

Sodic Soil

Water Movement Demonstration



Objectives for Sodic Soil Demo Project:

1. Create container for demonstration to help people visualize water flow through soil profile similar to tile drainage.
2. Determine if gypsum (CaSO_4) application improves water flow through sodic soil (Using gypsum source, scrubbed from Power Plant Stacks in ND).
3. Determine if “lime (CaCO_3) improves water flow through sodic soil.

Definitions: Routine lab tests

- Sodic Soil: Salt less than 2.0, Na% greater than 13%
- Saline: Salt greater than 2.0 Na% less than 13%
- Saline-Sodic soil: Salt greater than 2.0, Na% greater than 13%

Salt test = e.c. 1:1 soil water method, mmhos/cm

Na% = routine lab method for determining Ca, Mg, K, Na
(ammonium acetate)

Container to Simulate Tile Drainage and Water Flow through Soil Profile

1. Container allows you to see how the soil profile gets wet with different rates of gypsum
2. 20 holes drilled through pvc pipe to simulate tile drain



*Can **Gypsum (CaSO_4)** improve water infiltration and flow through sodic soils (high sodium & low salts)*

- Gypsum has moderate solubility in high pH soil
- Gypsum (CaSO_4) decreases dispersion and clay swelling (Calcium replaces sodium)
- Gypsum increases aggregate stability
- Gypsum increases the salt (e.c.) of the soil which also increases aggregate stability and water flow (This is Key)

Synthetic Gypsum created by Power Plant in ND

Basin Electric Power Cooperative
Leland Olds Station

CCR Fugitive Dust Control Plan

The method for controlling sulfur dioxide (SO₂) emissions from LOS is wet flue gas desulfurization. Limestone slurry is used as the scrubbing reagent. Flue gas enters the absorber reaction tank and passes vertically through multiple levels where a spray of fine slurry droplets contact and react with the flue gas, forming synthetic gypsum. The gypsum produced in the scrubbing process is removed from each absorber reaction tank through one of two bleed pumps and is directed to a dedicated hydroclone cluster for primary dewatering. The resulting slurry is pumped to one of two redundant vacuum belt filters for secondary dewatering. The synthetic gypsum has a moisture content of approximately 10 to 20 percent when transferred to the load out conveyors. The FGD material (synthetic gypsum) is periodically loaded into 40 or 70 ton off-highway haul trucks for transportation to the Glenharold Mine landfill.

FGD = Flue Gas Desulfurization

*Can **Lime** (CaCO_3) improve water infiltration and flow through sodic soils (high sodium & low salts)*

- Lime has very low solubility in high pH soils (35 times less soluble than Gypsum)
- Lime does not decrease dispersion and clay swelling (because it does not dissolve)
- Lime does not increase aggregate stability
- Lime does not increase the salt (e.c.) of the soil which increases aggregate stability and water flow in sodic soil

Sodic Soil (high sodium, low salts)

Gypsum Affect on Water Flow

19% sodium (routine test), 1.03 salt (routine test)



Check

5 ton/a

10 ton/a

30 ton/a

Sodic soil and Gypsum Provided
by Tom DeSutter - NDSU

Gypsum Rate

DI (distilled) water added to all treatments

19% sodium (routine test), 1.03 salt (routine test)



Check

5 ton/a

10 ton/a

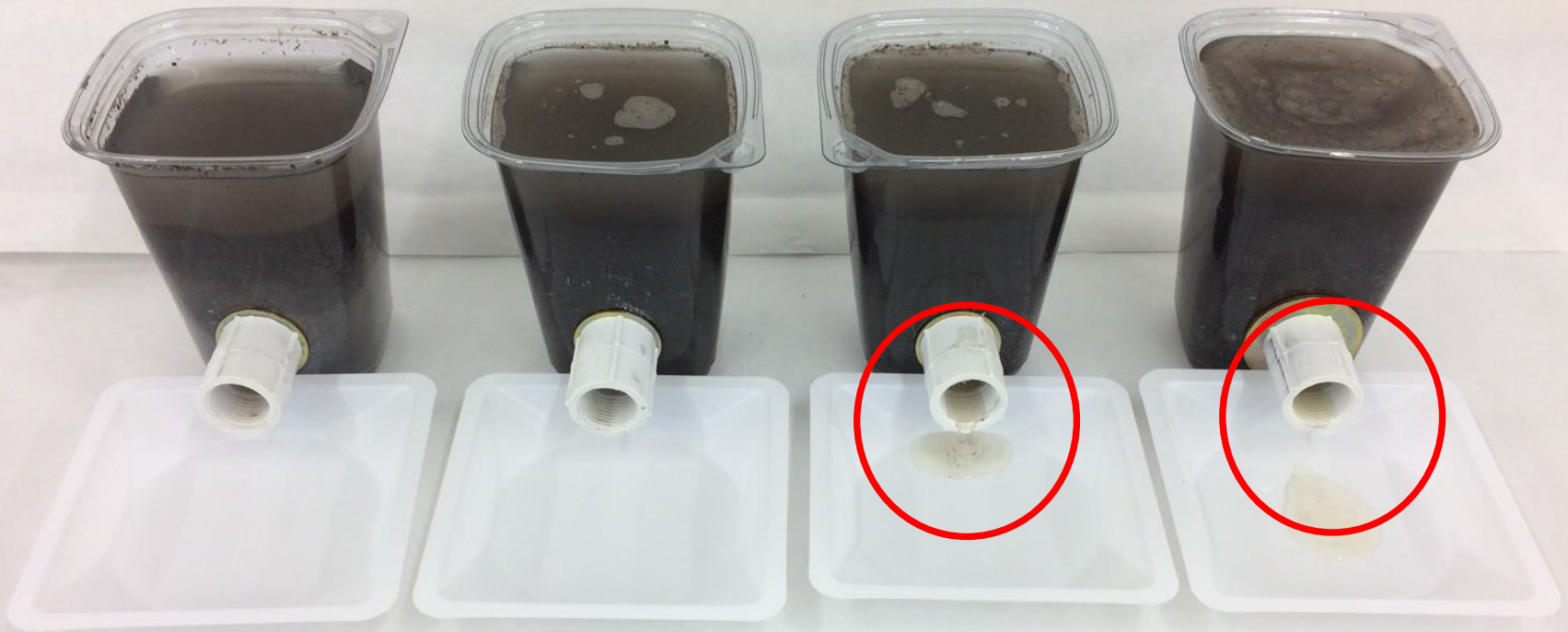
30 ton/a

Sodic soil and Gypsum Provided
by Tom DeSutter - NDSU

Gypsum Rate

19% sodium (routine test), 1.03 salt (routine test)

20 minutes



Check

5 ton/a

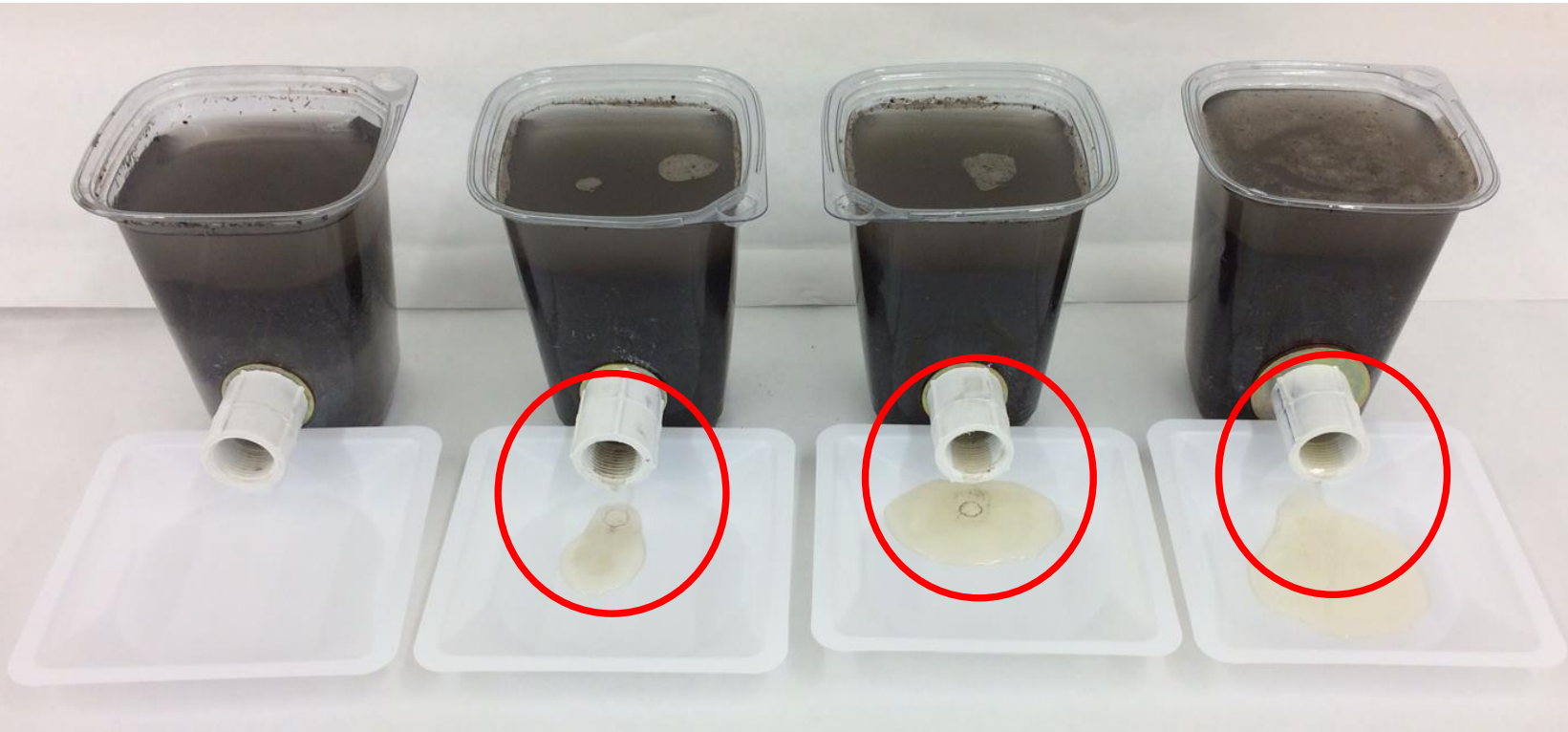
10 ton/a

30 ton/a

Gypsum Rate

19% sodium (routine test), 1.03 salt (routine test)

34 minutes



Check

5 ton/a

10 ton/a

30 ton/a

Gypsum Rate

19% sodium (routine test), 1.03 salt (routine test)

60 minutes



Check

5 ton/a

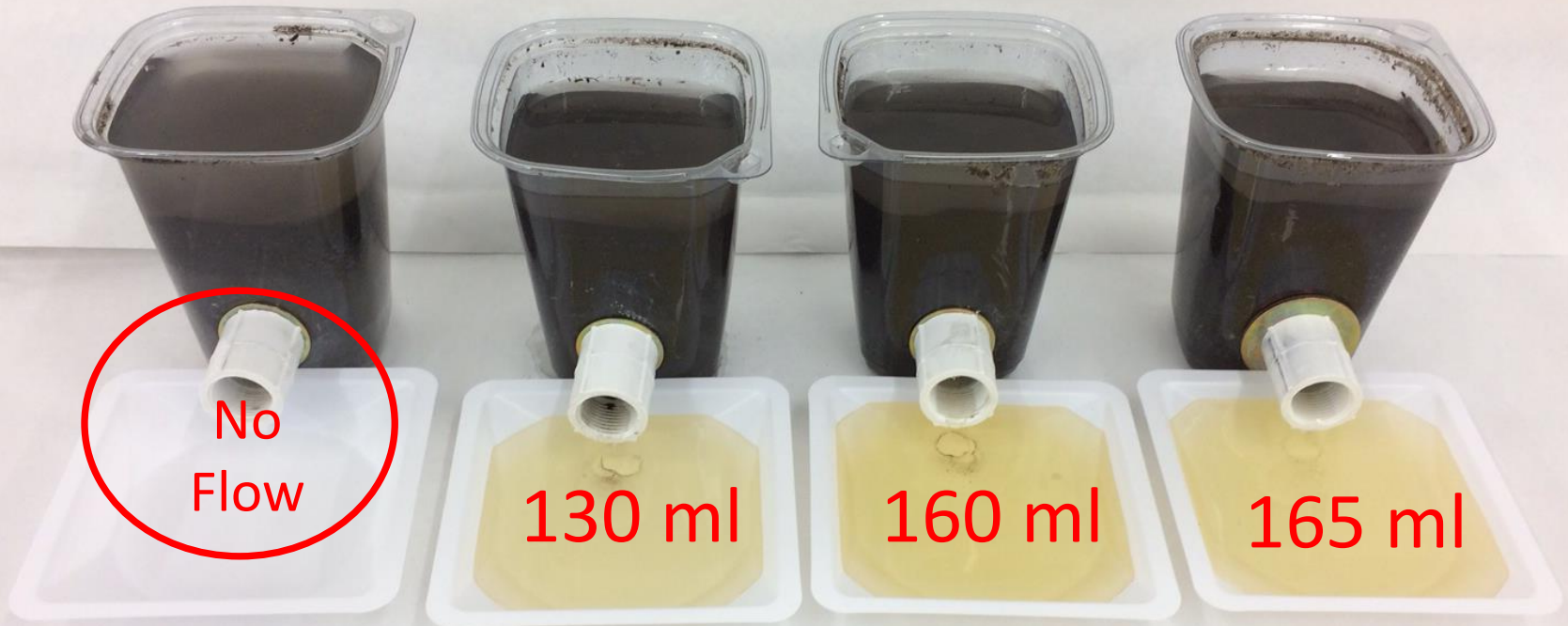
10 ton/a

30 ton/a

Gypsum Rate

19% sodium (routine test), 1.03 salt (routine test)

2 hour



Check

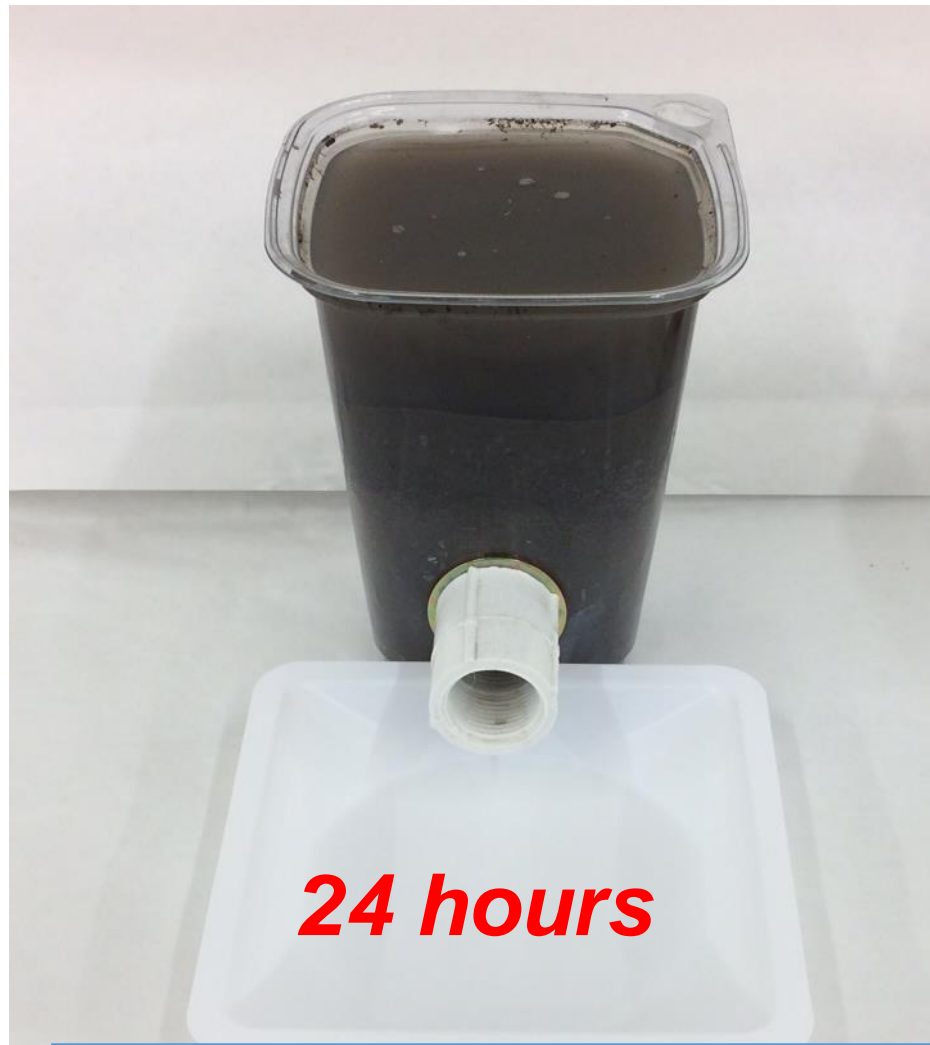
5 ton/a

10 ton/a

30 ton/a

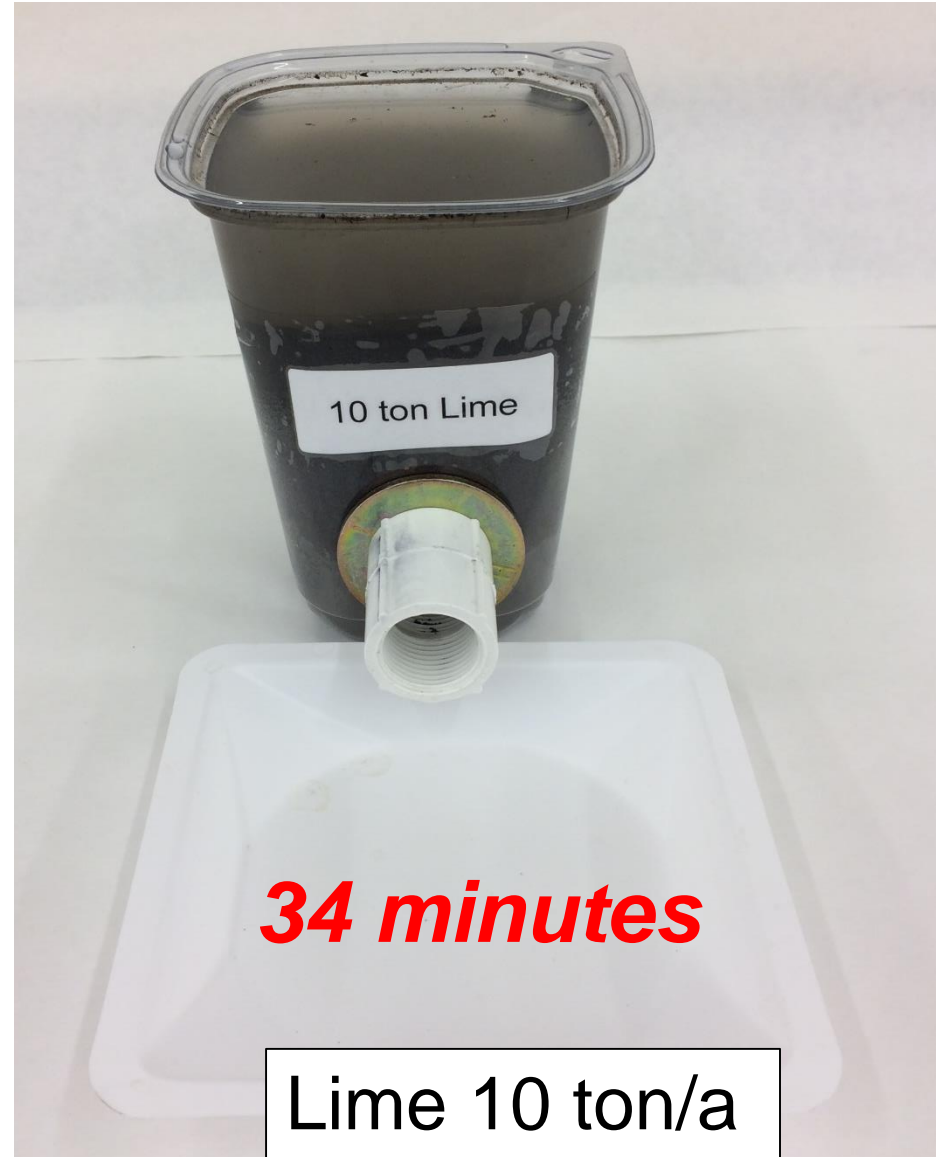
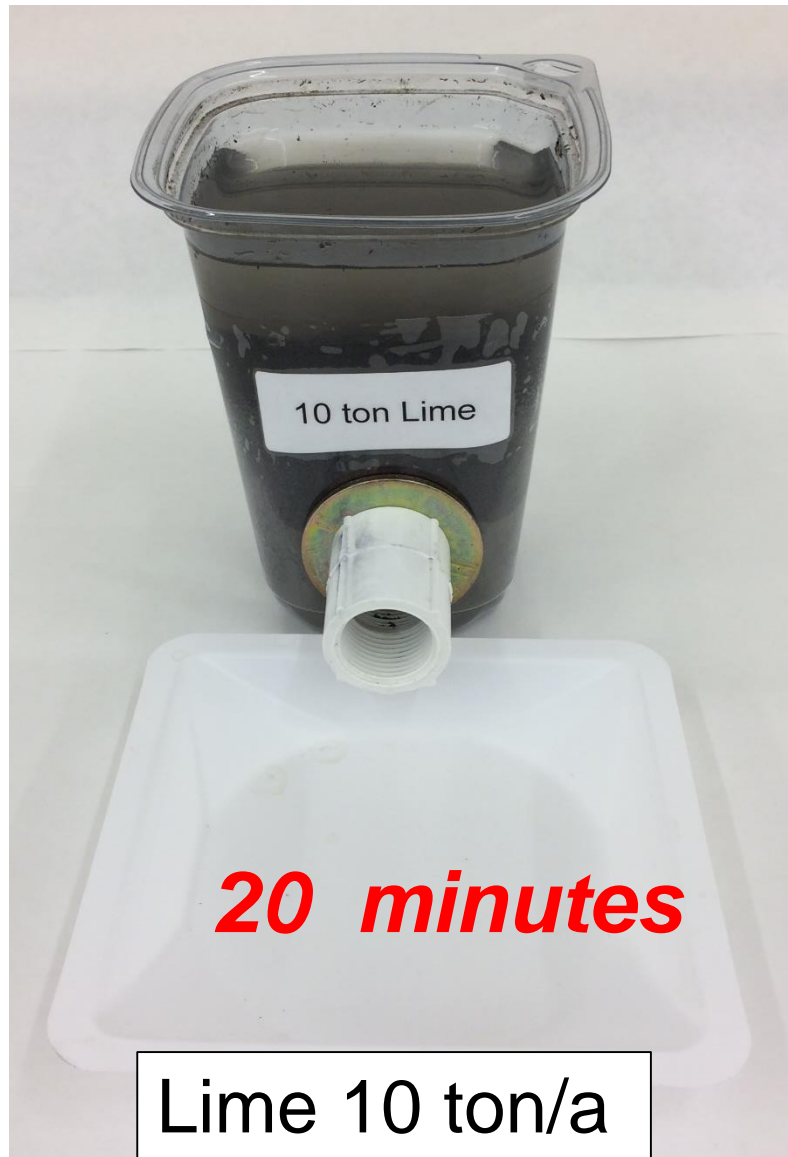
Gypsum Rate

19% sodium (routine test), 1.03 salt (routine test)

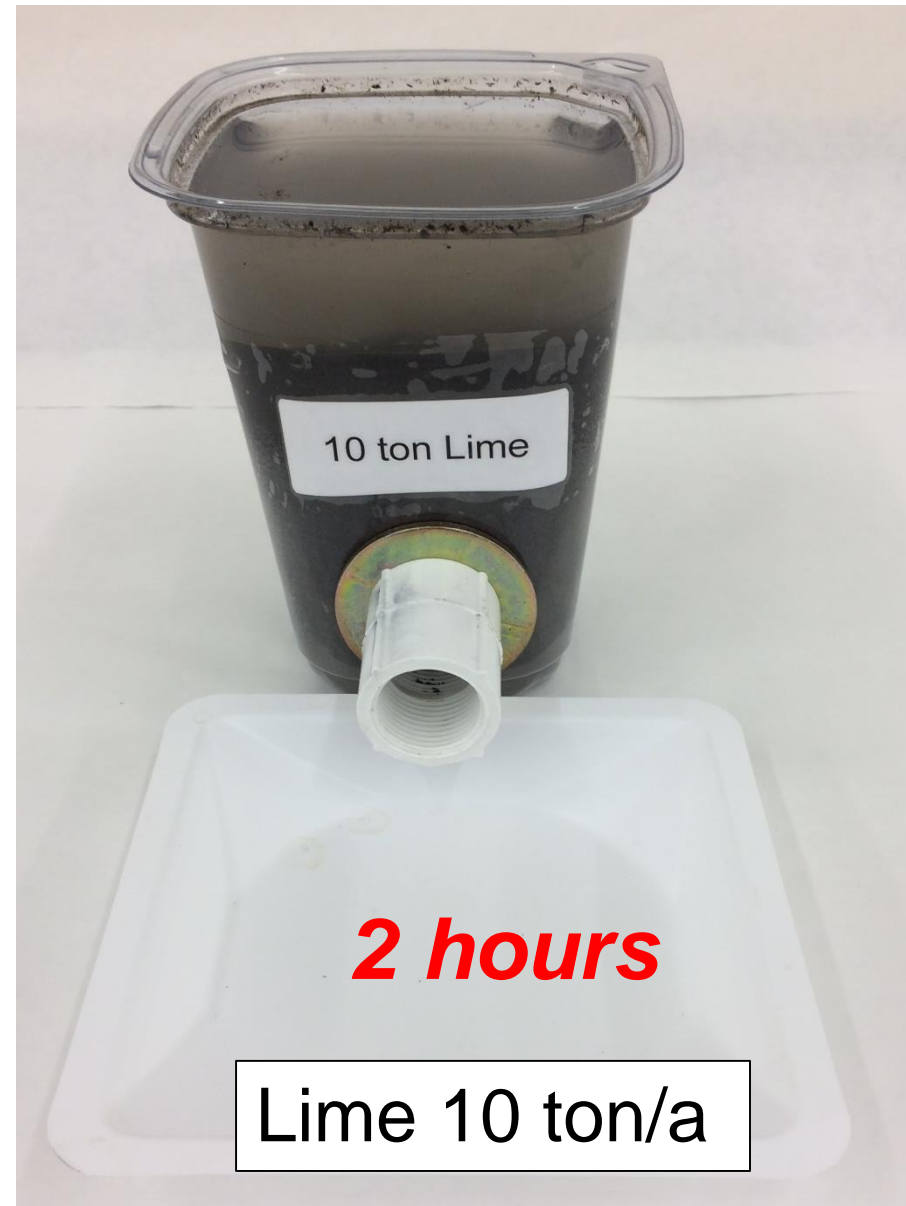
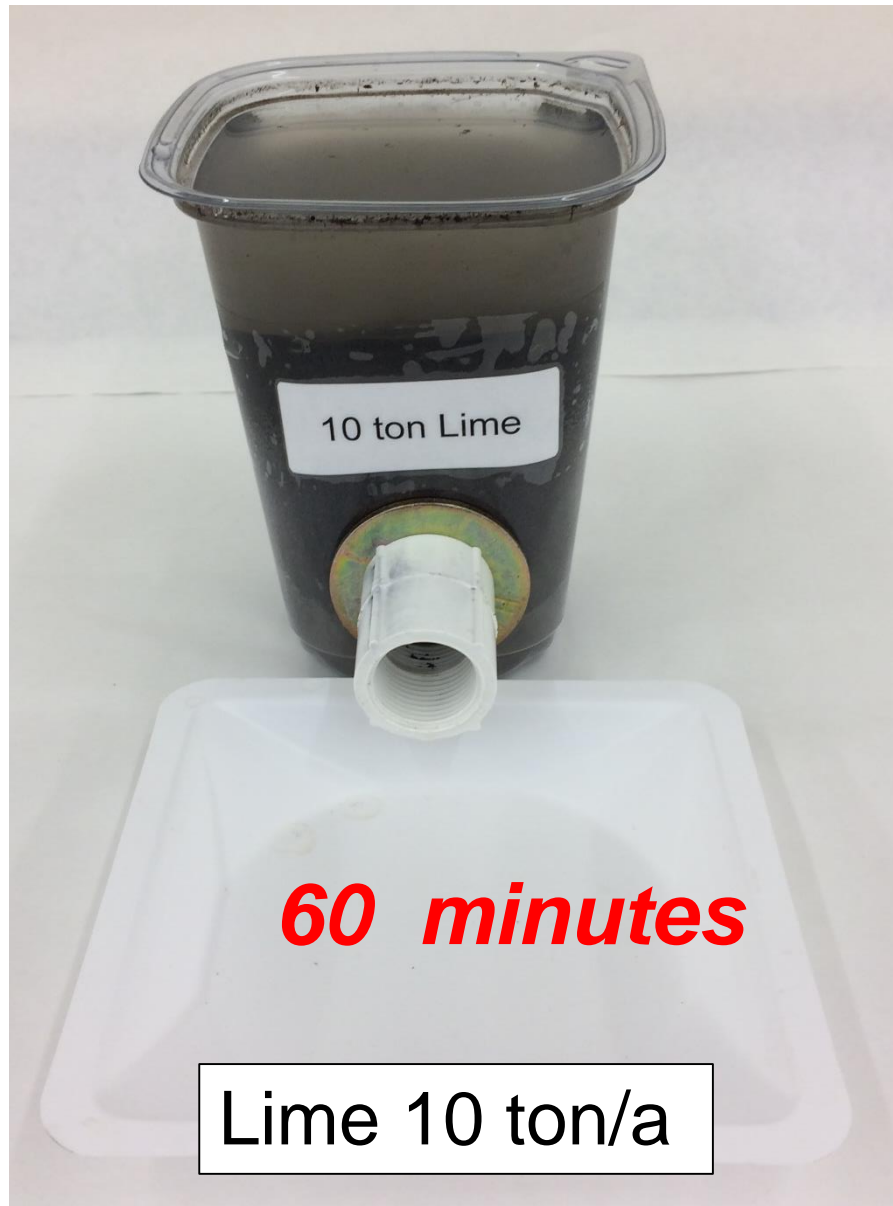


Untreated Check – No Water Flow until 5 days!

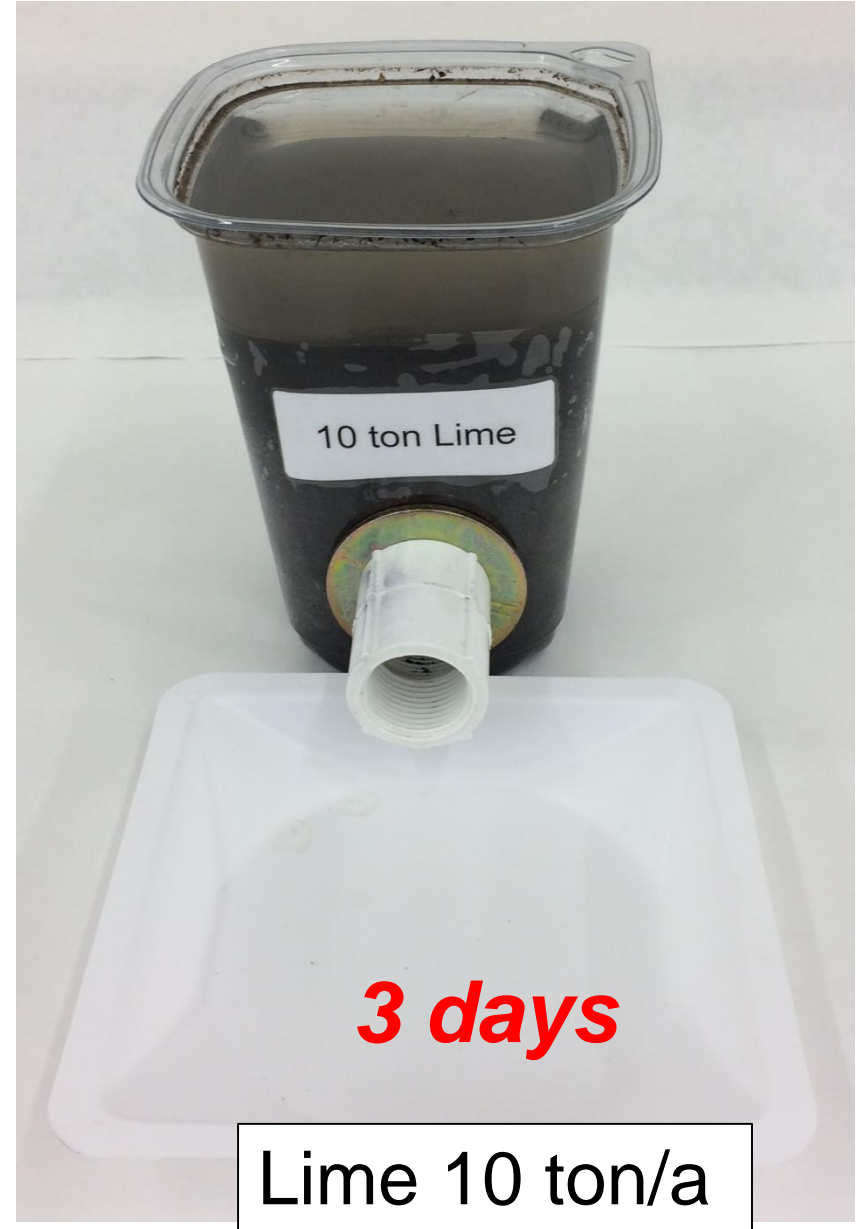
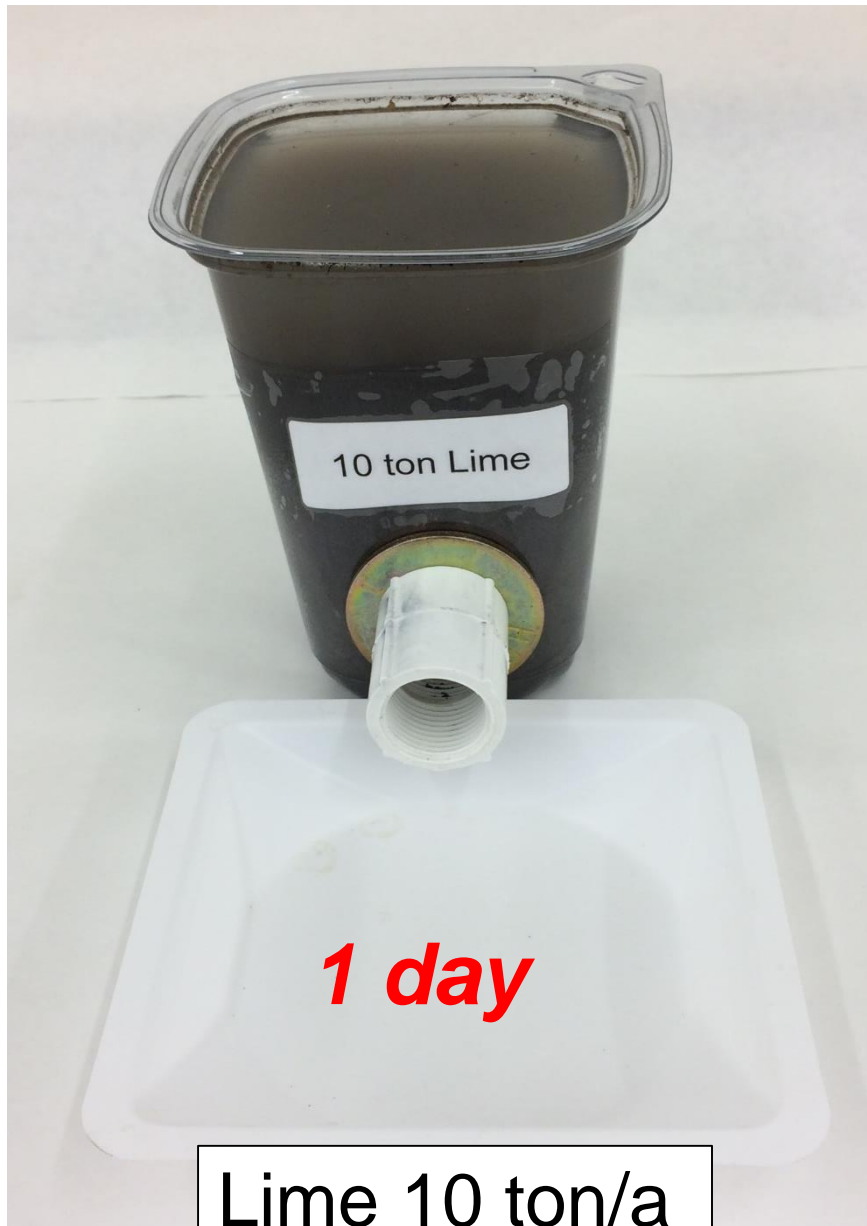
19% sodium (routine test), 1.03 salt (routine test)



19% sodium (routine test), 1.03 salt (routine test)



19% sodium (routine test), 1.03 salt (routine test)



Conclusions

- High sodium & low salts can severely limit water flow!!!
- Gypsum (CaSO_4) can increase the flow of water through sodic soil
- Higher gypsum rates did increase the water flow
- Locally produced gypsum works well to increase water flow
- Lime (CaCO_3) did not increase water flow in sodic soil
- If there are sodic areas in fields to be tiled, they need to be tested for % sodium and salts (e.c.) in 12" increments to see if they need amendment like gypsum.
- Soils with salts less than 2.0 and Na% greater than 5% can have reduced water flow even though they are not defined as sodic soils.

Sodic Soil Demo

***With Gypsum and Lime
Amendments***