Effect of Vermicompost on the Growth and Yield of Lettuce Plant (*Lactuca sativa* L. var. *crispa*)

ABSTRACT:
This research was done to find out the effect of increasing vermicompost application on yield of lettuce (*Lactuca sativa* L. var. *crispa*) plant. For this purpose *Lactuca sativa* L. var. *crispa cv. Bellafiesta* lettuce kind and Riverm Company vermicompost were used in this research. Four vermicompost doses (0 kg/ha, 4000 kg/ha, 8000 kg/ha and 12000 kg/ha) were applied to lettuce plant. According to the results, important increases of fresh weight, plant size, number of leaf, length and width of leaf for each plant and dry matter yield of plants were determined with increasing vermicompost applications. But the effects of Vermicopmost applications on some macro element (N, P, K, Ca and Mg) contents of plant were not found significant statistically.

Key words: Biological property lettuce macro nutrient element vermicompost,

1. INTRODUCTION

Today an increase in the products gained from per unit area has become a necessity to satisfy mankind's need for food. On the other hand, the necessity of increase in the products brings another necessity to use more inorganic fertilizers per unit area. As a result of the excessive application of inorganic fertilizers, natural sources such as soil and water are being polluted and serious health problems are occurring.

Mostly in vegetable farming, in order to reach a high degree of productivity and maximum growth, the amount of inorganic fertilizer as the main source of nutrient is emphasized, however, usually exceeded [1,2]. It has been a well-known fact that green plants respond positively to inorganic fertilizer with nitrogen content. However, nitrogen application has a limited positive effect on the crop yield. Increasing nitrogen fertilization can affect plant's agronomy, macro and micro nutrient element contents, and the quality of the product negatively. Nitrogen has an important role in the plant's vegetative development and crop yield. However, the excessive use of nitrogen fertilizer in order to increase productivity might cause the risk of nitrate accumulation [3,4].

While excessive inorganic nitrogen fertilizer causes soil pollution [5-7], it also causes the accumulation of harmful compounds for human health in vegetables [8]. Nevertheless, according to FAO/WHO [9] nitrate generates toxic effect if it exceeds 5 mg for each kg of human body. For this reason, in vegetable farming the management of nitrogen fertilization should carefully be programmed.

The scientists who are seeking a solution for this problem put forward that vermicompost applications should be increased in following years. Because while vermicompost and manure materials nutrient sources, they can reform the degenerations in soil and water caused by inorganic fertilizers. In recent years, the use of vermicompost is increasing especially in vegetable farming.

The aim of this research, the effects of increasing doses vermicompost application on some nutrient element content and some agronomic properties of lettuce (*Lactuca sativa* L. var. *crispa*) plant was investigated.

2. MATERIALS AND METHODS

In the research, *Lactuca sativa* L. var. *crispa cv. Bellafiesta* was used, which is a type of lettuce plant. Two seeds for each pot were planted and peat was used as the production ground (Klasmann-Deilmann, potground H, Germany). When they gained 3-4 leaves 30 days after the sowing and they were transplanted to their permanent pots. Randomized blocks were designed as 3 replications on the experimental design, and there were 108 plants in total, 9 in each parcel. Total experimental area was 75 m^2. The vermicompost was applied to the plants (0 g/m^2, 400 g/m^2, 800 g/m^2, 1200 g/m^2) right after the sowing. Chemical properties of vermicompost contains pH (7.60), organic matter (51.80 %), total humic + fulvic acid (46.10 %), organic carbon (27.80 %), total N (1.50 %), soluble P_2O_5 (0.20 %), K_2O (1.10 %), CaO (0.26 %), MgO (0.13 %).

Thirty days after the plantation the plants were harvested and plant height (cm), plant diameter (cm), leaf size (cm), leaf width (cm), root height (cm), plant weight (gr), and number of leaves were measured. Dry material content of the plants was obtained by washing them with pure water and drying them in 65^0C for 48 hours. After the dry weight was determined necessary elemental analyses were conducted on grained samples by using ICP-OES device [10]. The collected data were analyzed by using MSTAT program.

3. RESULTS AND DISCUSSION

3.1. The Effects of Vermicompost Application on Some Biological Properties of Lettuce Plant

The effects of increasing doses of vermicompost application on the height, diameter, number of leaves, leaf size, leaf width and the weight of lettuce plant were presented on Table 1. The effects on the biological properties of the lettuce plant vary depending on the amount of doses (Table 2).

Table 1. Effect of vermicompost on some biological properties of lettuce plant,

Dose	Plant height (cm)	Diameter (cm)	Root length (cm)	Num. of leaves	Length of leaf (cm)			Leaf width (cm)			Plant fresh weight (gm)
					Int.	Med	Ext.	Int.	Med	Ext.	
0	24.2ns	32.2b	18.7ns	20.6b	11.2ns	16.2b	16.9b	8.1ns	13.7b	15.0ns	126.4b
4000	26.6ns	34.8a	17.5ns	22.0a	11.0ns	16.7a	16.5b	8.1ns	14.7a	15.0ns	138.6a
8000	25.2ns	34.3a	19.3ns	21.8a	11.2ns	17.0a	17.4ab	8.9ns	15.4a	15.2ns	142.8a
12000	24.2ns	34.6a	18.0ns	22.2a	11.2ns	16.7a	17.0b	8.4ns	15.2a	15.4ns	122.7b

*: values average of three replications, **: each parameter was evaluated individually, ***: significant at the level of 5 %.

Significant rise in the plant width, the number of leaves, leaf size, leaf width, and the plant fresh weight was observed upon the increasing doses of vermicompost application. On the other hand, upon the vermicompost application decrease in the

height and root size of the lettuce plant was determined comparing to the control group. These results are concordant to the research indications by Yourtchi et al. [11].

In Bangladesh the effects of various doses of vermicompost on cauliflower farming have been investigated. 0, 1.5, 3 and 6 tones/ha doses of vermicompost were applied to the plants, and certain biological features were measured such as maximum plant height, the number of leaves, fruit width, fruit height, total weight, commercial weight, and crop yield of stem. According to the results, the maximum yield was obtained from the field on which 6 tones/ha of vermicompost was applied [12].

3.2. The Effects of Vermicompost Application on Some Macro Nutrient Element (N, P, K, Ca, Mg) Contents of The Lettuce Plant

The effects of vermicompost application on the some macro nutrient element contents of the lettuce plant were presented in average of three replications in Table 2.

Table 2. Effect of vermicompost application on some macro nutrient element (N, P, K, Ca, Mg) contents of lettuce plant, %.

Doses	N	P	K	Ca	Mg
0	5.43	0.92	10.95	1.42	0.21
4000	5.30	0.81	9.24	1.25	0.18
8000	5.09	0.71	9.86	1.24	0.18
12000	5.11	0.67	9.61	1.42	0.20

As it can be seen on Table 2, not significant mutation was discovered in N, P, K, Ca and Mg contents of the plant upon the increasing doses of vermicompost application. These effects were not considered as significant. The short probation period which is 30 days and plants' inability to obtain enough nutrient elements from soil could be demonstrated as the reason.

A study by Bai and Malakout [13] reveals that a significant increase in nitrogen, phosphorus, and potassium contents of the some vegetables were determined with the application of increasing doses of vermicompost.

4. CONCLUSION

This study exposes that the increasing doses of vermicompost application multiply the crop yield, fresh weight and diameter, number of leaves, size and width of leaves of the lettuce plant. However, the plant's nitrogen, phosphorus, potassium, calcium, and magnesium contents do not receive an important fluctuation. This study proves that vermicompost can be used in agricultural production by exhibiting the example of lettuce farming.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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