Effect of Cascade Minerals on Greenhouse Tomato

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Introduction

Cascade Minerals Remineralizing Soil Booster (CM) is finely ground basalt that is produced from a Miocene Columbia River formation near Madras, Oregon, USA. Laboratory analysis shows that the source of CM is high in iron, calcium, magnesium, and manganese. Previous research has shown that the nutrients in CM are available for plant uptake and can increase nutrient content in various plant species.

The existing scientific literature dealing with the use of crushed basalt as a natural fertilizer and soil amendment has dealt with extremely fine particle sizes (e.g. 88% passing 0.1 mm). Particle sizes in this range are typically a by-product from aggregate production. The manufacturing process for CM is different than this because it allows for the production of a range of particle sizes. The particle size that CM is ground to will likely influence nutrient availability and soil structural benefits. One greenhouse trial was conducted to evaluate the effect different particle sizes of CM on tomato yield and nutrient content in bark-based potting soil.

Other than CM there are competing commercially available rock mineral products. These other products differ from CM in particle size, source, and available nutrients. A second greenhouse trial was conducted to compare three competing rock minerals blended with coconut coir for growing tomato.

Methods

The particle size trial consisted of four treatments in bark-based potting soil. Treatments are listed in Table 1. The competing rock mineral trial consisted of six treatments in coconut coir. Treatments are listed in Table 2.

The methods described apply to both trials. Mineral products were blended by hand with potting media prior to planting. In order to supply sufficient nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) each pot was fertilized with Osmocote slow release fertilizer (19-6-12) at the rate specified on the label. The fertilizer was derived from coated ammonium nitrate, ammonium phosphate, calcium phosphate, and potassium sulfate. The coating provided 16% slow release N, 5% slow release P_2O_5, and 10% slow release K_2O.

Tomato (*Solanum lycopersicum)* seeds were planted in each pot and thinned after emergence to 1 plant per pot. Pots were 3.5 inches and planting date was June 26, 2012. Plants were repotted into 1-gallon pots on August 7, 2012 and additional fertilizer was incorporated. Treatments were arranged in 6 randomized complete blocks (reps).

Tomatoes were harvested from September 25 to October 29, 2012; fruit count and weight are shown in Tables 1 and 2. Fruit harvested on October 9 was analyzed with a refractometer for sweetness (data not shown). During the final fruit harvest, vine samples were collected for nutrient analysis (Tables 1 and 2). Harvested vine material was oven-dried at 70°C and sent to the Oregon State University-Central Analytical Laboratory for nutrient analysis. Nutrient analysis included N, P, K, calcium (Ca), magnesium (Mg), manganese (Mn), copper (Cu), boron (B), zinc (Zn), iron (Fe), sodium (Na), carbon (C, data not shown), and S (expressed as N:S ratio).

Results and Discussion

Based on the statistical analysis in Table 1, it appears that 6 replications may not have been adequate to verify the treatment effects. Nevertheless, there were some noticeable effects of CM on tomato growth and nutrient content and there also appear to be differences between the fine and coarse textured product.

Tomato fruit yield in the bark mix potting soil was 52% higher with the addition of CM coarse, while CM fine had little noticeable effect on fruit yield. In my opinion the increased yield with CM coarse is likely the result of physical alteration of the potting soil, that allowed for a more favorable balance between water-holding capacity and porosity.

The only statistically significant differences in vine nutrient content in Table 1 were for Mn, Cu, and Na. The low and high rates of CM fine increased vine Mn content by 72 and 76% respectively. Vine Cu content increased with all three CM treatments. Vine Na content was reduced with the high rate of CM fine and with CM coarse. Sodium reductions in plant tissue often occur as a result of increased plant available silicon. There was also an obvious trend for increased vine Fe.

Table 1. Tomato yield and vine nutrient content from greenhouse-raised plants grown in brand name bark-based potting mix amended with Cascade Minerals, 2012.

Treatment	Mineral rate	Tomato yield		N	P	K	Ca	Mg	Mn	Cu	B	Zn	Fe	Na	N:S
	% by vol.	Count	Grams	------------------ % ------------------					--------------------- ppm ---------------------						Ratio
Bark mix	0	3.7	114.6	2.07	0.24	2.49	1.15	0.77	110	4.6	49	20.1	96	0.54	7.04
Bark mix + CM fine[1]	15	3.5	100.9	1.81	0.29	2.55	1.24	0.64	189	6.7	58	19.0	145	0.51	5.83
Bark mix + CM fine	30	2.3	96.7	2.09	0.34	2.74	1.62	0.72	192	6.8	66	17.5	176	0.35	6.18
Bark mix + CM coarse[2]	15	6.3	174.5	1.90	0.32	3.20	1.77	0.74	112	5.8	79	18.6	156	0.41	6.05
LSD (p=0.05)		NS	NS	NS	NS	NS	NS	NS	62	0.5	NS	NS	NS	0.13	NS
CV		67	71	18	22	16	32	15	34	10	33	22	36	24	14

Note: data shown are an average from 6 replications.

1 CM fine = Cascade Minerals, where 100% passes a US #30 sieve (0.6 mm).

2 CM coarse = Cascade Minerals, where 100% passes a US #16 sieve (1.2 mm).

Table 2. Tomato yield and vine nutrient content from greenhouse-raised plants grown in coconut coir with different minerals, 2012.

Treatment	Mineral rate	Tomato yield		N	P	K	Ca	Mg	Mn	Cu	B	Zn	Fe	Na	N:S
	% by vol.	Count	Grams	------------------ % ------------------					--------------------- ppm ---------------------						Ratio
Coconut	0	1.5	53.6	2.67	0.25	2.88	1.30	1.24	56	4.6	76	26	124	0.39	6.30
Coconut + CM fine[1]	15	4.3	141.3	2.00	0.26	3.25	1.47	0.72	157	8.3	60	22	142	0.41	5.96
Coconut + CM coarse[2]	15	4.7	165.0	2.71	0.31	3.43	1.39	0.81	76	5.0	77	22	135	0.32	6.70
Coconut + Excelerite	15	0.8	22.5	1.86	0.20	3.21	2.18	0.65	96	4.7	51	20	89	0.29	5.43
Coconut + Gaia Green	15	5.3	153.6	1.81	0.23	3.55	1.22	0.64	143	8.3	55	19	117	0.52	5.75
Coconut + Azomite	15	0.8	31.0	2.08	0.21	3.66	2.68	0.65	104	4.4	60	20	114	0.29	5.70
LSD (p=0.05)		1.9	62	0.58	0.06	0.49	0.37	0.13	32	1.1	21	NS	35	0.11	NS
CV		56	55	20	20	11	17	13	23	14	26	20	22	24	12

Note: data shown are an average from 6 replications.

1 CM fine = Cascade Minerals, where 100% passes a US #30 sieve (0.6 mm).

2 CM coarse = Cascade Minerals, where 100% passes a US #16 sieve (1.2 mm).