

AZOMITE® and Coffee & Cacao

AZOMITE TESTING ON THE GROWTH OF COFFEE AND CACAO

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Report Summary

Nutrients loss in coffee and cocoa farming system is one of main problems encountered by planters. AZOMITE as a natural mined mineral product has shown significant increase in growth and yield of many crops, on the other hand results on coffee and cocoa are not yet known. The objective of this greenhouse study is to investigate the effect of AZOMITE on the growth of coffee and cocoa. The experiment was carried out in a greenhouse of Indonesian Coffee and Cocoa Research Institute, Jember, East Java. Randomized complete block design in factorial was used to laid the combination treatments with four replications. Both for coffee and cocoa, there were five levels of AZOMITE factor, i.e. 0, 10, 15 and 20 g/pot/month which combined with two levels of NPK (16-16-16) fertilizer factor, i.e. 0 and 5 g/pot/month. In every plot there were 3 plants. Parameters observed were plant growth, nutrient foliar content and soil pH. Results of this experiment showed that addition of AZOMITE 10-15 g/pot/month significantly increased growth of coffee plants and tended to increase cocoa growth. Application of AZOMITE significantly increased pH of soil, on the other hand addition of NPK (16-16-16) fertilizer reduced soil pH significantly.

Introduction

The growth of coffee and cacao plants is strongly affected by the physical, chemical and biological characteristics of the soil. These three soil characteristics play a role to keep the balance of nutrients required by plants.

At present soil quality as natural resource has deteriorated. This degradation in soil fertility is caused by the reduction in soil nutrient content through, among others, absorption by plants which is then lost through harvests, fixation in the soil into compounds that are difficult to be absorbed by plants, and leaching.

One of the efforts to improve soil fertility is through addition of nutrients required by plants through anorganic fertilization by using chemicals that are easily dissolved in the soil and absorbed by plant roots.

Addition of nutrients will not be effective if not followed by good soil management since not all nutrients in the soil are readily available and absorbable by plants, e.g.: nitrogen can be leached and volatilized, phosphorus will become unavailable if it is fixated in the soil, and calcium can be leached away and fixated by clay.

With conditions as mentioned above, efforts are needed to reduce the loss of nutrients in the soil by adding soil ameliorants. One such ameliorant that can slow the loss of nutrients in the soil is AZOMITE, a mineral of the hydrated aluminosilicate group containing alkaline cations.

AZOMITE is a mineral that works to return the balance of nutrients required by plants in order to maximize growth potential and crop production. AZOMITE contains complete micro-minerals and functions as an active metabolism catalyst required for plant growth. AZOMITE contains elements essential to plants, such as: N 0.15 %, P₂O₅ 0.15 %, K₂O 5.23 %, CaO 0.67 %, MgO 0.78 %, S 240 ppm, Cu 12 ppm, Zn 64 ppm, Fe₂O₃ 1.37 %, Mn₂O₃ 0.02 %, B 29 ppm, and Mo 12 ppm.

The aim of this research is to reveal the effects of AZOMITE on the growth of coffee and cacao.

Methodology and Materials

Research was conducted in the Greenhouse of the Indonesian Coffee and Cacao Research Centre in Jember. This experiment employed a random group design with the following treatments:

Coffee :

- A1 = control (no AZOMITE)
- A2 = AZOMITE 5 g/polybag/month
- A3 = AZOMITE 10 g/polybag/month
- A4 = AZOMITE 15 g/polybag/month
- A5 = AZOMITE 20 g/polybag/month

Cacao :

AZOMITE factor:

- A1 = control (no AZOMITE)
- A2 = AZOMITE 5 g/polybag/month
- A3 = AZOMITE 10 g/polybag/month
- A4 = AZOMITE 15 g/polybag/month
- A5 = AZOMITE 20 g/polybag/month

NPK Fertilizer Factor:

- P1 = control (no NPK fertilizer)
- P2 = fertilized with NPK 16-16-16 5 g/polybag/month

Each plot was planted with three plants, and repeated four times. The parameter monitored is plant growth, including: plant height, number of leaves, diameter of stem, wet and dry weights of the roots, stems and leaves; levels of nutrients N, P and K in the leaves, as well as soil pH levels.

Chemical and physical characteristics of the soil considered in the experiment are as follows: C organic 1.38 % (low), N total 0.28 % (medium), P₂O₅ Bray I 11 ppm (low), K exchanged 0.98 me/100 g (medium), Ca exchanged 19.80 me/100 g (high), Mg exchanged 10.10 me/100 g (high), SO₄ 12 ppm (low), Cu 26 ppm (medium), Zn 8 ppm (medium), Fe 8 ppm (medium), Mn reduced 148 ppm (medium), KPK 33.80 me/100 g (high), KB 92 % (high), pH (H₂O) 5.9 (medium), and the silty clay texture.

Research Period

Research was conducted from September 2005 until July 2006.

Research Results

Coffee

Results of observation on the growth of leaves, plant height, stem diameter, wet and dry weight of the roots, stems, and leaves at the age of 8 months are seen in Table 1.

Treatment	Number of leaves	Plant height (cm)	Stem diameter (mm)	Wet weight (g)			Dry weight (g)		
				Root	Stem	Leaf	Root	Stem	Leaf
A1	40.8 a	51.2 a	6.7 a	8.3 a	13.7 a	22 a	3.7 a	7.8 a	6.7 a
A2	36.2 a	53.7 a	6.8 a	9.1 a	14.4 a	21 a	3.8 a	7.4 a	7.2 a
A3	39.0 a	56.4 a	7.0 a	9.6 a	15.9 a	23 a	3.9 a	7.8 a	8.1 a
A4	39.6 a	55.5 a	7.1 a	9.5 a	16.2 a	23 a	4.3 a	8.2 a	7.1 a
A5	36.3 a	55.0 a	7.0 a	7.5 a	14.2 a	19 a	3.5 a	6.8 a	7.4 a

Notes : numbers in the same column when followed by the same letter do not show a clear difference according Tukey Test at 5% level.

To make it easy to draw a conclusion the data in Table 1 is analyzed using cluster observations. From these cluster observations (Dendrogram 1) it can be concluded that the best growth for coffee is obtained with AZOMITE treatment with 10-15 g/polybag/month dosage. This can be observed from the parameters of stem diameter, plant height, wet weight of the roots, stems and leaves, as well as the dry weight of roots.



Gambar 1. Coffee Growth with AZOMITE Treatment

Results of observations of nutrient levels of coffee leaves are seen in Table 2.

Table 2. Coffee Leaves Nutrient Levels with AZOMITE Treatment

Treatment	N		P		K	
	Level (5)	% Relative to Control	Level (%)	% Relavite to Control	Level (%)	% Relavite to Control
A1	3.05	100	0.17	100	2.24	100
A2	3.17	104	0.17	100	2.37	106
A3	3.09	101	0.15	88	2.25	100
A4	3.05	100	0.17	100	2.25	100
A5	2.92	96	0.19	112	2.29	102

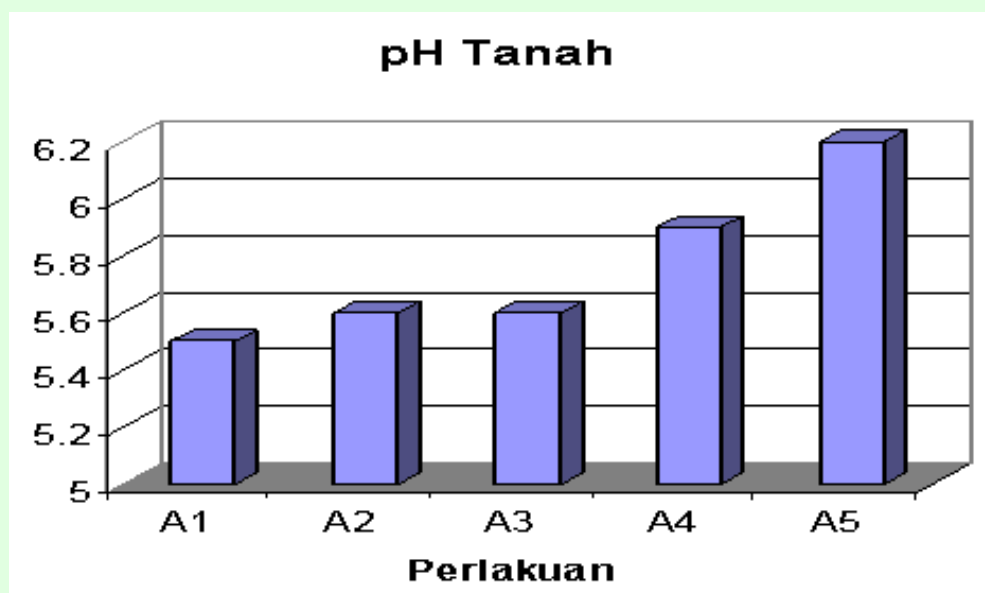
From Table 2 it is apparent that the application of AZOMITE 5 g/polybag/month tends to increase the levels of N and K nutrients in leaves. Meanwhile the levels of nutrient P only increases upon application of AZOMITE 20 g/polybag/month

Results of soil pH observations for coffee are seen in Table 3

Table 3. pH of Soil with AZOMITE Treatment for Coffee.

Treatment	pH (H ₂ O)	
	pH Levels	% Relative to Control
A1	5.5	100
A2	5.6	102
A3	5.6	102
A4	5.9	107
A5	6.2	113

From Table 3 and Figure 2 it is apparent that application of AZOMITE can increase the pH of the soil. The higher the dosage applied the higher the pH increase in the soil.

**Figure 2. pH of Soil of Coffee due to AZOMITE Treatment**

Cacao

Results of observations on the increase in the number of leaves, plant height, stem diameter, wet weight as well as dry weight of the roots, stems, and leaves at the age of 5 months are seen in Table 4.

Table 4. Growth of 5-month old cacao with AZOMITE treatment

Treatment	Leaf Count	Plant Height (cm)	Stem Height (mm)	Wet Weight (g)			Dry Weight (g)		
				Root	Stem	Leaf	Root	Stem	Leaf
A1	21.4 a	46.3 a	9.62 b	7.4 b	22.5 c	21.8 b	3.2 c	7.7 a	8.6 b
A2	22.6 a	50.5 a	9.74 b	7.6 b	23.2 bc	22.7 ab	3.6 bc	8.4 a	8.4 ab
A3	22.6 a	54.2 a	9.83 b	7.6 b	24.8 abc	24.3 ab	4.0 ab	8.2 a	8.7 ab
A4	21.3 a	54.9 a	10.28 a	8.2 ab	27.3 a	25.7 a	4.3 a	9.3 a	9.9 a
A5	23.4 a	51.4 a	10.29 a	9.1 a	26.2 ab	24.8 ab	4.6 a	9.3 a	9.4 a
P1	22.2 a	50.1 a	9.69 b	8.4 a	22.5 b	25.4 a	4.4 a	7.0 b	8.9 a
P2	22.3 a	52.9 a	10.21 a	7.6 a	27.1 a	22.3 b	3.5 b	10.1 a	8.7 a

Notes : numbers in the same column and factor when followed by the same letter do not indicate a clear difference according to Tukey Test at 5% level.

To make it easy to draw a conclusion, data in Table 4 was analyzed using cluster observations. From the results of these cluster observations (Dendogram 2) it can be concluded that cacao growth is best obtained with AZOMITE treatment at 20 g/polybag/month dosage. This is apparent from the parameters of plant height, stem diameter, wet weight of the roots and stems, as well as dry weight of the roots and leaves (Figures 3, 4, 5 and 6). Meanwhile, NPK 16-16-16 fertilizer with dosage of 5 g/polybag/month may accelerate the growth of the stem, wet weight and dry weight of the cacao stem.



Figure 3. Growth of Cacao with AZOMITE Treatment, without NPK Fertilizer



Figure 4. Growth of Cacao with AZOMITE Treatment, Fertilized with NPK



Figure 5. Growth of Cacao Stems with AZOMITE Treatment



Figure 6. Growth of Cacao Roots with AZOMITE Treatment

Results of nutrient level observations of cacao leaves are seen in Table 5.

Table 5. Nutrient Levels in the Leaves of Cacao with AZOMITE Treatment						
Treatment	N		P		K	
	Level (5)	% Relative to Control	Level (5)	% Relative to Control	Level (5)	% Relative to Control
A1	2.39	100	0.14	100	1.57	100

A2	2.26	95	0.10	71	1.44	92
A3	2.3	96	0.11	79	1.46	93
A4	2.1	88	0.13	93	1.43	91
A5	2.02	85	0.12	86	1.53	97
P1	1.71	100	0.14	100	1.56	100
P2A	2.71	158	0.10	71	1.41	90

From Table 5 it is apparent that application of AZOMITE 5-20 g/polybag/month tends to lower the nutrient levels of N, P and K in the leaves. Fertilization by NPK 16-16-16 5 g/polybag/month also tends to lower the nutrient levels of P and K, but at the same time increase the level of N in cacao leaves.

Results of soil pH observations on cacao plant are seen in Table 6.

Table 6. pH of the Soil with AZOMITE Treatment on Cacao Plant.

Treatment	pH (H2O)	
	Nilai pH	% Relative to Control
A1	4.86 c	100
A2	5.13 b	106
A3	5.12 b	105
A4	5.29 ab	109
A5	5.44 a	112
P1	6.04 a	100
P2	4.30 b	71

From Table 6 and Figure 7 it is apparent that the application of AZOMITE can increase the pH of the soil. The higher the dosage applied the higher the pH increase.

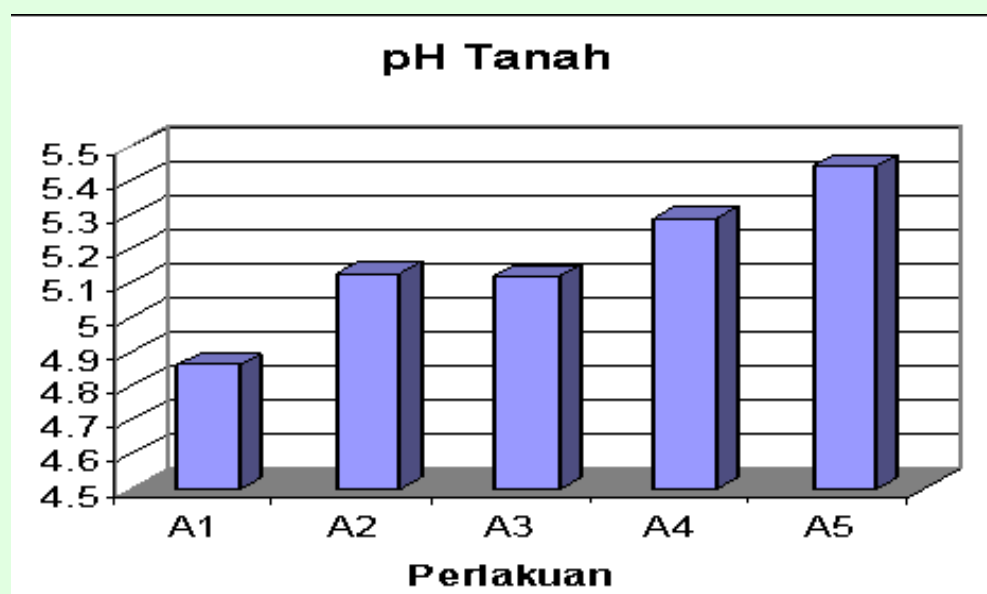


Figure 7. pH of the Soil in Cacao Plants After Treatment of AZOMITE

Conclusion

- Application of AZOMITE at dosage of 10-15 gram/polybag/month tends to improve the growth of coffee.
- Application of AZOMITE at dosage of 20 gram/polybag/month clearly improves the growth of cacao.
- Application of AZOMITE on coffee or cacao can clearly increase the pH of soil.
- Application of NPK 16-16-16 fertilizer clearly lowers the pH of the soil.



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