

Effects of Increasing Doses of Vermicompost Applications on P and K Contents of Pepper (*Capsicum annuum* L.) and Eggplant (*Solanum melongena* L.)

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Abstract—In this study, which was carried on in controlled circumstances, the effects of the increasing doses of vermicompost implementation [0 (VC1), 3 (VC2), 5 (VC3), 7(VC4), %] on the P and K contents of pepper (*Capsicum annuum* L.) and eggplant (*Solanum melongena* L.) have been investigated. When P and K analysis results of pepper and eggplants analyzed were observed, it has been realized that there is a linear increase in both element values with vermicompost applied at increasing rates. While the phosphorus and potassium contents of pepper plant were 0.0162% and 3.0454%, respectively, when the lowest dose (VC1) was considered, 0.0393% and 6.2519% respectively for the highest dose (VC4) application. While the phosphorus and potassium contents of the eggplant plant were 0.0121% and 2.1462%, respectively, when the lowest dose (VC1) was considered, 0.0277% and 3.2843% respectively with the highest dose (VC4) application. As a result of the study, organic worm fertilization practices, which are increasingly called vermicompost, have been shown to increase P and K contents in both pepper and eggplant plants. According to this result, it is possible to say that vermicompost can easily be used easily in P and K fertilization in the cultivation of such vegetables.

Index Terms—vermicompost, pepper, eggplant, phosphorus, potassium

I. INTRODUCTION

The increasing demand of eggplants and also peppers have gone along with the rapid growth of population. This is due to the increasing awareness toward the benefit of different vegetables in fulfilling the nutrient requirements of the family [1].

The changes in the agricultural production system in the world and in Turkey have led producers to investigate new agricultural input sources. The input costs of chemical fertilizers, which have a significant share in the agricultural inputs in the current system, are increasing steadily. One of the leading causes of this increase is imbalances in oil prices. This fact leads both fertilizer producers and farmers into new quests. This so-called

fact has a significant share in the growing interest in organic worm fertilizers, called “vermicompost”. Vermicompost can be use especially in vegetable and fruit cultivation. In Turkey, both production and use of this fertilizer are increasing day by day.

Vermicompost is also known as an environment friendly organic fertilizer. The experts in the field generally recommend the use of vermicompost fertilizers as sources for soil improvement and at the same time for the production of healthy crops [2]. Vermicompost is an organic fertilizer known to promote soil fertility, crop yield and quality while also suppressing some plant diseases [3]-[6]. The vermicompost can be utilized as plant growth media and soil conditioner and also promote soil microbial biodiversity by inoculating the soil with a wide array of beneficial microbes [7]-[9].

One of the most severe results of intensive and conventional agricultural system in Turkey is “decrease in the level of organic matter of soil”. With this decrease, the farming lands heading to degraded and their capacity of productivity has been declining. The most rational method for restoring the soil and transferring it to future generations in a sustainable way is to be included in vermicompost fertilization programs [10].

When the studies conducted are examined, many positive results such as the improvement of N, P, K and even Zn element contents, high porosity, aeration and the water-holding capacity of the soil can be observed through vermicomposting [11], [12].

In Antalya province, in which pepper, tomato and eggplant farming is common, farm manure is generally used as organic fertilizer. The use of vermicompost is a new practice for both Antalya and many other regions.

In a research conducted in Iran by cultivating eggplants in different dosages, the interaction effect of vermicompost and chemical nitrogen fertilizer has been found statistically significant on plant height at 1% level and the increase in eggplant fruit yield at 5% level, however effect on fruit length was found to be non significant [13]. Another study clearly showed that the biochemical properties of vermicompost play a major role in the growth and development of eggplant [14].

According to the results of a research held by Adiloğlu *et al.* [15], with the increasing doses of vermicompost implementation to cucumber plant, significant improvements were observed in the yield, wet weight, plant diameter and number of leaves of the plant, leaf length and width. Also, significant changes were identified in some macro nutrient elements of the plant such as, nitrogen, phosphorus, potassium, calcium and magnesium.

The main objective of the reported research was to examine the effect of vermicompost use on pepper and eggplant, with emphasis on the ability of vermicompost to affect P and K on these vegetables.

II. MATERIALS AND METHODS

The experiment was conducted under controlled laboratory conditions in the form of viol experiment, according to randomized parcel trial design with 3 replicates. Test plants were harvested on the 40th day after planting, dried in drying oven at 65°C until the weight is fixed, grinded and necessary analyses are were conducted.

The texture classes of the soil samples were determined via Bouyoucos hydrometer method [16]; pH (1:2.5 soil: pure water) glass electrode pH-meter [17]. Total nitrogen was determined for the soil samples via vapor steam distillation (Kjeldahl) method, useful phosphorus was determined via Olsen method, organic content was determined via Walkley-Black method [18], exchangeable cation was determined via flame photometer (K+), salinity was determined via electrical conductivity device (1:2.5 soil:water) and lime analyses were carried out via Scheibler calcimeter (CaCO₃) [17].

The soil and vermicompost analysis results used in this experiment are presented in Table I and Table II below. The soils used in the experiment were taken from a depth of 0-30 cm from the campus field of Namik Kemal University. The vermicompost, which is used as the fertilizer material and the analysis results are provided from a special producer company.

TABLE I. SOME PHYSICAL AND CHEMICAL PROPERTIES OF EXPERIMENTAL SOIL

| Depth (cm) | pH | EC (dS/m) | CaCO ₃ (%) | Organic Matter (%) |
|------------|---------------|-----------|-------------------------|-------------------------|
| 0-30 | 7.25 | 0.08 | 1.15 | 0.86 |
| | Texture Class | N (%) | P (mgkg ⁻¹) | K (mgkg ⁻¹) |
| | Clay | 0.04 | 5.72 | 69.16 |

The soil used in the research is a clay texturized soil with neutral pH character, does not contain salt and lime, low organic substance, N, P and K contents [19]-[22]. The vermicompost (Table II) used in the research is a high-quality organic fertilizer which is sold on the market in terms of neutral character, organic matter and N, P, K content obtained from cow manure.

TABLE II. SOME CHEMICAL PROPERTIES OF EXPERIMENTAL VERMICOMPOST

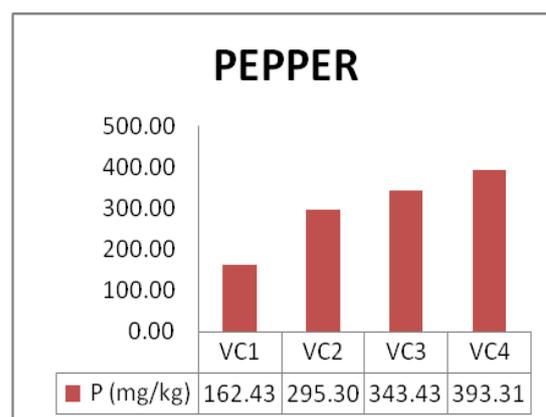
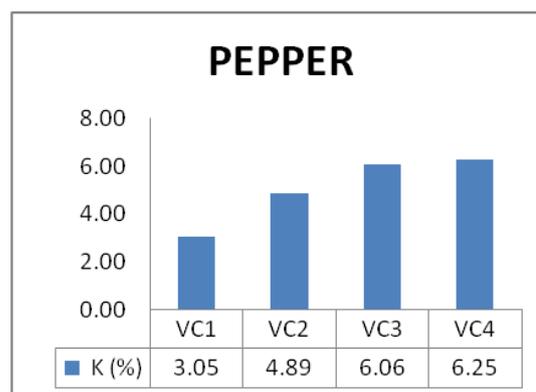
| Sample | pH | Org. Mat. | N | P | K | Ca | Mg |
|---------------|------|-----------|------|------|------|------|------|
| | | % | | | | | |
| Vermi-compost | 7.28 | 44.10 | 1.97 | 1.01 | 1.69 | 0.71 | 0.02 |

The vegetable seeds used in the experiment were obtained from a special company. The seeds used are sold on the market under the name of “hybrid pepper seeds (Kılçık F1)” and “hybrid eggplant seeds (A-6076 F1)” variety names.

Eggplant and also pepper plants have been observed in regard to physical appearance during the growth period. After the plants were harvested, they were washed with distilled water, dried and, the useful phosphorus in the extract obtained with wet decomposition method was determined by using spectrophotometric yellow method. The other useful K content was determined in ICP-OES device [23]. According to the analysis results of pepper and eggplant’s P and K contents, a linear increase was observed in the element levels as the doses increase, and thus, the results have been evaluated without a statistical analysis considering the previous studies.

III. RESULTS AND DISCUSSION

The analysis results of pepper and eggplant plants used in the research are given in Fig. 1, below.



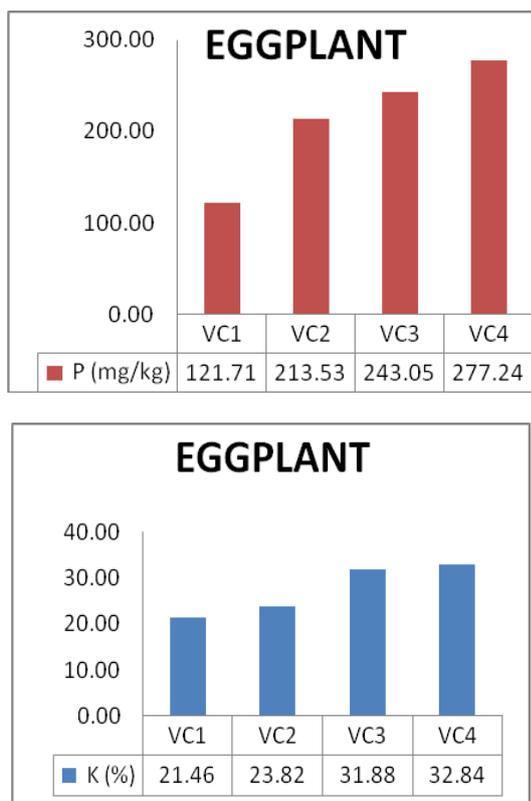


Figure 1. Effect on phosphorus and potassium contents of vermicompost applied to pepper and eggplant plants at different doses in the same plants.

As the analysis results of pepper and eggplant's phosphorus content are examined, it can be observed that both of them contain low P level [23], [24]. The vegetable (mostly eggplant) is known for being low in calories and having a mineral composition beneficial for people health. It is a rich source for Potassium, Magnesium, Calcium and Iron as well [25]. Another research clearly reveals that the biochemical properties of vermicompost play a major role in the growth and development of eggplant [14].

The vermicompost effect, which is applied to both eggplant and pepper plants as well at different doses, is clearly shown in Fig. 1 below. Accordingly, as the dose increase, P and K contents improve for both plants. Both plant's vegetative mass improvement and generative organs could be clearly seen when they were in viols before harvest, which means that as the doses increase, the plant grow high and produce more leaves. Some studies support the results of the pepper and eggplant experiment [26]-[28].

With the use of vermicompost does not only increase the P and K contents of the plants (pepper and eggplant) but also the total N contents increase significantly and a noticeable increase in the organic substance levels of the soil is observed. Vermicompost application also positively supports the increase of usable microorganisms in the soil.

However, these kind researches into the effects of vermicompost applications on field crop and vegetable production (eggplant, pepper, tomato, strawberry, etc.) have been very few in Turkey. Our main purpose was to

investigate the effects of increasing rates of vermicompost applications on the growth and many macro-micro element contents of peppers, eggplants in the open field with our next scientific researches. The single use of vermicompost is not enough for vegetable farming especially on the lands whose organic matter is low. Thus, many studies have been hold by including two kinds of fertilizer [29]. In future studies on pepper and eggplant plants vermicompost will be investigated in a way to meet all the needs of the plant by applying chemical fertilizers in different doses in addition to the fertilizer.

The promote plant growth and increases in yields could not be explained by the availability of N, P, K, because vermicompost treatments should be supplemented with inorganic fertilizers, to equalize macronutrient availability at growing time [30].

IV. CONCLUSION

According to the experiment result positive findings about P and K elements were obtained for both pepper and eggplant. Results from these studies may better inform a proper level and preparation technique for vermicompost use as a way to increase P and K levels in agriculture soils. Plant nutrient pollution and soil degradation from conventional agricultural systems continue to be a big global environmental quality issue and also human health. The use of vermicompost as both a support for chemical fertilizer and to improve soil properties has been shown to be effective in Turkey agricultural system. The results of this experiment showed that the increase in growth of pepper and eggplant with vermicompost could associate with greater uptake element nutrients such as: P and K.

According to experiment results positive effect of vermicompost on P and K of vegetable crops (pepper and eggplant) is recommended the study of vermicompost effects on growth, seed germination, yield and quality of vermicompost, as compared with chemical fertilizers in the case of vegetable crops examined. Effects of vermicompost in laboratory is being studied.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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