



Porous Inorganic Amendments - Unpacking How They Really Work

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EnviroTech
SOIL SOLUTIONS

LA CES Landscape Architecture Continuing Education System

IPIA Mineral Properties

Mineral	Porosity	Absorbency	Dry Density	Saturated Density	Pore Size	C.E.C.
Calcined Clay	74%	57-90%	40 lbs./cu. ft.	63 lbs.	0.045 microns	9-33 meq/g
Calcined DE	82%	114-142%	25 lbs./cu. ft.	53 lbs.	0.36 microns	6-27 meq/g
Zeolite	52%	30%	46 lbs./cu. ft.	60 lbs.	0.0005 microns	80-120 meq/g

C.E.C. - Cation Exchange Capacity

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USGA Green Committee:

“Porous inorganic amendments such as *calcined clays* (porous ceramics), *calcined diatomites*, and *zeolites* may be used in place of or in conjunction with peat moss in root zone mixes, provided that the particle size and performance criteria of the mix are met... Polyacrylamides and reinforcement materials are not recommended.”

Since 1983, the USGA has spent \$25 Million on Research Studies

Source:
USGA Recommendations For A Method Of Putting Green Construction
The USGA Green Section Staff

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Internally Porous Inorganic Amendments (IPIA's)

Material	Source Count
Calcined Clay	3 sources
Calcined Diatomaceous Earth	1 source
Zeolite (not calcined)	3 sources

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Additional Findings:

“Water stored in soil pore spaces is the easiest for the plant to extract, while water stored in the film around soil particles is much more difficult for the plant to withdraw.” (Risinger and Carver, 1987)

“Plant growth depends upon a renewable supply of soil water, which is governed by the movement of water in the soil, the soil-water holding capacity, the amount of soil water that is readily available to plants, and the rate at which soil water can be replenished.” (Duke, 1987)

Source:
water.epa.gov




Performance of Inorganic Amendments | George Serrill | EnviroTech Soil Solutions

Inter-Active Pores	vs.	Closed-Cell Pores
Calcined Clay Absorbs 90%		Pumice Absorbs 15%
Calcined DE Absorbs 142%		Vitrified Shale (Expanded Clay) Absorbs 8-20%
Zeolite Absorbs 30%		Perlite Absorption N/A

Inter-Active Pores are more porous and absorbent.

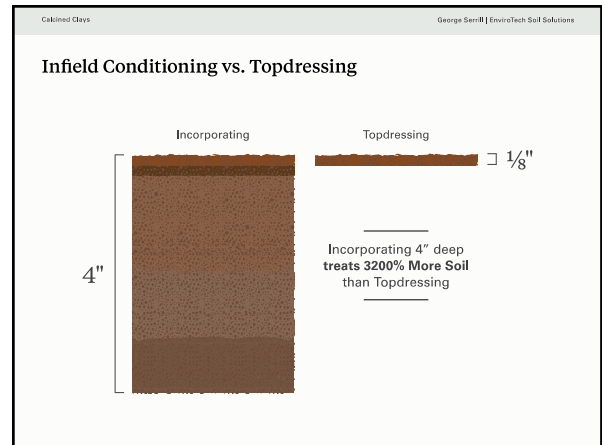
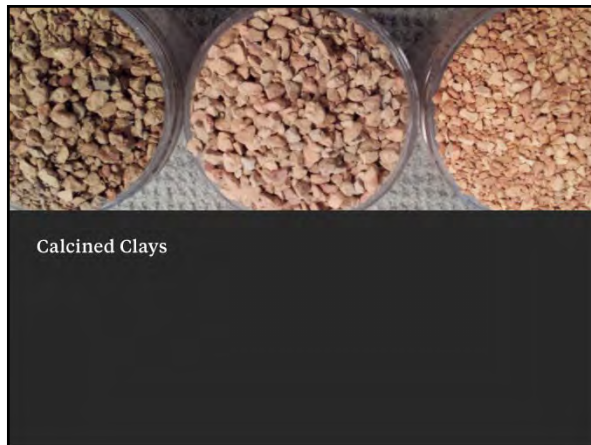
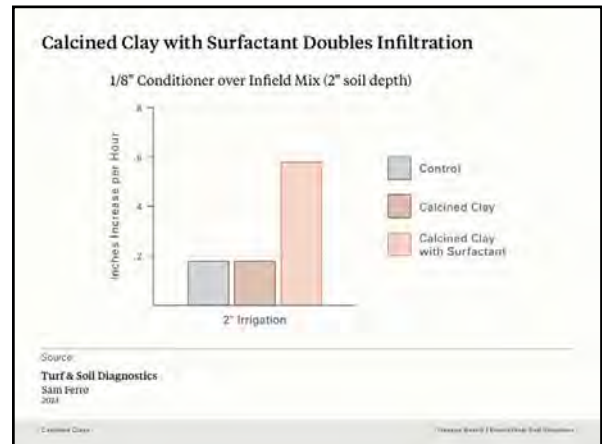
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Cost Estimate*

	 Calcined Clay	 Calcined DE	 Zeolite
Cost/Ton	\$430	\$702	\$395
Cu. Yds./Ton	+ 1.85	+ 2.96	+ 1.61
Cost/Cu. Yd.	\$233	\$237	\$245
<i>Bioswale & Rooftop Rate</i>			
Added Cost/Cu. Yd.	× 20% \$46	× 10% \$24	× 10% \$24
<i>Turfgrass Rate</i>			
Cost/Sq. Ft. (6" deep)	\$0.86	\$0.43	\$0.45
<i>Planting Backfill Rate</i>			
Cost/1 Gallon	× 20% \$0.68	× 15% \$0.53	× 10% \$0.35
Cost/5 Gallon	\$2.89	\$2.63	\$1.81

*These numbers combine the product costs and freight costs for a project in Phoenix, AZ.

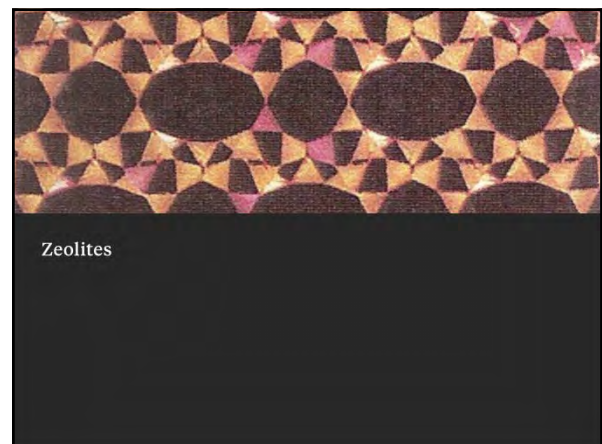
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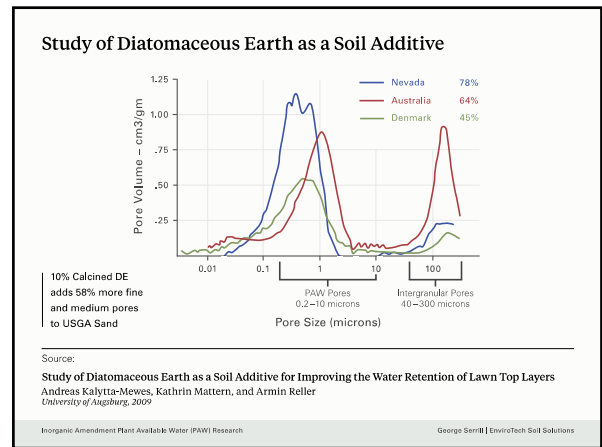
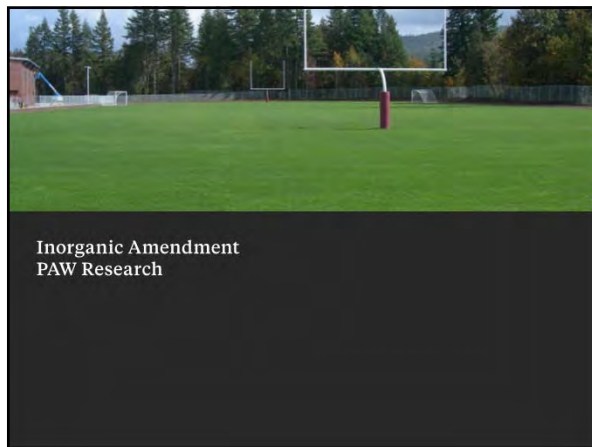
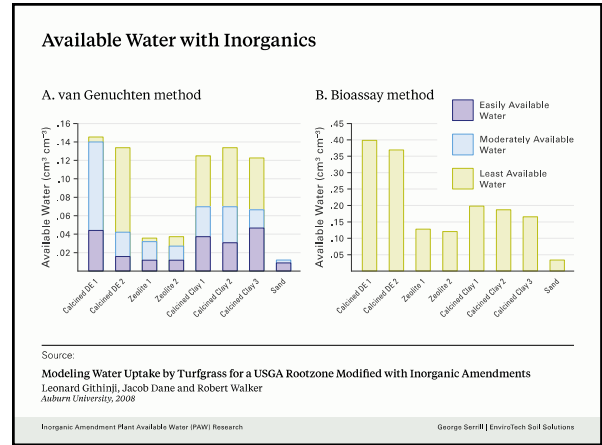
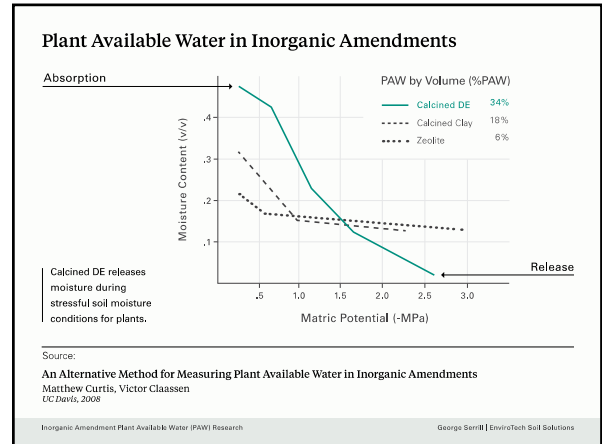
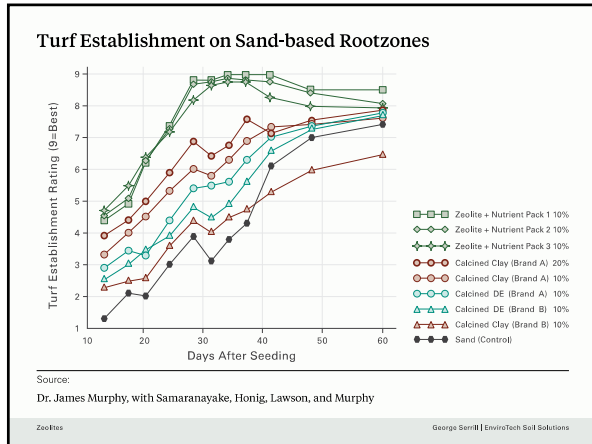


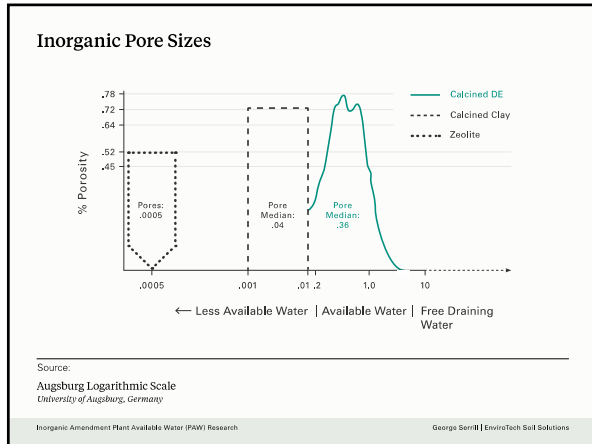
Infield Product Comparisons

PRODUCT	ABSORPTION % Wt. H2O	BULK DENSITY lbs/cu. ft.	VOLUME PER TON	RATES BY VOLUME	-80 MESH	-200 MESH
Calcined DE	110%	25 lbs.	3.0 yds.	10%	—	—
Calcined Clay A	70%	40 lbs.	1.8 yds.	20%	—	—
Calcined Clay B	57%	41 lbs.	1.8 yds.	20%	—	—
Calcined Clay C	53%	42 lbs.	1.8 yds.	20%	10%	—
Zeolite	30%	46 lbs.	1.6 yds.	—	—	—
Vitrified Clay	14%	79 lbs.	0.9 yds.	25-100%	13.2%	11.9%
Vitrified Shale	15%	61 lbs.	1.2 yds.	25-100%	—	—
Limestone	4%	59 lbs.	1.25 yds.	25-100%	25-35%	15-25%
Sandstone	20%	75 lbs.	0.9 yds.	25-100%	19.4%	—
Lava Cinders	17%	65 lbs.	1.1 yds.	25-100%	26.5%	—
Pumice	15%	57 lbs.	1.3 yds.	25-100%	37.5%	—

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Mineral Properties Dictate Amendment Strengths

INORGANIC	PRIMARY PROPERTY	PRIMARY STRENGTH
Calcined Clay	Pore Size & Color	Infield Conditioner
Calcined DE	Pore Size & PAW	Water Management
Zeolite	Pore Size & CEC	Nutrient Management

ALL IPIA's Increase Nutrient Retention, Porosity, Permeability, Water Holding, & Available Water to Reduce Irrigation

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Thank You!

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