The Effect of Different Soil Regulators on Quality Tomatoes

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Abstract: Soil structure are very important factor at plant growing. Plants take water and plant nutrients via their roots. If the factors such as water holding capacity and porosity of soil is good enough, yield and quality of plant will be increased. Tomato is valuable plant both for the fresh fruit market and the processed food industries. It is grown in a wide range of climates in the field and under protection.The aim of this research is to determine the effect of different soil regulators (zeolite, peat, Terra Cottem, organik fertilizer) on tomato quality. They were mixed into the soil before planting. At the end of the research, while organic fertilizer has the highest value in terms of fruit weight and fruit diameter, control treatment has the highest value at fruit lenght. According to the results, organic fertilizer is able to be mixed into soil for much better fruit quality.

Introduction

After the importance of vegetables on human nutrition is understood, both the number of works on vegetable growing, its rehabilitation and vegetable production-consumption increase quickly. Tomato is the one of these vegetables which is mostly produced and consumed and it is the one of them which is mostly worked on its quality and efficiency. In the world, tomato has 129.649.883 ton production on 5.227.883ha field. (Anonymous, 2010a) On the other hand in our country, we have 10.985.400 ton tomato production on 300.000ha field. Therefore, following China, UK and America, we are on the fourth rank on tomato production. (Anonymous, 2010b) Also, in spite of 247.996 hg/ha tomato profit in the world, in Turkey it is 366.180 hg/ha. Our efficiency is high because one part of the Works on tomato embraced by soil regulators used in growing**.**

In terms of soil wish, tomato is not a kind of selective plant. It is grown in each rich soil that is full of nutrition ingredients. There is an earlier crop development on the light origin soil, but the plant's life is short. According to this, the efficiency automatically fallen. On the other hand, although on heavy clay soil, plant development is rather slowly at the beginning, the plant always develops and grows new shoots**,**flowers and fruit. Thus, the efficiency is higher on these soils. The plant is stronger against to illness and pests. Tomate fruit produced on these cray soils becomes nicer on colour and more enduring. The highness water holding capacity of the soil also substantially affects the plant development and efficiency. Tomato needs 5.5-7 soil ph. Sometimes the soil conditions that the plant need can not be supplied or the plant can not get nutrition ingredients from the soil. This causes problems with the efficiency and quality.

The aim of using organic and inorganic soil regulators is to make simpler to get plant nutrition ingredients by doing soil's physical and chemical origin better.

Besides, the cure of soil's physical features is considerably important in terms of plant growing and soil protection. With the solution of negative effects of acid in soil and the saving the endurance of aggregation and aggragates, a plant can adequately grows. (Ozdemir et al, 2005) Generally our country's organic nutrient ingredients are not enough. By adding different organic materials, especially such as stable fertilizer , it is tried to make soil features (especially physical ones) better and to heighten the organic nutrient and the efficiency of the soil. Inadequacy of farm fertilizer and its expensiveness cause searches on using of other materials as organic nutrient source and soil regulator. (Kütük et al, 1995; Okur and Delibacak, 2006)

In this study, in order to protect the origin of soil; get maximum profit from water in soil; simplify plant's getting nutrient elements from the soil; provide product rise, zeolite, terra cottem, peat and organic fertilizers are used. The effects on tomato quality of these different soil regulators are searched.

Tomatoes Used in The Media

1.1.1.Zeolite

Chemical composition of zeolite is a hydrated silicic mineral of aluminium. Main characteristics of zeolite are high cation exchange capacity, in balance water retention/release, nutrient available via ion exchange, arrange of acidity and air porosity. In addition, zeolite like a slow release fertilizer(Ayan, 2001).

Trade Name	Application	Size (microns)	Price ($ / ton)
Zeta	Animal Coaster	2,5-3,5	70
NATM 900	Contribution feed	0-0,7	85
NMF 9000	Contribution of fertilizer	1,5-7,0	80
Filter Clino	Filtration, waste water	2,5-3,5 5,0-7,0 15,0-16,0	75 75 75

Table 1: Commercial Natural Zeolites Produced in Turkey (Anonymous, 2010d)

Chemical Structure	SiO_2	Al_2O_3	Fe_2O_3	K_2O	H_2O	CaO	MgO	Na_2O	Ti	Ag	N	B (ppm)
%	71.29	13.55	1.15	3.50	5.90	1.96	0.70	0.60	0.02	0.04	No	30

Table 2: Chemical Composition of Zeolites (Altan et al, 1998)

1.1.2.Peat

Peat is composed of water level decrease in lake's beds and then plant'activities come to the fore, in winter plant death by water level increasing. The natural phenomenon reproduce constantly. Peat is the type of organic soil and is used for vegetables, seedlings, cultivated mushroom and potted ornamental crops. İts ph is range from 5.5 to 6.5. it is a poor organic soil except for nitrogen and semi- steril. In Turkey peat deposites which are approximately 40- 50 thousand hectares, were found 15 units (Ulukan and Ece, 2006) . Peat is very popular and commanly used for growing vegetables and seedlings in Turkey.

1.1.3.Organic Fertilizer

Nowadays a huge range of products can be obtained, which have been produced intensively using chemical fertilizers; however, the extreme and careless usage of chemical fertilizers leads to structural damages and deterioration of physical, chemical and biological properties of the soil, like salinization, withering,

extreme pH-levels and the destruction of organic material which acts as nutrients for microorganisms, which can only be recognized at long-terms. For reestablishing the physical, chemical and biological balance of our farming grounds, organic fertilizing is essential. The organic substances which the soil gets enriched with by organic fertilizing reestablish the air/water balance in the soil and thus maintain a healthy soil structure. Due to increased activity of microorganisms in the soil as a result if adding organic substances, the biological activity also increases and nutrients will be released, what either leads to a better chemical structure of the soil. This way the physical, chemical and biological balance of the soil is being reestablished. In order not to devastate this balance, we urgently have to stop the intensive usage of chemical fertilizers and we need change to organic fertilizing (Anonymous, 2010c)

1.1.4. Terra Cottem

The terra cottem soıl conditıoner is a proprietary mixture of more than twenty components from six different groups all assisting the plant growth processes in a synergetic way:*The Growth Stimulators* play a very important role in the initial growth phase of the plant. They activate rootcell elongation and differentiation, and biomass production. In addition, roots are encouraged to grow more rapidly to depths where more water is present.

Terra cottem's crosslinked hydroabsorbent copolymers of acrylamide and acrylic acid partially neutralized by potassium and ammonia salts absorb and store water that is normally lost to evaporation and leaching, reducing the volume and frequency of necessary irrigation up to 50%. This water is then kept at the disposal of the plant that accesses the stored water on demand through its root hairs, keeping the water in the root zone for a longer period of time. In dry form, polymers are white, crystalline granules swell quickly, absorbing water and expanding into a gel- like substance. Each polymer is capable ofstoring many times its own weight in water. The terra cottem polymers have a low sensitivity to electrolytes, yielding numerous wet/dry cycles. The soluable mineral fertilizers absorbed by the hydrogels, feature a classic NPK mixture used as a starter component for the first growth phase of plants. They contain a high amount of trace elements. The slow release fertizlizers offer a constant flow of nutrients and play an important role in soil fertilization for many months. The release of nutrients starts approximately 2- 3 weeks after application and is temperature activated.

The organic fertilizers stimulate microbiological activity in the soil and contribute to overall soil conditioning by releasing nitrogen and other growth stimulating elements. Terra cottem's carrier material consists of a particular kind of volcanic pyroclastic rock (lava). The material acts as a component binder, a vehicle for the growth stimulators and allows homogeneous distribution of all components. Lava also improves the soil's aeration (Anonymous, 2010e).
Benefits

- Stronger and deeper root development
- Healthier plants and increased yields
- Higher resistance to diseases
- Increased survival rate
- Soil conditioning
- Water savings
- Better use of fertilizers
- Good for the environment
- Enable plant growth in degraded, saline or otherwise marginal soils

The Study

This study was conducted in Akdeniz Unıversity Faculty of Agrıculture's research and application field's greenhouses. Each application were prepared separately. Soil regulators mixed in the soil for growing. controls were composed of non-regulators soil. The usage area and the amonuts are the same with the line lenght 12. 3 cm and the soil regulator weight of 623 kg/da was used. Tomato cv M19 was choosen as

plantal material. Organic 1application was composed of %65 Clinoptilolite and %20 total organic materail. Organic 2 application was composed of %45 Clinoptilolite,%20 total organic materail, %8 total nitrogen and %1 organic nitrogen. Clinoptilolite is one of 40 different minerals of the group of zeolites and also the most important one among them. Because of its superior physiochemical characteristics and its versatile usability in a number of different industries it is used in geological, physical, chemical and agricultural, animal breeding and medical processes. Due to its huge anion and cation exchange capacity and its essential characteristics, like a balanced water management and its ability to bind and to release nutrients, Clinoptilolite is used as soil regulator and re-activator.

Study was carried out as Randomized block design with 3 replications for each application. 15 fruits observation was donefor each replications. Examined parameters are fruit width, length and weight. Fruit width and length were measured by electronic calipers. Statistical analyses were performed by using SAS-software package (SAS Institute, 1988), treatments means were separeted by Duncan's test.

Findings

The highest value was supplied with organic 1- 2 and these applications weren't significantly different from each other but they were significantly different from others; zeolite application showed the lowest value in terms of fruit width parameter. On fruit size parameter, the highest value was supplied with organic 1 and this application had statistically differences from the others; zeolite application gave the lowest value.when the total fruit weight parameter was taken into consideration, the highest value was supplied with organic nutrient 1-2 and these applications weren't significantly different from eac other but they were significantly different from other applications; zeolite application showed the lowest value [Table 3].

Applications (I.harvest)	Width	Size	Weight
Peat	71.6924b*	58.8913bc	184.952b
Soil	70.9832b	59.9996ab	185.981b
Zeolite	67.3582c	56.0720d	153.885d
Organic 1	74.4369a	60.4882a	202.085a
Organic 2	74.5020a	60.1896ab	204.602a
Terra cottem	69.0800c	58.4371c	168.517c

*Means with the same letter are not significantly different. There were significant statistically differences between applications($P<0.01$).

Table 3: Fruit width, size and weigth results of I. harvest.

It was seen that the highest value was supplied with organic 1and this application was significantly different from others; zeolite application showed the lowest value in terms the fruit width parameter**.** On fruit size parameter, the highest value was supplied with organic 1 and soil. Those applications had statistically differences from the others but these applications weren't significantly different from eac other; zeolite application gave the lowest value. When the total fruit weight parameter, the highest value was supplied with organic 1 and this application is significantly different from other applications; zeolite application showed the lowest value [Table 4].

Applications (II. harvest)	Width	Size	Weight
Peat	68 341 b *	57.1107 b	162.206b
Soil	69 712 ab	59.2798 a	173.842ab
Zeolite	67 453 b	56.6422 b	157.328b
Organic 1	71 890 a	59.7404 a	188.623a
Organic 2	68 078 b	56.6800 b	161.122b
Terra cottem	67 792 b	57.2582 b	160.508b

*Means with the same letter are not significantly different. There were significant statistically differences between applications($P<0.01$).

Table 4: Fruit width, size and weigth results of II. harvest.

On fruit width parameter, the highest value was supplied with organic 2, zeolite and soil. These applications weren't significantly different from each other but they were significantly different from others; the other applications showed the lowest value. When the fruit size parameter was the case, the highest value was supplied by soil and this application had statistically differences from the others; peat and organic 1 gave the lowest value. The highest value was supplied with zeolite, soil and these applications aren't significantly different from eac other but they are significantly different from other applications; organic 1,Terra cottem and peat applications showed the lowest value in terms of the total fruit weight parameter [Table 5].

Applications (III. harvest)	Width	Size	Weight
Peat	49 208 b *	43 827 c	72 874 c
Soil	54 166 a	48 610 a	91 720 a
Zeolite	53 379 a	47 292 ab	89 648 a
Organic 1	48 266 b	43 500 c	68 730 c
Organic 2	53 246 a	47 697 ab	88.321ab
Terra cottem	49 604 b	45 824 abc	71 854 c

*Means with the same letter are not significantly different. There were significant statistically differences between applications($P<0.01$).

Table 5: Fruit width, size and weigth results of III. harvest.

Conclusions

If soil doesn't have enough nutrients for farming and has low water holding capacity, soil regulators can be used for avoding these problem. Soil regulators provide; water savings, stronger and deeper root development, better use of fertilizers and fruit quality. In this study, the soil of greenhouse is Terra rossa soil which has rich in nutrient materails, enough holding water capacity. Therefore; difference among the applications were not put the case clearly. The impacts of applications come into being clearly in the bad soil condition. According to results of the study; on fruit quality, the highest value was supplied with organic 1 - 2 in first two harvest; in latter harvest zeolit supplied the highest value on the fruit quality because of initating heat stres, fruits didn't reach peculiar to fruit cultivar size.

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