Comparison between the Growth Rate of Plants in Hydroponic and Soil Growing Systems

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Abstract

Nowadays, due to rapid urbanization and industrialization , soil agriculture is facing several challenges ; such as decrease in land availability , lack and wastage of water, poor soil fertility , drought conditions and rise in temperature which are threatening food production. Under such circumstances, in near future it will become impossible to feed the entire population using soil system only. That's why hydroponic (soil-less) culture is becoming more relevant to cope with these hard circumstances and is increasing worldwide . In this research we made a study of the effect of hydroponic system on the growth rate of three kinds of plants which were lettuce , narcissus and monk's cress and compared it with the growth rate of the same kinds of plants in soil .We measured the growth parameters such as number of leaves and flowers. Our main result was that in hydroponic system plants grow more and faster because nutrients are delivered directly to the plants' roots via a continuous flow of nutrient solution . So In order to produce crops more intensely and faster , to save water and to solve agricultural lands unavailability ,we recommend that farmers should grow plants in hydroponic growing system instead of soil.

Keywords: Hydroponic , soil-less , growth rate .

Research question

What is the effect of Hydroponic and soil systems on the growth rate of lettuce ,Narcissus and Monk's cress (Tropaeolum majus).

Introduction

Plants can survive without being planted in soil. The science of growing plants in nutrient-rich water is hydroponics. In hydroponics, the nutrients are available at the plant's roots. So, without any work, the plant gets its food and nutrition and spends its energy growing bigger leaves, fruits, and flowers in a shorter amount of time .Since soil agriculture is facing so many hard circumstances, hydroponics is an appropriate solution for increasing food production, conserving water, allowing for year-round production, and minimizing use of pesticides. We chose lettuce , narcissus and monk's cress plants to study and compare between their growth rate in hydroponic and soil growing systems to find out that hydroponics is more efficient in increasing food production than soil .

Methodology

1) The Hydroponic system was prepared and provided with water and nutrients necessary for plant growth.
2) Lettuce, Narcissus and Monk's Cress (Tropaeloum Majus) ,five plants of each kind, were planted in both soil and hydroponic growing systems. Both hydroponic and soil systems were in the same area of study (air temperature and atmospheric pressure were measured using the Labdisc.)
3) The plants in the fertilized soil were irrigated three times a week regularly.
4) The pH of the nutritious solution in the Hydroponic system was daily measured by using pH meter and regulated by using pH-down solution ,as the pH should range from (5.5-6.5). Also the pH of soil was measured using 3-in-1Moisture Meter with light and pH Test Function.
5) The following growth parameters were measured weekly by students : plant length, stem length ,number of leaves and number of flowers.

Results

Table1.Measurements of the growth parameters of lettuce in soil and hydroponic

week	Soil		Hydroponics	
	Number of leaves	Stem length (cm)	Number of leaves	stem length(cm)
1	5	6.5	5	6.5
2	6	6.8	7	7.3
3	7	7.8	8	8.1
4	7	8.4	9	8.9
5	11	11.4	11	12.9
6	12	12	13	13.5
7	13	13.6	16	17.6

Figure1. Comparison between growth rate of lettuce in hydroponic and soil systems.

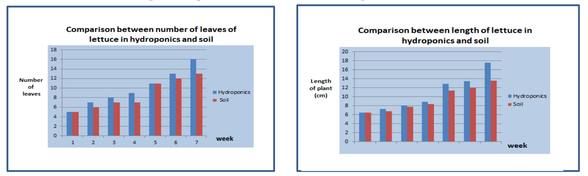

Table2. Measurements of the growth parameters of Tropaeolum majus in soil and hydroponic

week	Soil		Hydroponics	
	Number of leaves	Stem length (cm)	Number of leaves	stem length(cm)
1	5	1.5	7	2.7
2	7	2.8	11	4
3	9	3.2	16	4.8
4	14	3.7	18	5.7
5	22	4.3	29	7.7
6	24	4.7	34	10.3
7	29	5	47	12.7

Figure 2. Comparison between growth rate of Tropaeolum majus in hydroponic and soil systems.

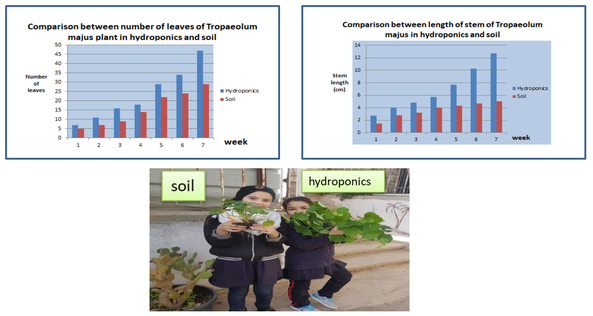

Table3. Measurements of the growth parameters of Narcissus in soil and hydroponic

week	Soil			Hydroponics		
	Number of leaves	Stem length (cm)	Number of flowers	Number of leaves	stem length(cm)	Number of flowers
1	5	1.5	0	7	2.7	0
2	7	2.8	0	11	4	0
3	9	3.2	0	16	4.8	0
4	14	3.9	0	18	5.7	0
5	22	4.3	0	29	7.7	5
6	24	4.7	0	34	10.3	7
7	29	5	7	47	12.7	11

Figure 3. Comparison between growth rate of Narcissus in hydroponic and soil system.

Discussion

From our results , it was noticed that the three species of plants grew more and faster in hydroponic system than in soil .
The main reason is because nutrients are delivered directly to the plants' roots via a continuous flow of nutrient solution. Because these nutrients are received directly by the roots, the plants aren't forced to expend energy in search of nutrients as they would in soil, where plant food becomes diluted. As a result, the plants spend their energy growing bigger leaves, fruits, and flowers in a shorter amount of time. This also explains why the roots of narcissus grown in soil were longer than those grown in hydroponic system.
Another reason is in a hydroponic system, more plants can grow at once. This is because their root systems aren't fighting for the space required to find enough nutrients as they would in soil. An even distribution of nutrient solution eliminates the need to compete.
The pH in hydroponic system is more controlled than in soil and this affects the growth of plants because there is an ideal range at which plants can absorb the necessary nutrients. If the pH of the media is too acidic or too alkaline, the plant will be unable to absorb certain elements, which may result in a nutrient deficiency.

Conclusion

Since the length of plant, the length of stem, the number of leaves and the number of flowers are more in hydroponic system than in soil system, we conclude that plants grow in hydroponics more and faster than in soil .

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Recommendation

In order to produce crops more intensely and faster , to save water and to solve agricultural lands unavailability ,we recommend that farmers should grow plants in Hydroponic growing system instead of soil.

References

https://www.researchgate.net/publication/276320585_A_REVIEW_ON_PLANT_WITHOUT_SOIL_-_HYDROPONICS [accessed Apr 18 2018].
https://www.epicgardening.com/hydroponics-vs-soil/
http://www.fullbloomhydroponics.net/hydroponic-systems-101/

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