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Effects of Different Organic Materials on the Yield and Some Quality Specifications of Fruits in Tomato

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The aim of this study is to investigate the effect of green fertilization and applications of various organic materials on quality of tomatoes. Common vetch (*Vicia sativa* L.) was used as green fertilization plant. Organic material used in the study included sheep manure, molasses and Org-E-Vit. Yield (g/plant), total soluble solid (%), ascorbic acid (mg 100 g^{-1}) and pH were measured. In tomato, green fertilization significantly affected total water-soluble dry matter while green fertilization × applications interactions highly significantly affected ascorbic acid content. Applications investigated in this study did not significantly affect other characteristics. It was observed that green fertilization plants and organic materials used in organic farming have effects on some fruit quality characteristics.

Key Words: Tomato, Green-manure, Organic material, Yield, Quality

INTRODUCTION

In today's world, the feeding problem of the increasing population has also brought with it the problem of more human intervention in nature. Particularly, several agronomical applications made for increasing the yield in unit area such as firstly fertilizing and usage of agricultural insecticides causes environmental pollution to occur[1,2].

Chemical insecticides and fertilizers pollute soil, underground and on earth water sources. The remnant materials spoil the plant, soil and food materials in a way that they can be dangerous for living beings. Studies have shown that the most reliable production method is organic agriculture[3]. That is why organic agriculture has gained much more importance in proportion to the conventional agriculture that is widely used in many countries of the world.

In these researches, animal manures being at first, various vegetable and organic originated materials have been used as fertilizers[1,4–10]. Besides, there are also studies indicating again that using organic originated pesticides against various detrimental diseases will be useful[11–14]. It was determined that the total soluble solid, pH, vitamin C content and fruit size of the materials used in tomato raising have caused changes in different directions[5–7,9,15].

In the recent years although there has been an increase in the production of organic products in many countries, this increase is not sufficient to meet the

demand, because demand increases faster than production. To increase the organic production new products must be added to the existing ones and importance must be given to the products having economical value[16]. Thus, organic agriculture may show a faster increase. In this study, it has been aimed to determine the effect of different organic materials on the quality specifications of fruit quality in tomato, which have an importance place in its international vegetable trade.

EXPERİMENTAL

This study has been carried out in an area where there had been no agricultural activity for four years in the year 2004 vegetation period in Tokat's ecological conditions.

Elif 190 hybrid types of vegetable material suitable to pole raising up were formed. The trial area was a soil with clayey-loamy, neutral and light alkaline reaction organic material, in medium richness with no problem of salt[17].

Between April and September months, when the research was made, the average temperature varied between 11.3–21.9°C. In the trial period, there had been a total of 124 mm rainfall. Relative moisture values varied between 65.2–78.6%. The water amount that the tomato needed had been supplied with the drop watering method[18].

In this research, as organic material, sheep manure, molasses, Org-E-Vit and as green manure, common vetch (*Vicia sativa* L.) was used. In the areas where the trial was done, nitrogen (N), phosphorus (P), potassium (K) contents of the organic materials in the soil before and after the green fertilizing was presented in Table-1.

TABLE-1
CONTENT OF THE ORGANIC MATERIALS USED IN EXPERIMENTAL PLOTS

Samples	N (%)	P (%)	K (%)
Before green-manure application	0.15	1.20	2.28
After green-manure application	0.12	1.16	1.79
Sheep manure	2.76	2.83	9.77
Molasses	1.60	0.92	1.13
Org-E-Vit	3.50	2.00	3.00

The research has been established by 3 times repeatedly on the divided plots trial design. The application of green-manure on main plots and organic materials to the below plots was placed. The organic material applications were made as shown below.

1st Application: Control (No application was made)
2nd Application: Sheep manure (17282.6 kg/ha)
3rd Application: Molasses (25603.4 kg/ha)
4th Application: Org-E-Vit (8640 kg/ha)
5th Application: Sheep manure + Org-E-Vit (5366.6 kg/ha + 4233.3 kg/ha)
6th Application: Molasses + Org-E-Vit (12800.0 kg/ha + 4233.3 kg/ha)
7th Application: Sheep manure + molasses (5366.6 kg/ha + 12800.0 kg/ha)

All the organic materials were given to soil before planting. The plants were placed at 75 × 40 cm distance and one in a plot. The seedlings were planted in the trial area on 20 May, 2004.

In the study, yield (g/plant), total solible solid (TSS %)[19], ascorbic acid (mg 100 g^{-1})[20] and pH[21] properties were examined. The data obtained were subjected to variance analysis according to the statistical analysis method[22], in the averages showing importance the LSD significance test was applied.

RESULTS AND DISCUSSION

In tomato, green manure in TSS caused 0.05 level changes and green manure × application interactions in ascobic acid caused 0.01 level changes. The other factors examined did not cause any other significant changes (Table-2).

Yield, in the areas where no green manure (2540.30 g/plant) was made, was quantitatively higher compared to those where it was made 2407.29 g/plant. Although there were no differences between the applications the highest yield was obtained from the second (2727.18 g/plant) and the lowest yield was obtained from the first application (2154.87 g/plant). No dual interactions in the specification in question were determined. In the green fertilized plots, the highest yield was obtained in the third (2704.33 g/plant) and the lowest in the first application (1895.50 g/plant). In the plots where no green fertilizing is made the highest yield was obtained in the seventh (2774.97) and the lowest in the third application (2231.83 g/plant) (Table-2).

In tomato, green-manure applications in the TSS contents caused significant changes. The TSS (4.05%) ratio where the green fertilizing was made was higher compared to the areas where it was not made (3.71%). Although there were no statistically important changes among applications, the highest TSS ratio was obtained from the fifth application with 4.37% and the lowest from the fourth application with 3.33%. The interactions between green fertilizing × applications have no significance. In the plots where green fertilizing was made while the fifth application giving the maximum value (4.75%) the lowest value was obtained from the 4th application. The maximum value in the plots where no fertilizing was made was obtained from the fifth application (4.00%) and the lowest value from the 6th application (3.25%) (Table-2).

The TSS amount of the plots where no green fertilizing was made has been determined higher compared to the ones where not done. When there is sufficient amount of nitrogen and organic materials in the soil it is unsusceptible that the plants would show a better growing up. The better grown up plant fruits would be larger and the ratio of dry material would be higher. In the areas where green fertilizing was done the increase in the organic material and nitrogen ratio of the soil will enhance the plant to make photosynthesis under better conditions and their development. This will lead to an increase in the assimilation material amount that helps the development of the plants.

TABLE-2
ASCORBIC ACID, pH, TSS AND YIELD OF TOMATO GROWN UNDER DIFFERENT ORGANIC MATERIALS AND GREEN-MANURE APPLICATIONS

Aplications	Yield (g/plant)			TSS (%)		
	GM	No GM	Mean	GM	No GM	Mean
1	1895.50	2414.23	2154.87	4.42	3.92	4.17
2	2903.30	2551.07	2727.18	4.33	3.45	3.89
3	2704.33	2231.83	2468.08	3.85	3.83	3.84
4	2501.30	2581.77	2541.53	3.00	3.67	3.33
5	2411.87	2650.20	2531.03	4.75	4.00	4.37
6	2050.37	2578.03	2314.20	4.08	3.25	3.66
7	2384.37	2774.97	2579.67	3.91	3.83	3.87
Mean	2407.29	2540.30		4.05 a	3.71 b	
LSD	GM = ns	A = ns,	GM × A = ns	GM = 0.163*	A = ns,	GM × A = ns

Aplications	pH			Ascorbic acid (mg 100 g^{-1})		
1	4.44	4.39	4.41	22.58 abc	22.04 abc	22.31
2	4.53	4.47	4.50	20.06 c	25.77 a	22.92
3	4.47	4.47	4.47	20.91 bc	22.14 abc	21.53
4	4.42	4.43	4.43	24.20 ab	23.80 ab	24.00
5	4.45	4.42	4.43	24.67 ab	18.21 c	21.44
6	4.47	4.42	4.45	18.74 c	25.36 ab	22.05
7	4.42	4.40	4.41	25.29 a	21.53 bc	23.40
Mean	4.45	4.43		22.35	22.69	
LSD	GM = ns	A = ns,	GM × A = ns	GM = ns	A = ns,	GM × A = 4.128†

ns: Not significant, GM = Gren-manure, A = Application
a, b: Means in the same column with different superscript are significantly different
* P < 0,05 † P < 0,01

The factors examined in the study and their dual interactions did not cause any significant change in the pH values of the fruits. The pH values of the fruit samples taken from plots where fertilization was made and not made were respectively amended as 4.45 and 4.43. The pH values of the applications changed between 4.41–4.50, the maximum pH value was obtained from the 2nd and the lowest from the 1st and 7th applications. When the interactions were examined in both of the plots where green fertilizing was made or not made it was seen that the 2nd application was giving the highest value. The lowest values were

given by 4th and 7th in the green fertilized plots and by 1st applications in the unfertilized areas.

The ascobic acid content of different organic materials with green fertilizing showed significant changes. In the plots where the green-manure plant was used, the ascorbic acid content varied between 18.74–25.29 mg 100 g^{-1}. In these plots, the maximum value was given by the 7th and the lowest values were given by 6th and 2nd applications. In the areas where no green fertilizing was made the maximum value was given by 2nd and the lowest value was given by 5th application. In the formation of ascorbic acid the effects of green fertilizing and its applications were insignificant.

Among the applications taken by green fertilizing, it was only determined that there was a very significant interaction in terms of the ascorbic acid amount. From Table-2, it would be seen that although it does not show much significance a higher average was obtained in the parcels where no green fertilization was not made compared quantitatively to the ones where it was made. In these plots the intake of more nitrogen compared to the plots where no green fertilizing was made might have a negative effect on the formation of ascorbic acid in the body of the plants[23]. It is reported that in the formation of ascorbic acid potassium and magnesium have an incentive but nitrogen has a hindering effect. Common vetch, which is used as green fertilizing plant is a faba bean food plant. This plant consumes more phosphor compared to other faba beans from the soil during the vegetation process (0.65 g 100 kg^{-1} dry material)[22].

This returns to the soil with vegal remnants in the phosphor. Besides, when the mineral material contents of the study applications are examined it would be seen that these do also offer a significant amount of organic nitrogen and phosphor (Table-1). All the given nitrogen and phosphor being in the organic form, these decomposing by time leaves nitrogen and phosphor to the plant root continually necessary. In addition phosphor and nitrogen are two plant food materials affecting, even enhancing, the intake of each other. The presence of enough phosphor in the medium with nitrogen leads to an increase in the efficiency of nitrogen and the amount taken by the plant.

The results of this study may be evaluated as follows:

- Common vetch and other organic materials used cause positive changes in some quality criteria. This result gives the idea that the mentioned organic materials may be used in organic tomato growing.
- Green-manure and organic materials have long period different labels in soil. That is why in the areas where these type of materials are used the possibility to utilize in plant raising may appear. This is determined as an important criterion in terms of organic raising principles.

As a result, the green fertilizing plants used in organic raising and organic materials has effects on fruit quality and many studies may be needed to put forward these effects.

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