.99

There is no significant difference between means with common letters per column according to Duncan's multiple range tests at 5% level.

Plant height

According to the mean comparison table (Table 2), there is a significant difference between different media, including media No. 1 and 2 on the height of cucumber plant so that the medium No. 1 with a mean 104.99 cm has the highest plant height compared to the medium 2 with a mean 94.83 cm and based on the Duncan's test grouping, the media No. 1 and 2 are located in groups "a" and "b" the medium respectively. According to the experiments, it was found that the yield of medium (1) has the greatest effect on the plant height with the right ingredients such as vermi-compost, leaf soil and peat moss. In the above medium, the greenhouse cucumber root of Negeen could be expanded easily and it readily absorbed the required nutrients such as nitrogen from all parts of the soil due to being lightweight and having the nutrients needed by plants. This appropriate rooting ultimately causes an increase of plant height in the tested medium and the results of the research correspond with those of Ghoojani [7] and Narkhed *et al* [7].

Stem diameter

According to the mean comparison table (Table 2), there is a significant difference between different media on the cucumber stem diameter. The comparison showed that the medium No. 1 with a mean 10.64 mm has the most stem diameter compared to the medium No. 2 with a mean 9.5mm and it is located on the Duncan's test grouping "a". According to the experiment, it was found that the yield of medium (1) with the right ingredients such as vermicompost and leaf soil has the greatest effect on the plant stem diameter. In the above medium, the greenhouse cucumber root of Negeen could be expanded easily and it readily absorbed the required nutrients from all parts of the soil due to being lightweight and having the nutrients needed by plants. This appropriate rooting ultimately causes an increase of plant stem diameter in the tested medium and the results of the research correspond with those of Mirzahoseini [5] and Zarabi *et al* [2].

Fruit diameter

The mean comparison table of fruit diameter mean shows the growth in different media over the time on the cucumber stem diameter. According to the mean comparison table, there is a significant difference between different media on the cucumber fruit diameter. So that the medium No. 1 with a mean 32.07 mm has the most fruit diameter compared to the medium No 2 with a mean 29.31 mm and both (media No. 1 and 2) are located on the Duncan's test grouping "a" and "b" respectively. It was found that the yield of medium (1) with the right ingredients such as vermicompost, peat moss and leaf soil has the greatest

effect on the fruit diameter according to the experiment. In the above medium, the greenhouse cucumber root of Negeen could be expanded easily and it readily absorbed the required nutrients from all parts of the soil due to being lightweight and having the nutrients needed by plants. This appropriate rooting ultimately causes an increase of fruit diameter in the tested medium. The increase of fruit diameter can effect on the yield and economic benefit of greenhouse positively and the results of the research correspond with those of Ghoojani [7] and Almasian [4].

The cause of non-significance of humic acid treatment as well as its interaction with the medium can be seen in the further effect of medium as the first factor in the mentioned traits. The difference between development growth and yield rate in the cultivar "Negeen" can be related to a difference in plant cultivation on different media. The rate of development growth and yield were affected following the growth and due to root growth space limitation and nutrient absorption. Having a strong main root that penetrates the soil to a depth of one meter is of greenhouse cucumber plant's traits. A number of secondary roots have moved to the lower depths of the soil and form a new root system in the deeper soil during the plant growth and this new system is replaced with the previous root system [10,11]. Since the yield rate of the final period was far less than the initial period, it can be concluded that the initial root system loses its yield over time and because there was no space to create a new root system, its growth was reduced over time. Therefore the greenhouse cucumber root system needs more space and in future research, the amount of space and good soil conditions must be assessed in terms of texture and nutrition. Also, according to Solgi and colleagues [12], the cause of non-significance of some certain traits such as fruit weight and fruit length can be attributed to a insufficient space for the growth of plant root system and as a result the larger pots should be used to apply this method. But since there is a significant difference in some traits between different media, therefore it is recommended that other media should be used in following experiments to compare the growth of seeds.

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