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The Effects of Increasing Mycorrhiza Applications on Some Biological Properties of Baby Carrot (*Daucus carota* L.) Plant

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Abstract: The study was done to determine the effect of increasing mycorrhiza application on some biological properties of baby carrot plant. According to the pot experiment results, important increases in some biological properties of baby carrot plant were determined with increasing mycorrhiza applications. The tuber diameter were determined as 9.79 cm, 11.09 cm, 12.58 cm, 13.60 cm, 13.80 cm and 14.25 cm; height of leaf 12.98 cm, 15.11 cm, 15.00 cm, 16.07 cm, 17.79 cm and 16.81 cm; number of leaf 7.11 cm, 7.44 cm, 6.99 cm, 7.89 cm, 7.66 cm and 8.11 cm at I. dose: 0 ml /pot, II. dose: 120 ml / pot, III. dose: 150 ml / pot, IV. dose: 180 ml /pot, V. dose: 210 ml /pot and VI. dose: 240 ml/ pot, respectively. These root diameter and height of leaf increases were determined significant at the level of 5 %, statistically. The effect of mycorrhiza application on number of leaf was not found statistically significant.

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1. Introduction

Carrot (*Daucus carota* L.) is considered a basic vegetable in many countries. Various cultivars are grown in the world's mild areas [1]. It is known that growth conditions and management practices affect the concentrations of these compounds in the storage roots of carrots which are important for both human nutrition and taste [2-4]. Carrot (*Daucus carota* L.) is a good source of natural antioxidants, especially carotenoids and phenolic compounds [5]. The demand for organic vegetables is increasing day by day in domestic and international market. Carrot (*Daucus carota* L.) is highly nutritious and preferred as salad vegetable in common household.

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Mycorrhiza use has increased rapidly to accelerate plant growth and improve soil [6, 7]. Researches has shown that mycorrhiza accelerates plant growth, increases the plant's fight against stress, increases the plant's need for sugar -which is important for this carrot plant- and increases the plant's photosynthesis rate [6-10].

For organic carrot is nourishing very fast, farmers are gradually adopting organic carrot cultivation using vermicompost as organic source of nutrients [11]. This is the case in mycorrhiza. According to the some earlier research results, some biological properties of different plants increased with mycorrhiza applications [12, 13]. Root and shoot height of plants, yield and uptake of nutrient elements from the soil increased with increasing mycorrhiza application to the soils [14].

One other earlier research was done determine the influence of mycorrhiza inoculation on plant growth, yield and fruit quality of tomato plants grown in greenhouse conditions and to detect the influence of different doses of Symbion VAM (mainly *Glomus fasciculatum*) as mycorrhiza source. According to results root infection rate increased with Symbion VAM inoculation and in parallel with this increase plant growth and total and marketable yield increased. Besides, fruit diameter, red color (a), vitamin C and pH of fruit juice increased [15].

This research was done to determine the effect of increasing mycorrhiza application on some biological properties of baby carrot (*Daucus carota* L.) plant.

2. Material and Methods

This pot experiment was carried out greenhouse conditions in December 2016 to March 2017, Tekirdag (40°98'N, 27°48'E) Turkey. Pot experiment was done Namik Kemal University, Agricultural Faculty, Department of Soil Science and Plant Nutrition.

Soil samples filled in pots 4 kg soil /pot. Research was designed as three replications according to randomized block experimental design. The variety of baby carrot (Zengarden Firm) was used for the research (Figure 1). Baby carrots seeds were sown in pots.

After germination, three plants were left in each pot. Some chemical and physical properties of soil sample as, pH: 6.5, EC $\times 10^6$: 700, organic matter: 3.9 %, lime: 5.2 %, exchangeable potassium (K_2O : 128 kg da⁻¹), available phosphorus (P_2O_5 : 9.25 kg da⁻¹) and texture: Clay (C).

Six mycorrhiza doses (I. dose: 0 ml /pot, II. dose: 120 ml / pot, III. dose: 150 ml / pot, IV. dose: 180 ml /pot, V. dose: 210 ml /pot and VI. dose: 240 ml/ pot) were applied 6 days after sowing to the sample of the plants. Plants were harvested 60 days after sowing.

Some biological properties of baby carrot plants (*Daucus carota* L.) -root diameter, height of leaf, number of leaf- were determined. Then experiment analysis results were evaluated SPSS 21 statistically program. ANOVA variance analysis was done and Duncan multiple comparison tests were done on this research results. The climatic conditions necessary for growing of the plants have been provided in the laboratory (Table 1). In addition no pesticides were used during the growing period.



Figure 1. Area of research and post harvest baby carrot plants (original).

Table 1. Average some climate data in laboratory during the experiment period.

Month	Average temperature (°C)	Average humidity (%)
December	7.4	90
January	7.3	92
February	7.6	91
March	9.6	89

3. Results and Discussion

The effect of mycorrhiza applications on some biological properties of baby carrot (*Daucus carota* L.) plant is given in Table 2. According to the Table 2, number of leaf of baby carrot was obtained 7.11 and 8.11 for I. dose and VI. dose, respectively. Height of leaf of baby carrot was obtained 12.98 and 16.81 for I. dose and VI. dose, respectively. Root diameter of leaf of baby carrot was obtained 9.79 and 14.25 for I. dose and VI. dose, respectively.

Consequently, height of leaf and root diameter of baby carrot (*Daucus carota* L.) increased with increasing mycorrhiza application to the pots. These increases were found statistically significant at the level of 5 %, except number of leaf. Similar results were obtained earlier researchers [15].

Another research was done the effects of increasing vermicompost and mycorrhiza application on pepper plant growth and mineral nutrition. Three mycorrhiza doses (0, 1 and 2 g pot⁻¹) and four vermicompost doses (0, 2.5, 5 and 10 g pot⁻¹) was applied to the plants. According to results, vermicompost and mycorrhiza applications positive affected on fresh weight, dry weight and some nutrient element contents of pepper plant [16]. This result is similar our research results.

Eissenstat et al., [17] would have reported mycorrhiza colonization can enhance root of plants. Many variables involved in building roots might affect root longevity, including root diameter. Mycorrhizal associations have evolved to improve the fitness of both plant and fungal symbionts [18]. The beneficial effects of mycorrhizal fungi on plant performance are essential for sustainable management of agricultural [19].

Table 2. The effect of increasing mycorrhiza application on some biological properties of baby carrot plant, *, **, ***

Mycorrhiza doses	Number of leaf	Height of leaf	Root diameter
I. dose	7.11±5.0 ns	12.98±2.3b	9.79±5.4b
II. dose	7.44±6.9 ns	15.11±23.6ab	11.09±29.1ab
III. dose	6.99±5.7 ns	15.00±16.3ab	12.58±11.1ab
IV. dose	7.89±6.9 ns	16.07±5.0a	13.60±18.8a
V. dose	7.66±3.3 ns	17.79±15.8a	13.80±19.1a
VI. dose	8.11±6.9 ns	16.81±20.1a	14.25±18.1a

*: values are average of three replications,

***: each parameter evaluated individually,

***: p<0.05, ns: none significant

4. Conclusion

According to this pot experiment results, increasing doses of mycorrhiza application was increased some biological properties on baby carrot (*Daucus carota* L.) plant. This result is important quality of baby carrot plant. Also, according to the earlier researchers, mycorrhiza applications were positive effects of some soil physical, chemical and biological properties. On the other hand, mycorrhiza and another different organic fertilizers and organic materials should be applied to the agricultural soils for quality plant production and sustainable soil fertility.

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