WESTERN Pozzolan

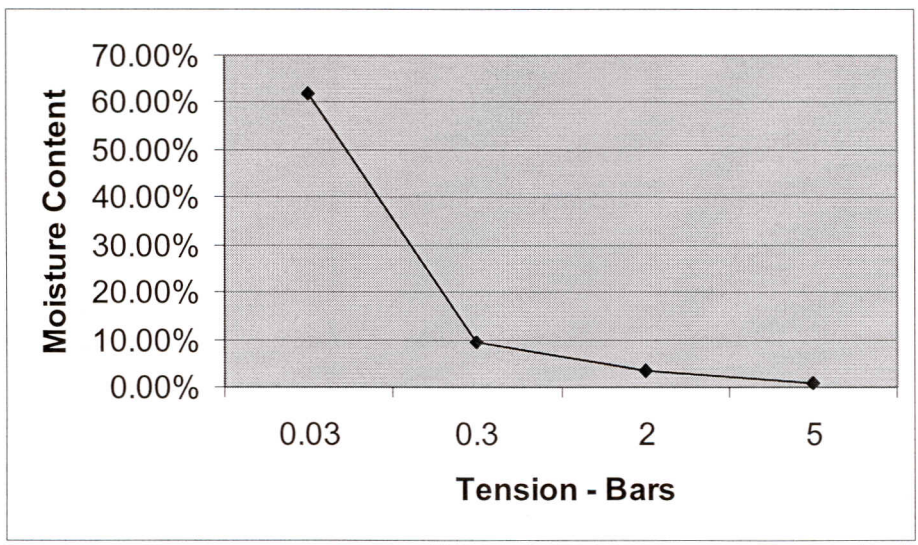
www.westernpozzolan.com

"POZZ"/ Lassenite : MOISTURE ABSORPTION/RELEASE

Water moves through the soil profile in response to gradients in the potential energy of the water, going from regions of higher water potential to those with lower water potential. Water potential is the measure of free energy status of water and its availability to plants. The addition of Lassenite Pozzolan provides for hemispheric moisture throughout the soil profile to produce consistent regions of higher water potential.

For water to be available to a plant the plant's roots must first be present; water must move through the soil to the root, pass into the root, and travel to the leaf surface. The water supply must be able to meet transpiration requirements to maintain cellular functions. At high evaporation rates, the soil may be unable to transport enough water to meet transpiration demands and the plant may go into water stress at higher soil water contents than it would at lower evaporation rates.

During a dry down sequence, between irrigation cycles, water is physically extracted from the soil profile. In the lab, increasing levels of energy are applied to samples to simulate dry down cycles. This is how moisture release curves are generated. The 0.03 bar moisture retention is representative of the maximum moisture retained by a 12" depth of soil (as in a putting green root zone). Moisture released between saturation (0 cm tension or pressure) and 0.03 bars reflects gravitational water or free drainage. This portion of the moisture is of little agronomic interest. Of greater importance is the water released from the soil profile from 0.03 bars tension or pressure on. This is defined as plant available water. The 2 bar value is representative of the moisture content at which the turf would be irrigated. Water released after 5 bars tension or the "theoretical wilt point" is not considered in the "water management range" due to the fact that the Turf Manager or Superintendent would not allow the soil profile to get this dry prior to irrigation. Note that nearly all the moisture held by the Lassenite Pozzolan is plant available and released prior to 2 bars tension.



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THOMAS TURF SERVICES

DISCUSSION OF LAB RESULTS

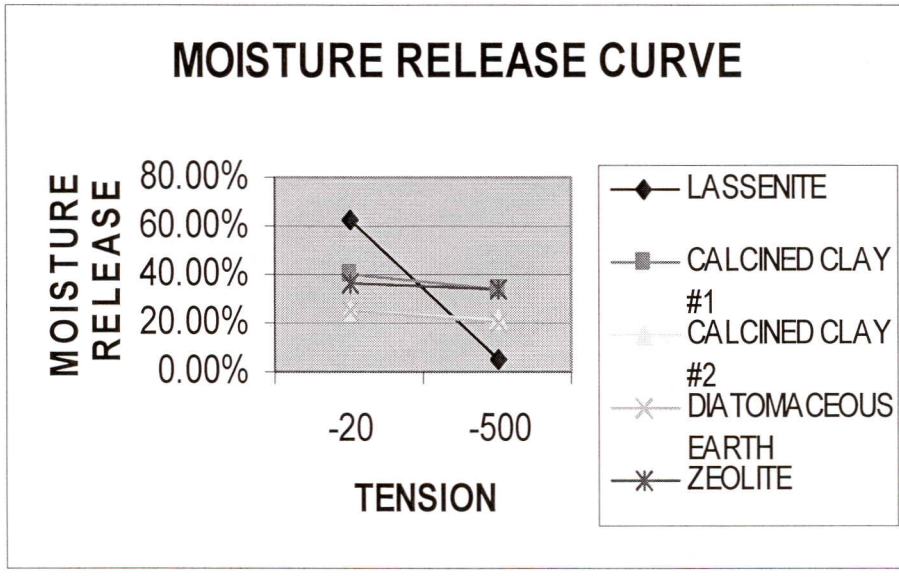
The physical measurements test was performed on the "pure" pozzolan to determine the saturated hydraulic conductivity (infiltration rate), moisture retention at 30 cm tension, bulk density, particle density, total porosity, capillary porosity and air-filled porosity.

The physical measurements of the pozzolan showed it to have acceptable saturated hydraulic conductivity of 10.9 inches per hour which is in the normal range of 6-12 inches per hour recommended by the USGA. The pozzolan retained 62.1% moisture at 30 cm tension. The pozzolan had a low bulk density of 0.81 g/cc and a low particle density of 2.49 g/cc. The pozzolan had a high 67.7% total porosity, a very high 50% capillary porosity and an acceptable 17.7% air-filled porosity.

The physical measurements show that the pozzolan will have a high amount of total porosity and retain a very high amount of water. Therefore, the pozzolan will be effective in increasing the capillary porosity of a root zone sand.

To determine at what tension the pozzolan releases the majority of water, the water retention was measured at a range of tension including 0.03 bar (-30 cm tension), 0.3 bar, 2 bars, and 15 bars. The 0.03 bar moisture retention is representative of the maximum moisture retained by a 12" depth of soil (as in a putting green root zone). The 0.3 bar is the maximum moisture retained in a field situation similar to a fairway using native soil. The 2 bar value is representative of the moisture content at which a turf would be irrigated. The 15 bar value is considered to be the maximum amount of water that can be removed by plants. The measured values for the pozzolan are as follows:

Tension	Moisture Content (%)
0.03	62.1
0.3	9.3
2.0	3.6
15.0	0.8



LASSENITE POZZOLAN & SAND MIX DESIGNS

FOR

TOPDRESSING, DRILL & FILL, DRYJECT® & ROOTZONE CONSTRUCTION

Based upon volumetric calculations

Assumptions:

One cubic yard of sand weighs 2,700 lbs or 1.35 tons
One cubic yard of Lassenite weighs 1,107 lbs or 0.5535 tons
One cubic foot of Lassenite weighs 41 lbs

TOPDRESSING

For One Cubic Yard of One Ton of Greensmix:

90% Sand/10% Lassenite:

0.90 x 2700 lbs/yd³ = 2,430 lbs Sand
0.10 x 1,107 lbs/yd³ = 111 lbs Lassenite

Each cubic yard of 90/10% blended Greensmix will weigh 2,541 lbs

Each ton of 90/10% blended Greensmix will contain 1,913 lbs sand and 87 lbs Lassenite

85% Sand/15% Lassenite:

0.85 x 2700 lbs/yd³ = 2,295 lbs Sand
0.15 x 1,107 lbs/yd³ = 166 lbs Lassenite

Each cubic yard of 85/15% blended Greensmix will weigh 2,461 lbs

Each ton of 85/15% blended Greensmix will contain 1,865 lbs sand and 135 lbs Lassenite

80% Sand/20% Lassenite:

0.80 x 2700 lbs/yd³ = 2,160 lbs Sand
0.20 x 1,107 lbs/yd³ = 221 lbs Lassenite

Each cubic yard of 85/20% blended Greensmix will weigh 2,381 lbs

Each ton of 80/20% blended Greensmix will contain 1,811 lbs sand and 188 lbs Lassenite

70% Sand/30% Lassenite:

0.70 x 2700 lbs/yd³ = 1,890 lbs Sand
0.30 x 1,107 lbs/yd³ = 332 lbs Lassenite

Each cubic yard of 70/30% blended Greensmix will weigh 2,222 lbs

Each ton of 70/30% blended Greensmix will contain 1,701 lbs sand and 299 lbs Lassenite

Example: One sixteenth inch of 70% Sand 30% Lassenite to cover 100,000 ft^2

100,000 ft^2 x .005 ft (.0625"/12") = 500 ft^3 Topdressing material
500 ft^3/27 ft^3 =18.52 yd^3 x 2,222 lbs/ yd^3 = 41,151 lbs or 20.2 tons of 70/30% blend required

Example: One sixteenth inch of 70% Sand 30% Lassenite to cover One Acre (43,560 sq ft)

43,560 ft^2 x .005 ft (.0625"/12") = 218 ft^3 Topdressing material
218 ft^3/27 ft^3 =8.1 yd^3 x 2,222 lbs/ yd^3 = 18,000 lbs or 9 tons of 70/30% blend required

DRILL & FILL

Using a one inch drill bit at an application rate of 0.25 yd^3 per 1,000 ft^2.
The area of application consists of 100,000 ft^2 of greens

.25 yd^3 x 100 (100,000/1,000) = 25 yd^3
25 yd^3 x 1,107 lbs/ yd^3 Lassenite = 13.84 tons
13.84 tons x .10% waste = 1.38 tons + 13.84 = 15.2 tons of Lassenite required

DRYJECT®

Using 3" x 2" spacing at an application rate of 5 ft^3 per 1,000 ft^2.
The area of application consists of 100,000 ft^2 of greens

5 ft^3 x 100 (100,000/1,000) = 500 ft^3
500 ft^3 x 41 lbs/ ft^3 Lassenite = 20,500 lbs or 10.25 tons of Lassenite required

Using 3" x 3" spacing at an application rate of 4 ft^3 per 1,000 ft^2.
The area of application consists of 100,000 ft^2 of greens

4 ft^3 x 100 (100,000/1,000) = 400 ft^3
400 ft^3 x 41 lbs/ ft^3 Lassenite = 16,400 lbs or 8.2 tons of Lassenite required

Using 3" x 4" spacing at an application rate of 3 ft^3 per 1,000 ft^2.
The area of application consists of 100,000 ft^2 of greens

3 ft^3 x 100 (100,000/1,000) = 300 ft^3
300 ft^3 x 41 lbs/ ft^3 Lassenite = 12,300 lbs or 6.15 tons of Lassenite required