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Research Article

Effects of Cytozyme Crop Plus on *Lycopersicum esculentum* Mill. Plant Yield

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Abstract: The effects of various concentrations of Cytozyme Crop Plus (CCP) on *Lycopersicum esculentum* Mill. plant yield have been examined in this study.

Single doses of 50 and 100 ml per decare of CCP were pulverized on seedlings of 15 cm height after second flowering, which have been given normal care. In addition, 50 ml per decare has been aplied twice in a separate parcel. The data obtained from the three replicates organized according to random blocks trial pattern have been compared with the control.

In the trial parcel where daily irrigation and care procedures were carried out, specific yield values have been examined after harvest. The root length, stem height, fresh and dry weights and N, P and K contents in the root, stem and fruit have been determined besides average number of fruits in the plant, fruit diameter, number of carpels, dry and fresh weight of fruit, % dry matter, colour of fruit and sugar content analyses.

According to the data obtained, CCP is found to be effective on the yield of tomato plant by increasing the dry matter and sugar content in fruit compared to control group, depending on the concentration and application.

Key Words: Cytozyme Crop Plus, Yield, *Lycopersicum esculentum.*

Cytozyme Crop Plus'ın *Lycopersicum esculentum* Mill. Bitkisinde Verim Üzerine Etkileri

Özet: Bu çalışmada, *Lycopersicum esculentum* Mill. bitkisine uygulanan farklı konsantrasyonlardaki Cytozyme Crop Plus'ın verim üzerine etkileri incelenmiştir.

Fidelikten 15 cm boyda seçilen fidelere, tarlaya dikim sonrası normal bakım işlemi yapılmış ve gelişen bitkilerde ikinci çiçek salkımı oluştuktan sonra, 50 ve 100 ml/dekar konsantrasyonlarında Cytozyme Crop Plus, tek doz olarak, püskürtme şeklinde uygulanmıştır. Ayrıca, 50 ml/dekar konsantrasyon uygulaması bir diğer parselde iki kez tekrarlanmıştır. Tesadüf blokları deneme desenine göre üç tekrarlı olarak kurulan denemede, elde edilen veriler kontrol ile karşılaştırılmıştır.

Günlük sulama ve bakım işlemlerinin yapıldığı deneme parselinde, hasat zamanı belirli verim değerleri incelenmiştir. Bu açıdan, hasat edilen bitkilerde, ortalama meyve sayısı, çapı, karpel sayısı, meyve yaş ve kuru ağırlığı, % kuru madde miktarı, meyve rengi ve şeker içeriği analizleri yanısıra, bitkide kök ve gövde ve meyvede N, P ve K miktarları saptanmıştır.

Elde edilen bulgulara göre, uygulanan Cytozyme Crop Plus, kontrola göre, konsantrasyon ve uygulamaya bağlı olarak domates bitkisinde meyva, kuru madde ve şeker miktarının artmasına neden olmakla verim üzerinde etkili bulunmuştur.

Anahtar Sözcükler: Cytozyme Crop Plus, Ürün, Lycopersicum esculentum

Introduction

In our country, several problems related to application of high doses of fertilizers by conscious or unconcious producers are encountered. For this reason the use of some composite substances recently started to gain ground as leaf fertilizers. The reason for producers to prefer this type of substances which are rich in macro and micro nutrient is their easy application. Besides, fertilizer application through the leaf allows the addition of insufficient nutrients required for the normal growth of a plant.

In distinct areas of the world the effects of these bioctechnological growth regulating substances on yield and product quality are being investigated by means of different agricultural techniques, on different agricultural plants under different climate and soil conditions (1, 2, 3).

These substances known as leaf fertilizers can be applied to the plants one by one or in combination (4). The application time and dosage of these fertilizers should be well adjusted. Therefore in this study the aim is to determine the effect of different concentrations of CCP, which is a leaf fertilizer, on the yield of *Lycopersicum esculentum* Mill. plants.

Material and Methods

The research is conducted in the experimental field of the botanical garden under Bornova-İzmir conditions. *Lycopersicum esculentum* Mill. plant is used in the study. Single doses of 50 and 100 ml per decare of CCP are applied by pulverization. In addition, in another parcel, two doses of 50 ml per decare are applied, second application being two weeks after the first. Seedlings of 15 cm height were taken from the nursery and planted on the field. Planted seedlings the encountered normal care process. When second flowering was observed, CCP was applied by means of a hand pulverizer until the plants were entirely wetted.

Application of different concentrations were compared with the control in the trial undertaken in three replicates according to random blocks pattern. Tomato fruit were harvested when 2/3 of them were red in the trial parcel, where daily irrigation and care processes were carried out and specific yield values were examined.

During the harvest period, 50 gram samples were taken from the fruits and cut into pieces. The extract obtained was drained and completed to 50 ml with distilled water in a graduated cylinder. Percent saccharose amount of the fruit extract was determined by saccharometer. For the determination of fruit colour, absorbance was measured at the wavelength where maximum absorbance was observed, i.e. at 360 nm, by spectrophotometer (5).

For fresh and dry weight measurements; first fresh weights of samples from each application and control were determined. Then the samples were put in an incubator at 105ºC. After 48 hours of incubation, samples were again weighed in order to determine the dry weights. For each morphological property considered, averages of the numerical data and deviations are determined by the necessary statistical method; differences in the statistical significance are assessed by means of variance analyses at P=0.05 (6).

Results

When the results related to the fruit diameter are examined a singificant statistical difference is observed between the control and application groups. The fruit diameter and number of carpels of the 50+50 ml per decare application proves to be higher than the control group, 100 ml per decare and 50 ml per decare applications. When the number of carpels is compared, the statistical difference is not significant (see Table 1). Also, it is observed that the total number of fruit in a single plant is higher 50+50 ml per decare application relative to the control and other groups. Total fresh weight of fruit per plant in the 50+50 ml per decare application division was determined to be 34.7% heavier than the control (see Table 2). However, in case of fresh weight of a single fruit, no significant difference was observed between the control and application groups (see Table 3). In 100 ml per decare application percent dry matter of fruits from a single plant and a single fruit is determined to be 12.6% and 14.8% higher than the control respectively (see Tables 2 and 3).

Table 1. The Effect of Various Concentrations of CCP on the Fruit Diameter and the Number of Carpels in L*ycopersicum esculentum* Plant

	Fruit Diameter*	Number of Carpels
Control	4.38±0.05	2.12±0.03
100 ml/decare	3.93±0.07	2.18±0.04
50 ml/decare	3.98±0.09	2.05±0.02
50 + 50 ml/decare	4.39±0.05	2.19±0.04

*The values differ at P= 0.05

Table 2. The Effect of Various Concentrations of CCP on Total Number of Fruit, Fruit Age and Dry Weight, % Colour and Sugar Yield in a Single Plant of *Lycopersicum esculentum*

	Total Number of Fruit/Plant*	Total Fresh Weight of Fruit/Plant	Total Dry Weight of Fruit/Plant (g)	% Colour in Fruit**	% Sugar in Fruit
Control	11.96±1.61	667.7±10	3.852±0.77	0.084	0.58
100 ml/decare	11.71±1.52	584.7±11	4.410±0.342	0.1409	0.73
50 ml/decare	12.83±1.63	704.5±13	3.590±0.57	0.088	0.59
50+50 ml/decare	18.61±2.10	1023.3±11	3.098±0.417	0.063	0.35

* The values differ at P=0.05, ** 360 nm

Table 3. The Effect of Various Concentrations of CCP on the Fresh Weight, % Dry Matter, Colour and Sugar Content of a Single Fruit of *L. esculentum.*

	Fresh Weight (g)	% Dry Matter	% Colour	% Sugar
Control	55.84	0.32	1.00	6.96
100 ml/decare	49.91	0.376	1.65	8.57
50 ml/decare	54.89	0.279	1.13	7.62
50+50 ml/decare	54.98	0.166	1.18	6.54

The colour and sugar content of fruits of a single plant and a single fruit of *L. esculentum* plants is found to be higher in 100 ml per decare application when compared to control and to the other applications (see Table 2 and 3). When the root length and stem height of the plants are axemined, the root is 13% longer and the stem is 26% higher in 50+50 ml per decare application group. However when dry and fresh weights of the plant are considered, 100 ml per decare CCP applied group and the control result in heavier plants compared to other applications (see Table 4).

Table 4. The Effect of CCP on Root Length, Stem Height, Fresh and Dry Weights of *L. esculentum* Plants.

	Root Length (cm)	Stem Height* (cm)	Fresh Weight (g)	Dry Weight (g)
Control	24.55±1.9	56.67±3.8	36.66±7.9	36.66±1.3
100 ml/decare	25.00±2.2	60.00±4.4	36.44±7.3	38.72±2.3
50 ml/decare	25.00±2.2	65.00±5.0	24.60±0.9	24.60±1.9
50 ± 50 ml/decare	28.33±3.0	76.67±4.2	31.02±9.0	22.16±2.4

As explained above, when the data related to root length and stem height is examined 50+50 ml/decare group is seen to be more effective than the other application groups.

Finally, it is concluded that the application of 100 ml CCP per decare induces the plant yield significantly. However, applying this amount in two equal doses 15 days one after the other proves to be better than a single dose.

The data obtained from the N, P and K analyses are the following: The lowest value of N in the fruit is observed in 50+50 ml per decare application. Although the amount of N in the root and the fruit are approximately the same, it is less in the stem. Therefore, this shows that N is used more in the stem. N content in the fruit is higher in the control group than in other application groups (see Figure 1).

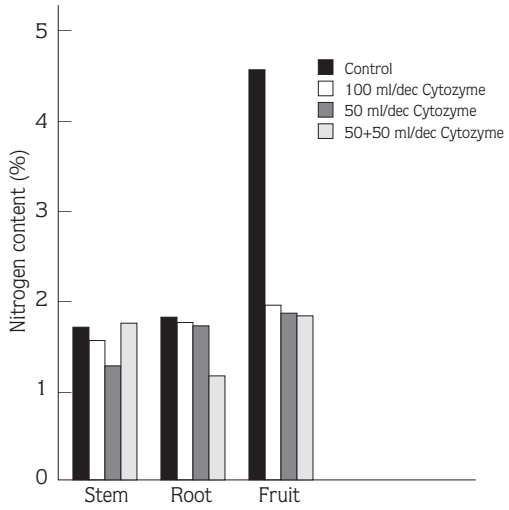

Figure 1. The Effect of Different Concentrations of CCP on N Content in *L. esculentum.*

In spite of the fact that P content is the least in the stem in 50+50 ml per decare application, the opposite is observed in the root. P is utilized in the stem and accumulated in the root (see Figure 2).

The least amount of K is accumulated in the stem in all applications while maximum K accumulation is observed in the fruit. K accumulation in the stem and root is observed in the control group, less accumulation occurs in other groups (see Figure 3).

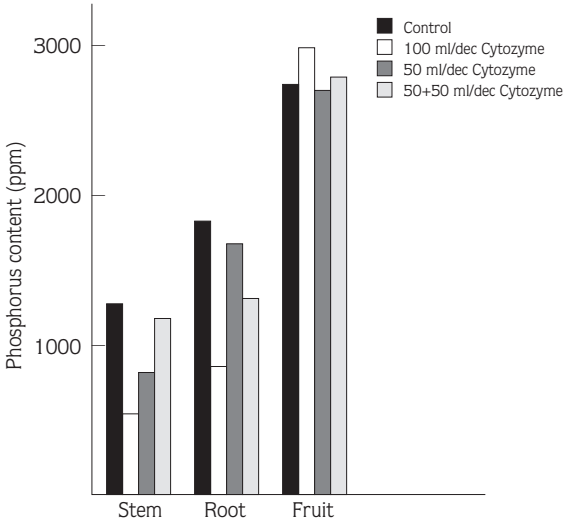

Figure 2. The Effect of Different Concentrations of CCP on P Content in *L. esculentum.*

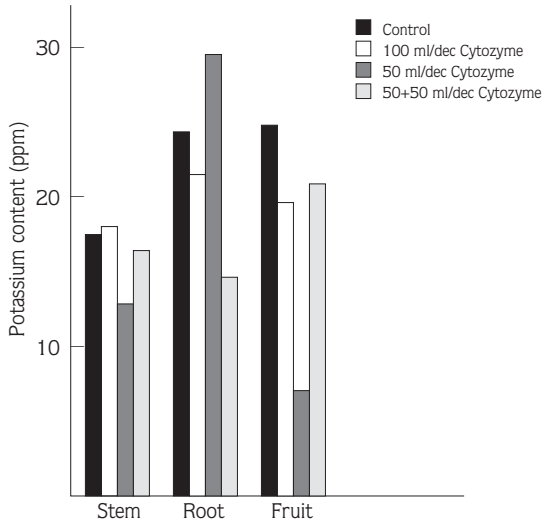

Figure 3. The Effect of Different Concentrations of CCP on K Content in *L. esculentum.*

In light of the results of N, P and K analyses, the reason for the N content to be less in the stem than N content in the root can be explained by the priority of N requirement of the plant as its mineral source (see Figure 1).

Discussion and Conclusions

Researchers aiming to benefit from the limited agricultural lands on the world have switched to an agricultural technique called hormonal agriculture and therefore increased the yield from unit area. The basic problem is the requirement for optimal concentration and conditions to obtain beneficial effects from hormones of plant origin on growth and development. The artificial growth regulating materials for plants that are used instead of these hormones have residues such as chlorine and mercury and therefore lead to problems related to health and environment. Hence new compounds regulating growth and development are searched. The product of such a study is a substance named Cytozyme which is obtained by means of two-step fermentation of microorganimsms. Cytozyme Crop Plus and CYtozyme Seed Plus applied to seed or vegetative structure of several agricultural plants have shown to increase yield (7,8).

Although Silva *et al.* (1980) stated that leaf fertilizer did not increase the "Rome" tomato variety yield, they improved plant yield with combined leaf fertilizer. Data from studies reporting significant increases in tomato plant yields as a result of nutrients applied through the leaves (9, 1) and from this study are comparable. However, in an other study (10) it is stated that leaf fertilizer applications are dependent on soil types.

Different results were obtained from studies carried out in order to determine the effects of Cytozyme on plant yield or other morphological-physiological effects under varying climates and application conditions (2-4, 11-13). These products of microorganism fermentation are determined to contain substances from auxin, gibberellin and cytokinin groups which are metabolic products of microorganisms (14, 15).

As a result of this study carried out under Bornova-İzmir conditions, CCP application is determined to increase *L. esculentum* plant yield depending on the concentration applied. Instead of a single application of 100 ml per decare, it is preferable to apply 50 ml per decare to begin with and another dose of 50 ml per decare 15 days later.

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