

The Effect of Mixed Fertiliser with or Without Zinc on the Yield and Quality of Tomato Grown Under Çanakkale Conditions in Turkey

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Abstract: The objective of this research was to investigate the effect of mixed fertiliser (15-15-15) with or without zinc on the yield and quality of tomato grown under Çanakkale conditions. The mixed fertiliser with zinc increased the tomato yield up to 6% compared to the one without zinc. However, the mixed fertiliser with zinc caused a fast decrease in the yield after a certain dose (75 kg/da). This decrease indicated that the fertiliser with zinc should be used under strictly controlled conditions. Optimum fertiliser is the mixed fertiliser without zinc and dose is 50 kg/da under Çanakkale conditions.

Key words: Tomato, Zinc, Nutrition, Turkey

Introduction

The annual production of tomato in Turkey is about 7250000 ton, 404426 ton of which is produced in Çanakkale. Tomato constitutes 75% of the fruit bearing vegetables (Anonim, 1995).

The fertilisers with zinc are used to increase tomato yield in the area. Several studies have indicated that zinc has important effects on the yields of various plants.

Tisdale *et al.* (1985) found that zinc, which is contained in the plant, is a vital element among the other nutritive elements in the plant (Kacar, 1997). In addition Kacar (1997) pointed out that a great part soils are lacking in zinc also fertilizing with zinc is of a great importance since the level of lime is too high and the level of pH is over 7,0 in these soils. Zinc deficiency can cause mental deficiency and growth disorders as well as other important health problems (Acarsoy, 1997).

According to Çakmak (1996), the most common deficiency of microelements in our cultured soils in zinc deficiency and a level of 0,5 mg Zn.kg⁻¹ is the critical value. He adds that in plants lacking zinc there is a significant decrease in the vertical growth and the plant remained short.

According to another research, Oktay (1999) the element of zinc caused the formation of auxin group hormones within the plant and these hormones affected the development and growth of the plant positively. He also noted that the lack of this element caused a decrease in cell-growth and general growth of the plant. In addition, with the use of zinc, cell-growth increased and the plant grew faster, which resulted in 200% increase in yield. This increase was 35% in hybrid broccoli.

Therefore, it is aimed to increase the yield and thus provide a high income to the farmers by experimenting with different doses of zinc-added and without zinc fertilisers.

This study was carried out to investigate the effects of zinc as a nutritive plant element on cell growth and also to determine its effects on the yield. We hope that it will be a reference to similar studies in the future.

Materials and Methods

In this study tomato plant was chosen and Rio Grande tomato was used.

After the seeds, which were sown in peat in May 01, 1999, grew in to seedling with four real leaves, the

seedlings were planted in 13 litre pots containing 10 kg fertilised soil with 4000 kg/da manure in June 12, 1999. Before planting, the fertilisers were left the 10 cm depth. The pots were placed in 50×100 cm intervals.

In the experiment 5 different doses of mixed 15-15-15 fertilisers with and without zinc were used and a total of 40 pots were used 4 repeat experiments. The experiment was set according to split plot design.

In this study with zinc 15-15-15 and without 15-15-15 fertilisers were used. The doses of fertilisers are 25, 50, 75, 100 and 125 kg/da.

During the growth period, the surface of the soil was mixed to ensure an even and appropriate irrigation.

In the vegetation period, the ammonium nitrate was used in August 08, 1999 and the doses is 15 kg/da.

The harvest began on July 30, 1999 and ended on September 17, 1999.

The following criteria were noted and evaluated.

Yield (kg/da): It was found by weighting the whole plant.

Tomato height (cm/number): It was found by measuring the projection distance between the harvest point and the top of the tomato.

Tomato diameter (cm/number): It was found by measuring projection of the harvested plant.

Tomato number (number/plant): It was found by counting tomatoes obtained from a plant.

Tomato weight (g/number): The average weight is each of tomato.

Shoots number (number/plant): The average branch number is each of plant.

Dry matter (%): It is determined with manual refractometer.

COSTAT package programme was used in the statistical analyses of the data that were obtained during the experiment and grouping was made according to Duncan Multiple Comparative Test (Yurtsever, 1984).

Results and Discussion

The results of analysis of the soil which was used in this study were as follows; pH: 8,1; organic matter: 0,4%; lime: 5,2%; C.E.C.: 18,3 me/100g; Ca+Mg: 17,1 me/100g; K: 0,6 me/100g; Na: 0,2 me/100g; Fe: 1,8 mg.kg⁻¹; Mn: 2,4 mg.kg⁻¹; Zn: 1,0 mg.kg⁻¹; Cu: 1,2 mg.kg⁻¹; sand: 42,7%; silt: 35,9%; clay: 21,4%; available phosphorus: 2,8 kg P₂O₅ /da. The obtained parameters were shown in Table 1.

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Table 1: The Obtained Parameters

Fertiliser dose (kg/da)	Yield (kg/da)	Tomato height (cm/number)	Tomato diameter (cm/number)	Tomato Number (number/plant)	Tomato weight (g/number)	Shoots number (number/plant)	Dry matter (%)
25 -Zn	682	4,9	3,8	9	42,0	12	6,1
50 -Zn	854	5,0	4,0	10	43,7	14	6,1
75 -Zn	776	4,9	3,9	10	39,6	16	6,6
100 -Zn	728	4,8	3,7	10	36,6	17	7,3
125 -Zn	718	4,6	3,6	11	32,5	19	6,6
25 +Zn	664	4,7	3,7	10	35,6	13	6,1
50 +Zn	722	5,3	4,0	9	45,0	16	5,6
75 +Zn	906	4,8	3,6	13	35,5	16	6,4
100 +Zn	684	4,7	3,6	10	34,5	22	6,4
125 +Zn	650	4,6	3,5	10	31,7	16	7,3

As can be seen from Table 1, the yield increased when the dose was increased from 25 kg/da to 50 kg/da. The highest total yield was found with 50 kg/da of 15-15-15 fertiliser. The difference between the highest and the lowest yields was 25% with the same fertiliser.

The fertiliser with zinc resulted in increases in tomato yield with the increase in dose up to 75 kg/da, after which the yield started to decline gradually. The difference between the highest and the lowest yield values was about 39% with this fertiliser. The relationship between yield and fertilisers doses are shown in Fig. 1.

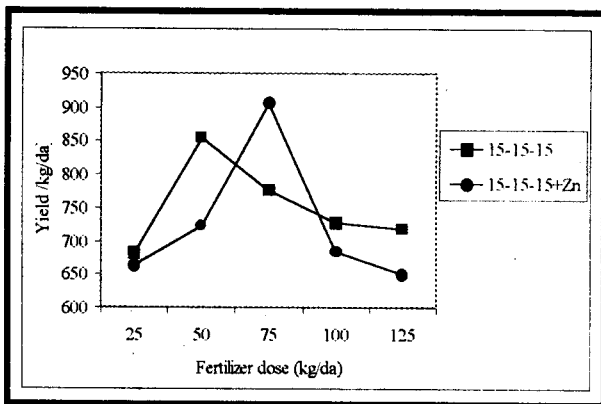
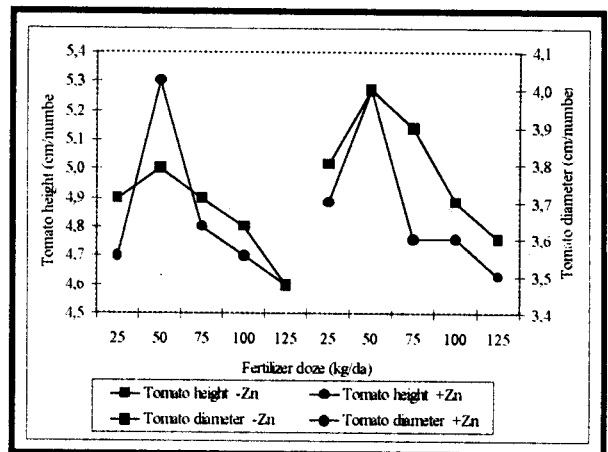


Fig. 1: the Relationship Between Yield and Fertilisers Doses

The result of the present study presented in Fig. 1 have revealed that the tomato yield gradually decrease with both of the fertilisers after the highest yield. Müftuoğlu *et al.* (1998) also found similar responses in lettuce yield with zinc containing fertiliser under Çanakkale condition. At all fertiliser doses, except for 75 kg/da, the 15-15-15 fertiliser without zinc gave higher yield values as compared to these obtained with the fertiliser with zinc. The fertiliser without zinc resulted in a higher tomato yield at only 75 kg/da dose, whereas the other one with zinc resulted in higher tomato yield values by 6% at other fertiliser doses. The decrease in yield with the fertiliser containing zinc was faster than that with the one without zinc after the highest yield had occurred. When the yield values were examined, it was found that the yield with zinc containing fertiliser

decreased from 906 kg to 684 kg by 24,5% and then to 650 kg by 28%, and the other hand, it declined from 854 kg to 776 kg by 9,1% and than to 718 kg by 15,9% with the fertiliser without zinc. Therefore, care should be taken in the application of zinc. A similar suggestion has been proposed for broccoli by Müftuoğlu *et al.* (2000), although increases in yield up to 34% with zinc containing fertiliser were found until the highest yield was achieved. There is no difference mixed fertiliser (15-15-15) with or without zinc on the yield as statistical.

Although the height and diameter of the product were numerically different, no effect of fertilisers and their dose was found. The relationship between plant height and diameter, and fertilisers doses is presented in Fig. 2.



Figs. 2: The Relationship Between Plant Height and Diameter, and Fertilisers Doses

The highest fruit number and yield were found with 75 kg/da of 15-15-15 fertiliser with zinc. Similarly, the highest branch number with 100 kg/da of 15-15-15 fertiliser with zinc and dry matter content with 100 kg/da of 15-15-15 fertiliser without zinc and 125 kg/da of 15-15-15 fertiliser with zinc were obtained. Though the results were numerically different, the fertiliser composition and dose had no effects on fruit number, branch number and dry matter content. When all values were studied, it was seen that the highest yield was obtained with the use of 15-15-15 with zinc fertiliser at the dose of 75 kg/da.

However, there was a sharp decrease in yield after the highest yield when this fertiliser was applied.

As a result, 15-15-15 zinc added fertilisers led to 6% increase compared to 15-15-15 fertiliser in the highest yield. However, 15-15-15 zinc added fertiliser also led to a decrease in total yield after a certain dose, which made us consider that this fertiliser should be used more carefully.

Although nitrogen was thought to be responsible for the decrease in yield with 15-15-15 fertiliser without zinc, the decline in yield with fertiliser with zinc was thought to have been brought by zinc, which was supposed to support this negative effect as a result.

The continuous increase in the use of zinc containing fertilisers in order to increase tomato yield could create potential problems in the future, which may affect farmers economically in a negative way. In view of the present results, 15-15-15 fertiliser at a dose of 50 kg/da could be used instead of the corresponding fertiliser with zinc.

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