

Effect of a soil conditioner (Azomite) from Shanghai (Tomato in Shanghai)

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1. Introduction:

Azomite is a natural mineral soil conditioner that contains silica and various rare earth elements. Previously it has been shown to increase the growth rate of crops, improve yield, and quality of the produce. The purpose of this field trial is to study the effect of Azomite on the growth, production, and quality of Tomato in a small-plot-trial, thereby establishing scientific evidence for further application and promotion of the product.

2. Material and Methods:

- a) Test site: The test was conducted in a production greenhouse of Shanghai Agriculture Science Institute. Total size of the plots was 400 m<sup>2</sup>. The soil had a basic fertility strength at 26.3mg/kg organic content, total nitrogen 1.75 mg/kg, effective P 76.2mg/kg, effective K 120.0mg/kg, pH7.9.
- b) Fertilizer: Soil conditioner Azomite is provided by Shanghai Lytone Biochemical, Ltd. The product contained 62.92% SiO<sub>2</sub>. A commercial Silica fertilizer was purchased from the market, containing 41.28%. The combination fertilizer was provided from the fertilizer department of SAAS and contained N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O=15:15:15.
- c) Crop: HeZuo 903 tomato seeds were used.
- d) Design and Treatments:
  - i. Design: There were 4 treatments. Treatment 1: CK (Blank), Treatment 2: Combination Fertilizer 50kg/Mu(667m<sup>2</sup>), Treatment 3: Silica fertilizer 30kg/Mu + combination fertilizer 50kg/Mu, Treatment 4: Azomite 30 kg/Mu + combination fertilizer 50kg/Mu. Each treatment was triplicated. Each replicate plot was 30 m<sup>2</sup> in size, randomly located in the green house.
  - ii. Field management: Azomite and the combination fertilizers were mixed together on Feb 22, 2006 and applied into soil according to plan. The tomato seedlings were fix planted on March 29, 2006, and the recording started. An additional application of fertilizer was performed on April 27 with a combination formula at 40kg/Mu on all the treatment groups except Treatment 1. Harvesting started on May 11, and finished on July 10. The amount of tomato harvested each day was recorded individually, then summarized together at the end. Vitamin C, total acidity, soluble sugar ect were tested. Pest control and moisture management were identical among all the treatments.

3. Results and Analysis:

- a) Effect of Azomite on the growth and other biological properties of Tomato:

The biological properties and characteristics of Tomato were studied on March 29, 2006. Parameters included height of plants, total number of leaves, flowers, and fruits. It was apparent that Azomite was able to improve the growth, physiological development when compared against the other treatment groups. The plant height of Azomite group was taller than the Blank, Normal Fertilizer, and Silica fertilizer groups by 5.18 cm, 3.68cm and 0.66cm respectively. Total number of leaves, flower and fruits were also higher with

Azomite group when compared against the other groups. For results please see Table 1.

Table 1. Effect of various treatments on the biological properties of Tomato.

treatment	Plant height (cm)	Leaves/plant	flower/plant	Fruit/plant
1 (Blank)	41.06	10.93	1.23	0.40
2(Normal fertilizer)	42.56	10.70	1.53	0.63
3(Silica fertilizer)	45.58	11.08	2.03	0.66
4(Azomite fertilizer)	46.24	11.09	2.29	0.86

There was no significant difference between Treatment group 1 and 2 in terms of biological properties. But both of them were significantly different from those of Treatment 3 (Normal fertilizer only), in terms of plant height, stem diameter, color of leaves, number of fruits per plant, and average weight of individual fruit. The blank group without any fertilizer was the worst off, for obvious reason. Pathogen infection status was inspected on June 20<sup>th</sup>. The infection rate was 4.8%, 6.1%, 7.2%, and 5.8% for treatment groups 1, 2, 3, and 4, respectively. It seems Azomite was able to reduce infection on Tomato, probably by increasing resistance of the plant. It was also observed that tomato from Azomite group had significantly less cracked skin or blemish skin that would render the fruit at a lower market value.

b) Effect of various treatments on the quality of Tomato:

Azomite groups yielded tomato fruits with better quality. In terms of mouth feel, the Azomite tomato has a finer tissue while more juicy, and sweeter flavor. Those from the other groups were all rather flat and acidic in flavor. The test results showed that Azomite tomato had a higher vitamin C content than the blank, normal fertilizer, and silica fertilizer groups by 27.03%, 24.09%, and 10.20%, respectively. Soluble sugar level was also higher by 30.34%, 26.00%, and 16.31%, respectively. Azomite group tomato was lower in acidity than the other groups. The ratio of sugar and acid influence the mouth feel of tomato significantly. This study indicated that Azomite could improve the sugar/acid ratio and improve mouth feel of tomato. Details of the results are shown in Table 2.

Table 2. Effect of various fertilizers on the quality of tomatoes

Treatment	Vitamin C(mg/kg)	Soluble sugar(%)	Total acidity(%)	Sugar/acid ratio
1 (Blank)	106.69	2.90	0.503	5.77
2(Normal fertilizer)	109/22	3.00	0.460	6.52
3(Silica fertilizer)	122.98	3.25	0.475	6.83
4(Azomite fertilizer)	135.53	3.78	0.427	8.87

c) Effect of various treatments on the yield of Tomato:

- i. Original data on the yield of different treatments and their analysis are shown in Table 3 and Table 4. Multiple factor comparison are shown in Table 5. F value analysis (Table 4) indicated that the yield difference among different groups were significant (higher than 5%) ( $F=6.48$ ,  $F_{0.05}=4.76$ ). Multifactor analysis (Table 5) indicated significant difference between the Azomite group and the other groups, while Silica fertilizer group did not show any significant difference with the normal fertilizer group.

Table 3. Yield of Tomato from different treatments (kg/plot).

Treatment	Replicate 1	Replicate 2	Replicate 3	Total	Average.
1 (Blank)	170.2	187.4	179.8	537.4	179.1
2(Normal fertilizer)	183.5	189.2	190.5	563.2	187.7
3(Silica fertilizer)	194.2	187.7	198.3	580.2	193.4
4(Azomite fertilizer)	205.5	196.4	201.6	603.5	201.2
total	753.4	760.7	770.2	2284.3	

Analysis of the data above is shown in Table 4 and Table 5.

Table 4. Statistical analysis on the effect of Azomite on Tomato.

Comparison	Degree of freedom	Summation of Square	Average square	F value	$F_{0.05}$	$F_{0.01}$
between treatment groups	3	35.48167	17.74083	0.444153	5.143253	10.92477
Between replicates	2	776.8892	258.9631	6.483306	4.757062	9.779538
Variance	6	23.96583	39.94306			
Total D.F.	11	1052.029				

Table 5. Multiple comparison of Tomato yield in various plots (LSD method)

Treatment	Average yield (kg/plot)	Significance	
		5%	1%
1Azomite	201.2	a	A
2 Si	193.4	ab	AB
3 Normal	187.7	bc	AB
4 Blank	179.1	c	B

According to the cumulated yield data, Azomite improved the tomato yield significantly. Azomite unit yield was higher than the blank, normal fertilizer, and Silica fertilizer group by 12.34%, 7.19% and 4.03% respectively. Profit gained by Azomite group was higher than the blank, normal fertilizer, and silica fertilizer group by 458.0 CNY/MU, 360.2 CNY/MU, and 200.1 CNY/MU, respectively.

ii. Economic analysis of the various treatments:

Table 6, Economic analysis of different treatment groups

Treatment	Yield (Kg/667m <sup>2</sup> )	Value (CNY/667m <sup>2</sup> )	Gross profit (CNY/667m <sup>2</sup> )
1 (Blank)	3982.0	5973.0	5973.0
2(Normal fertilizer)	4173.2	6259.8	6070.8
3(Silica fertilizer)	4299.9	6449.9	6230.9
4(Azomite fertilizer)	4473.3	6710.0	6431.0

Note: Tomato price 1.5 CNY/kg, Azomite 3.0CNY/kg, Commercial SiO<sub>2</sub> fertilizer 1.0 CNY/kg, Normal combination fertilizer is 2.1 CNY/kg.

4. Conclusion:

- a) Azomite soil conditioner was able to provide significant enhancement in growth rate, development, fruiting rate, and size of the fruit.
- b) Azomite soil conditioner was able to significantly increase the content of vitamin C, soluble sugar and sugar/acid ratio in tomato, reduce the amount of organic acids, and improve the quality of tomato in general.
- c) Azomite soli conditioner is able to increase the yield of tomato significantly. The increase when compared with blank, normal fertilizer, and silica fertilizer groups were 12.34%, 7.195, and 4.03% respectively.

Study was conducted under supervision of Environmental Sciences Research Institute, Shanghai Agriculture Academy of Science, by Lu Wei-Guang, pH.D, Associate Scientist, and Shen Guo-Hwei, Deputy Director.