Sodic Soil
Water Movement Demonstration

Objectives for Sodic Soil Demo Project:

1. Create Demonstration container to help people visualize water flow through sodic 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% great then 13%

- Saline: Salt greater than 2.0 and Na% less than 13%

- Saline-Sodic soil: Salt greater than 2.0 and Na% greater than 13%

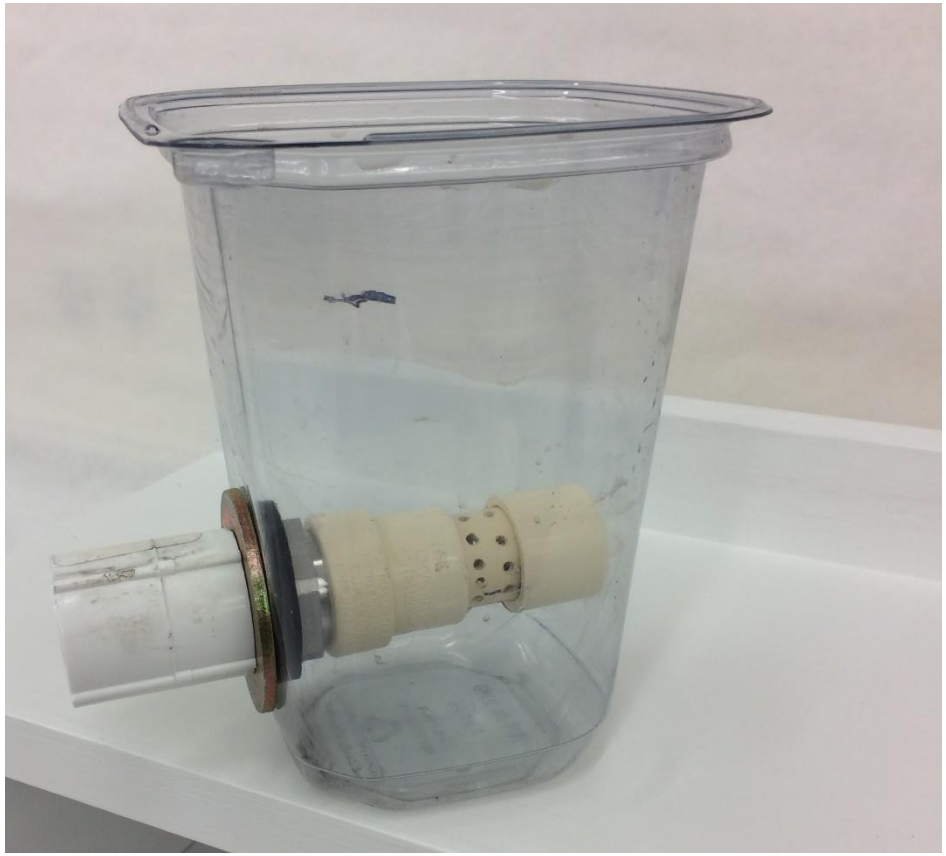
Salt test = e.c. 1:1 soil water method, mmhos/cm

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 (supplies some soluble Ca)
- Gypsum ($CaSO_4$) decreases dispersion and clay swelling
- Gypsum increases aggregate stability
- Gypsum increases the salt (e.c.) of the soil which 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 (SO_2) 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.

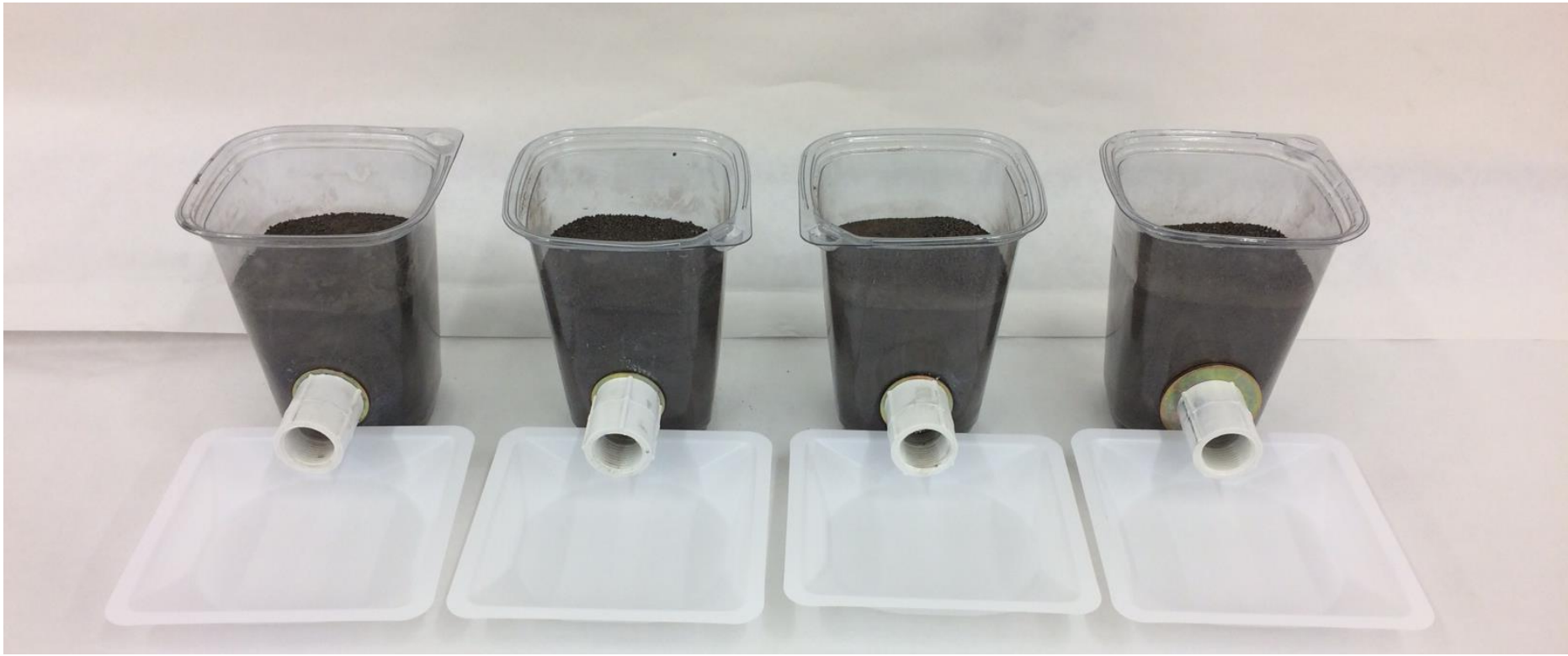
FGD = Flue Gas Desulfurization

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)



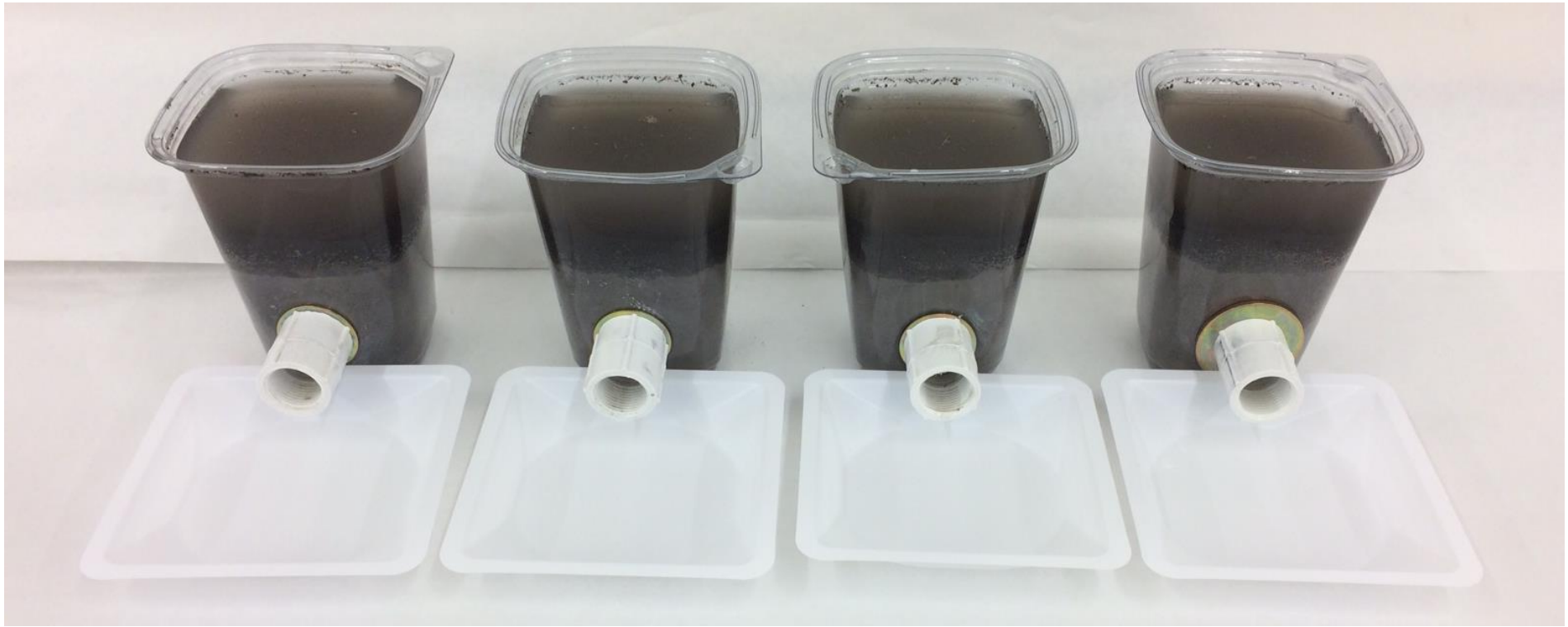
Check 5 ton/a 10 ton/a 30 ton/a

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)



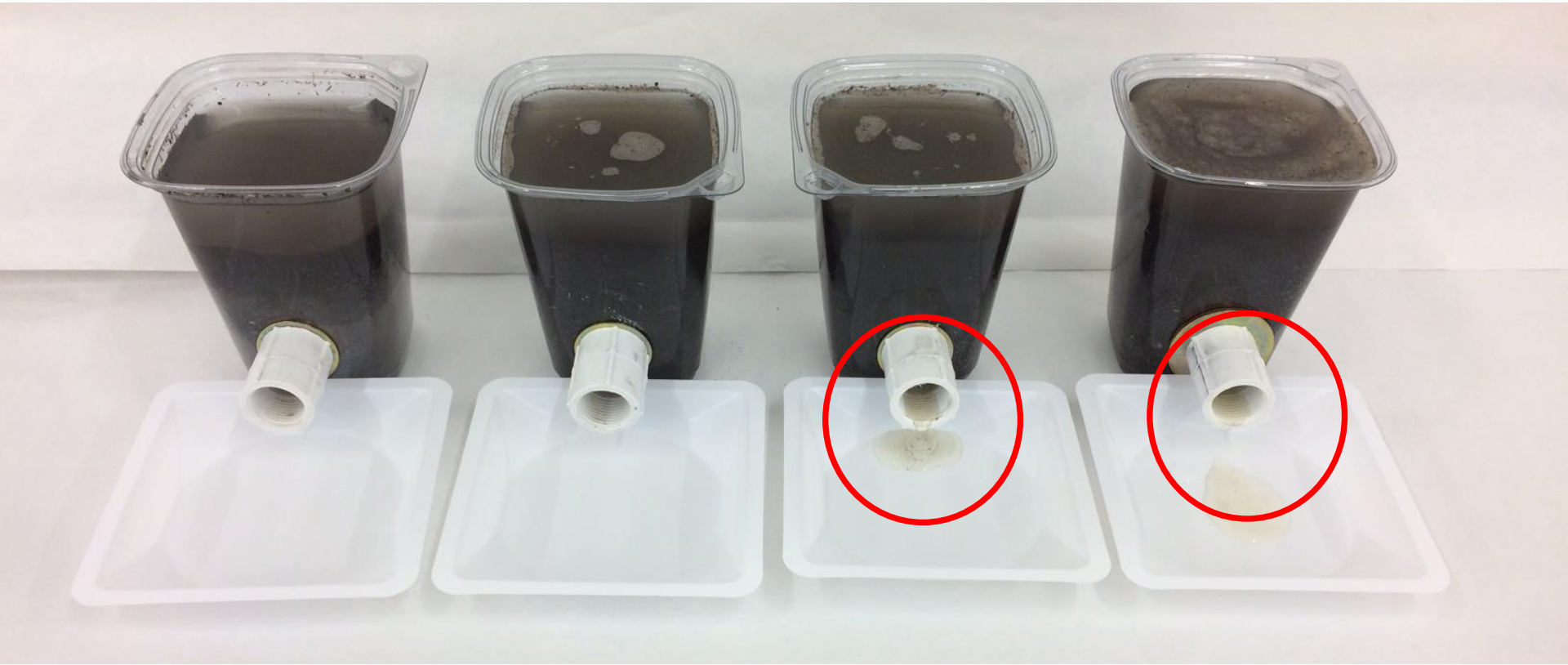
Check 5 ton/a 10 ton/a 30 ton/a

Sodic soil and Gypsum Provided by Tom DeSutter - NDSU

Gypsum Rate

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

20 minutes

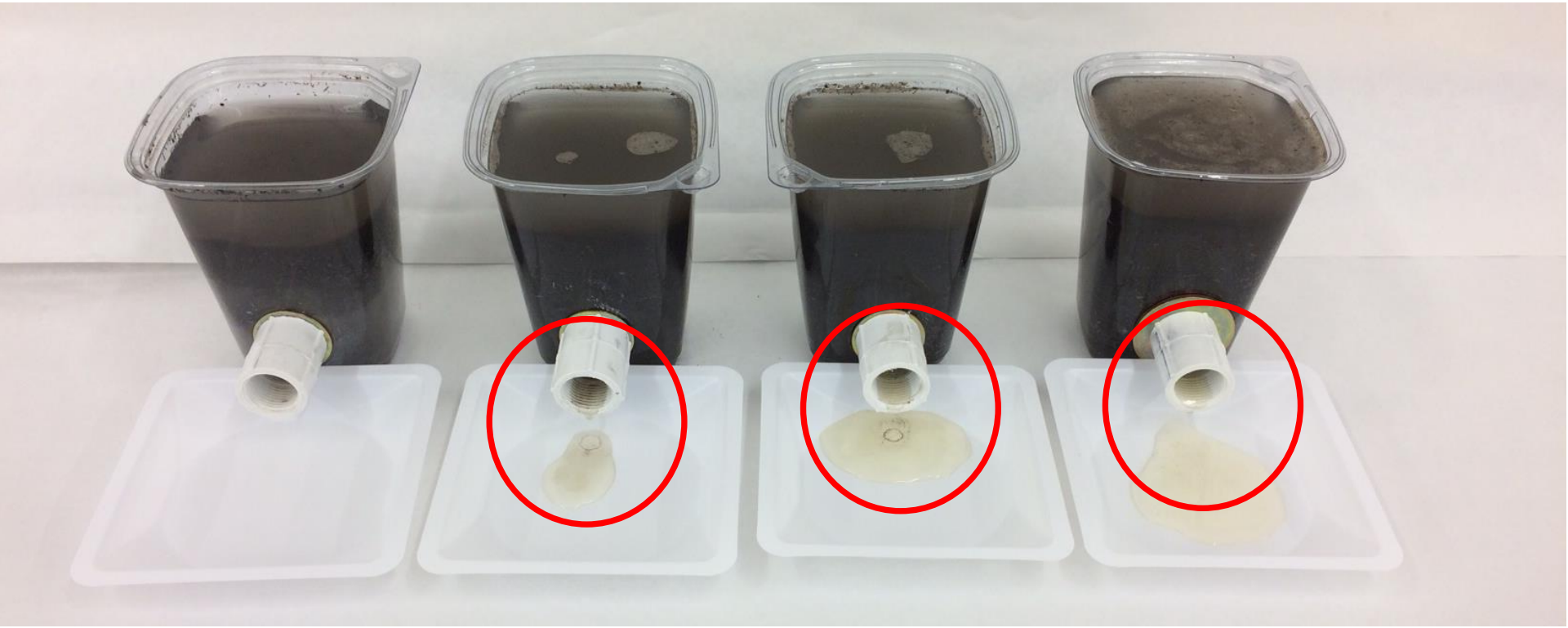


Check 5 ton/a 10 ton/a 30 ton/a

Gypsum Rate

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

34 minutes

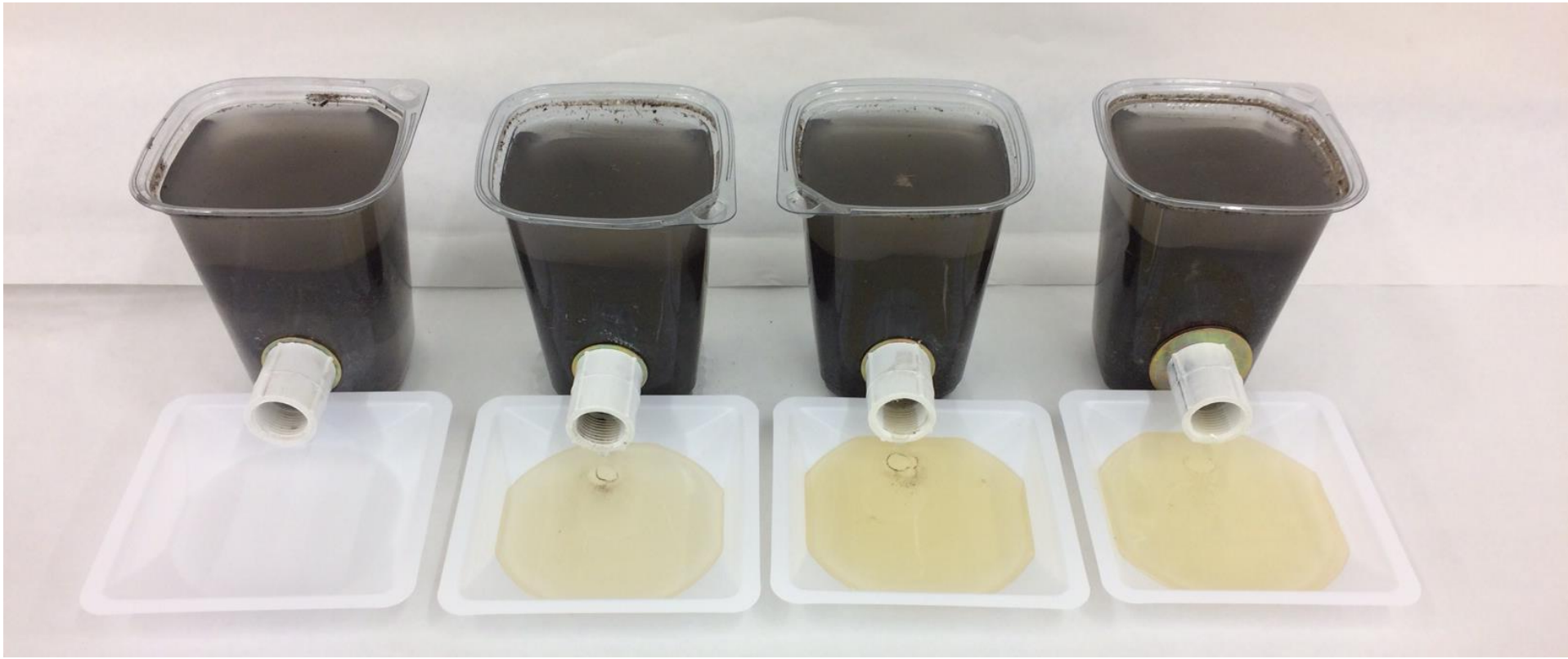


Check 5 ton/a 10 ton/a 30 ton/a

Gypsum Rate

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

60 minutes

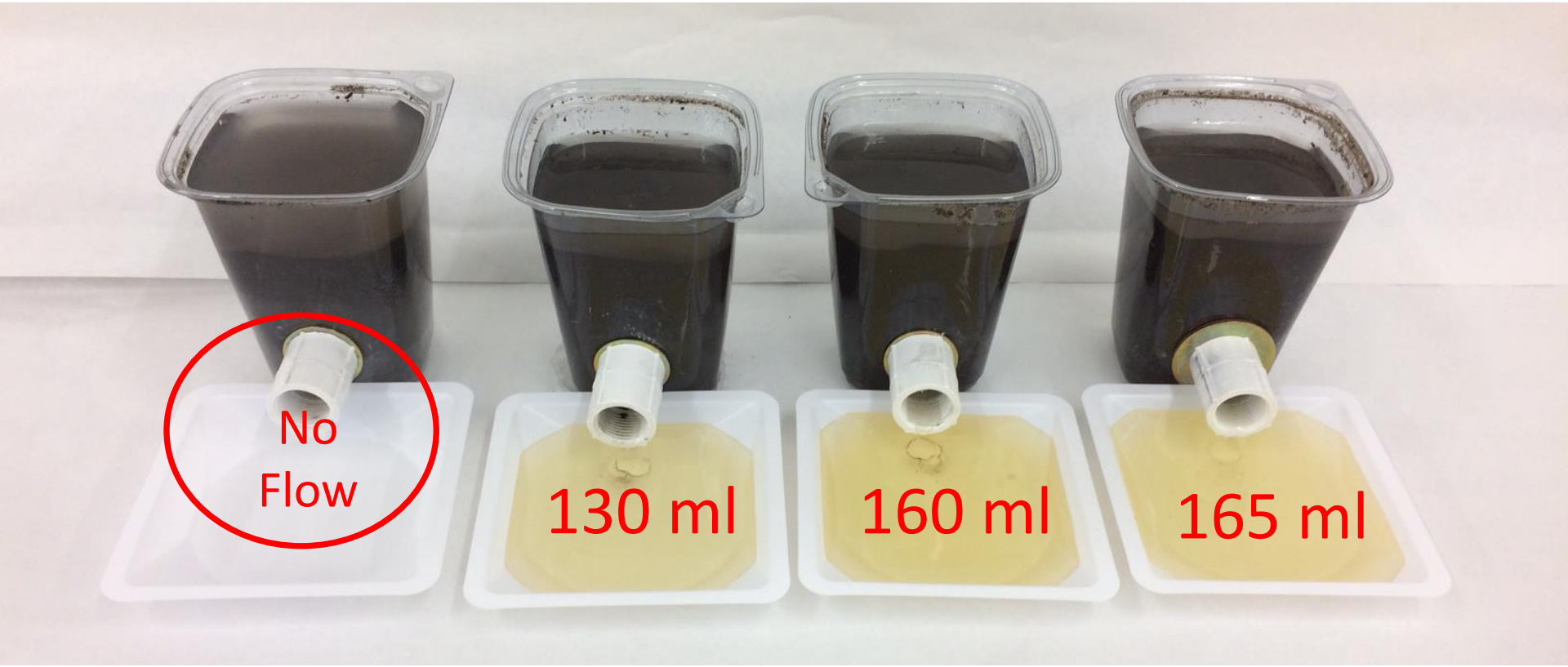


Check 5 ton/a 10 ton/a 30 ton/a

Gypsum Rate

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

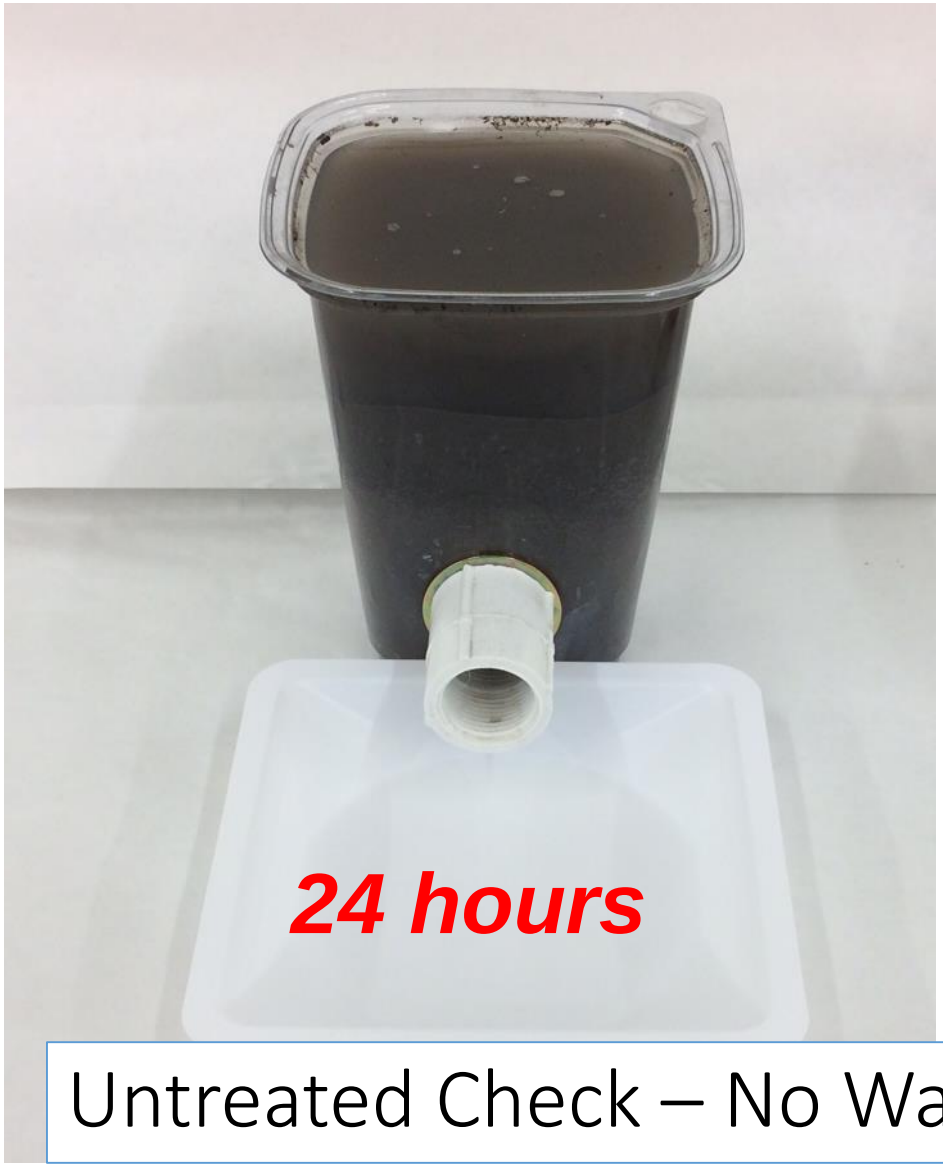
2 hour

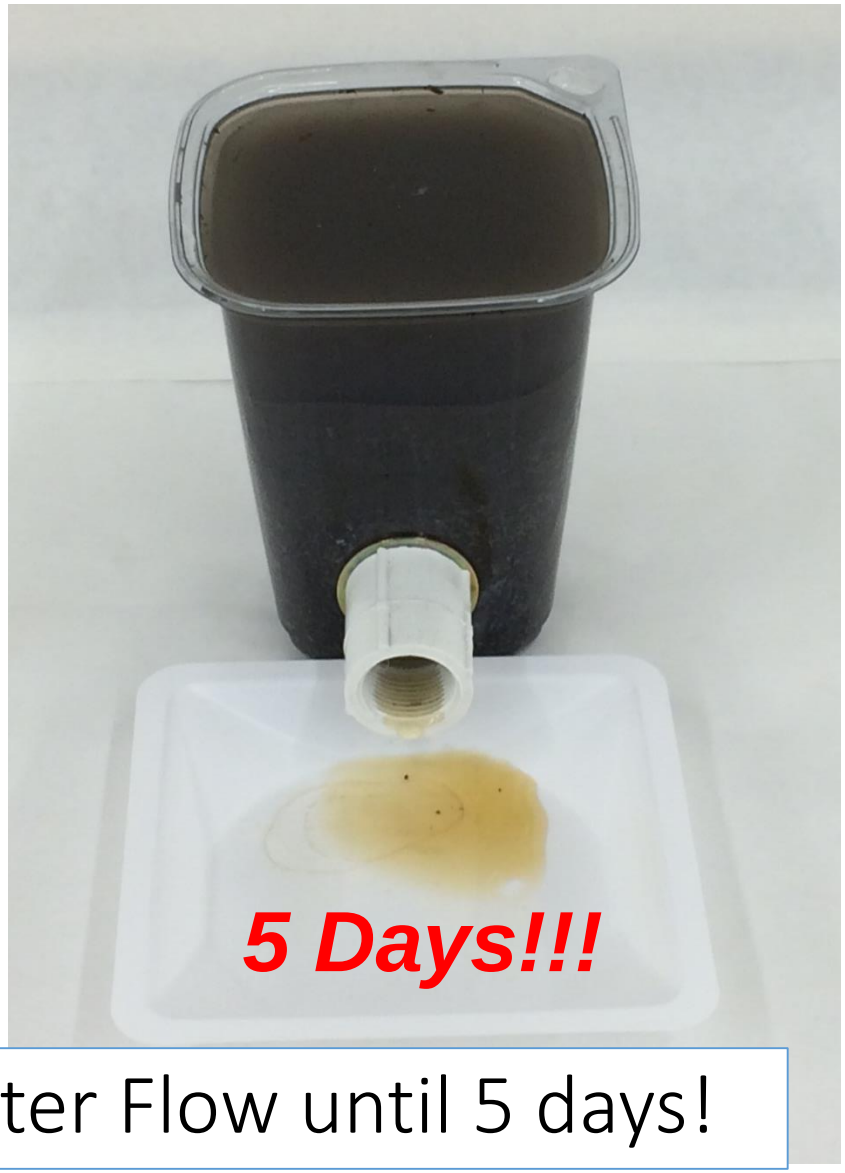


Check 5 ton/a 10 ton/a 30 ton/a

Gypsum Rate

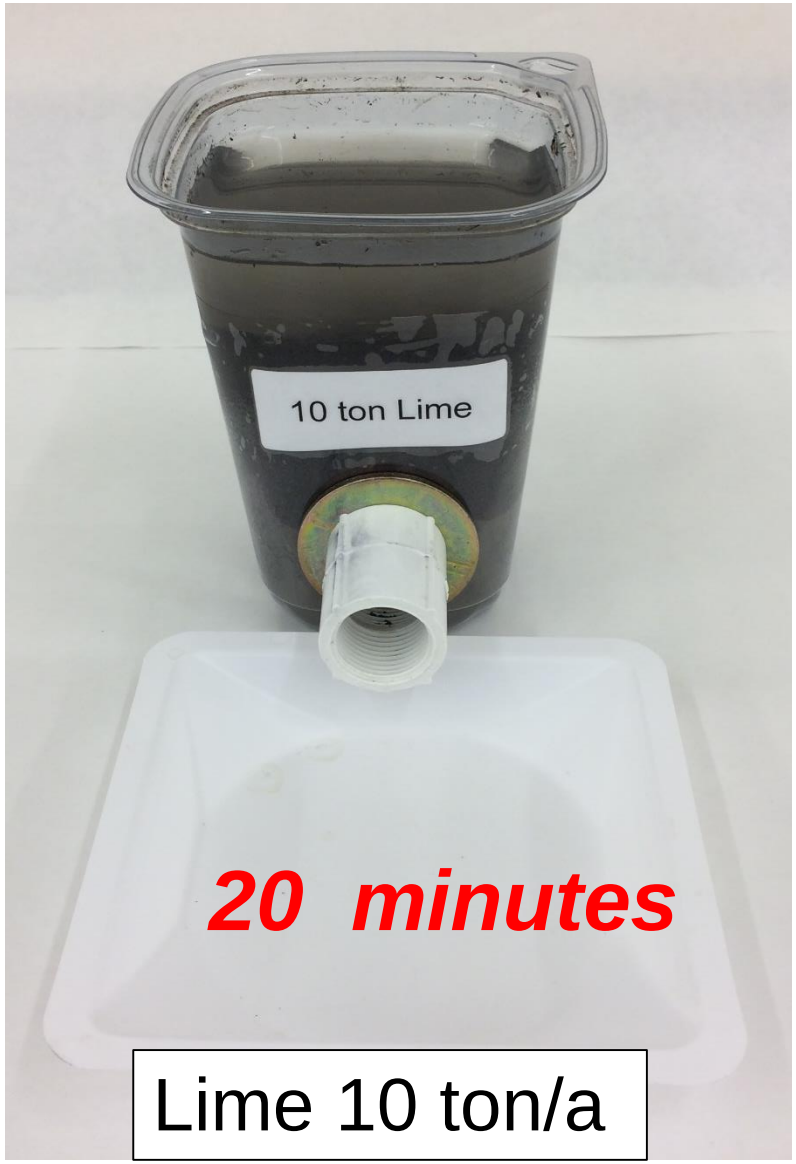
19% sodium (routine test), 1.03 salt (routine test)



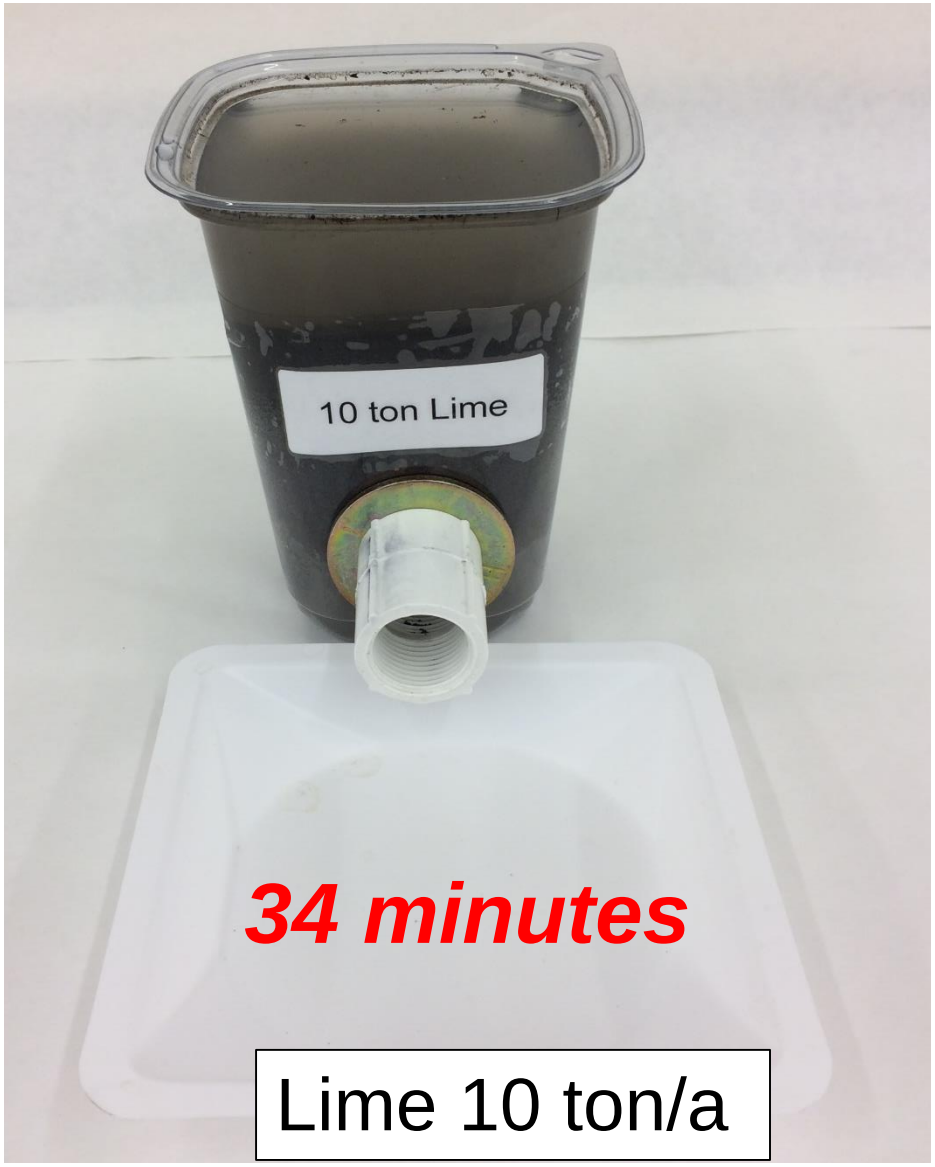


Untreated Check – No Water Flow until 5 days!

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

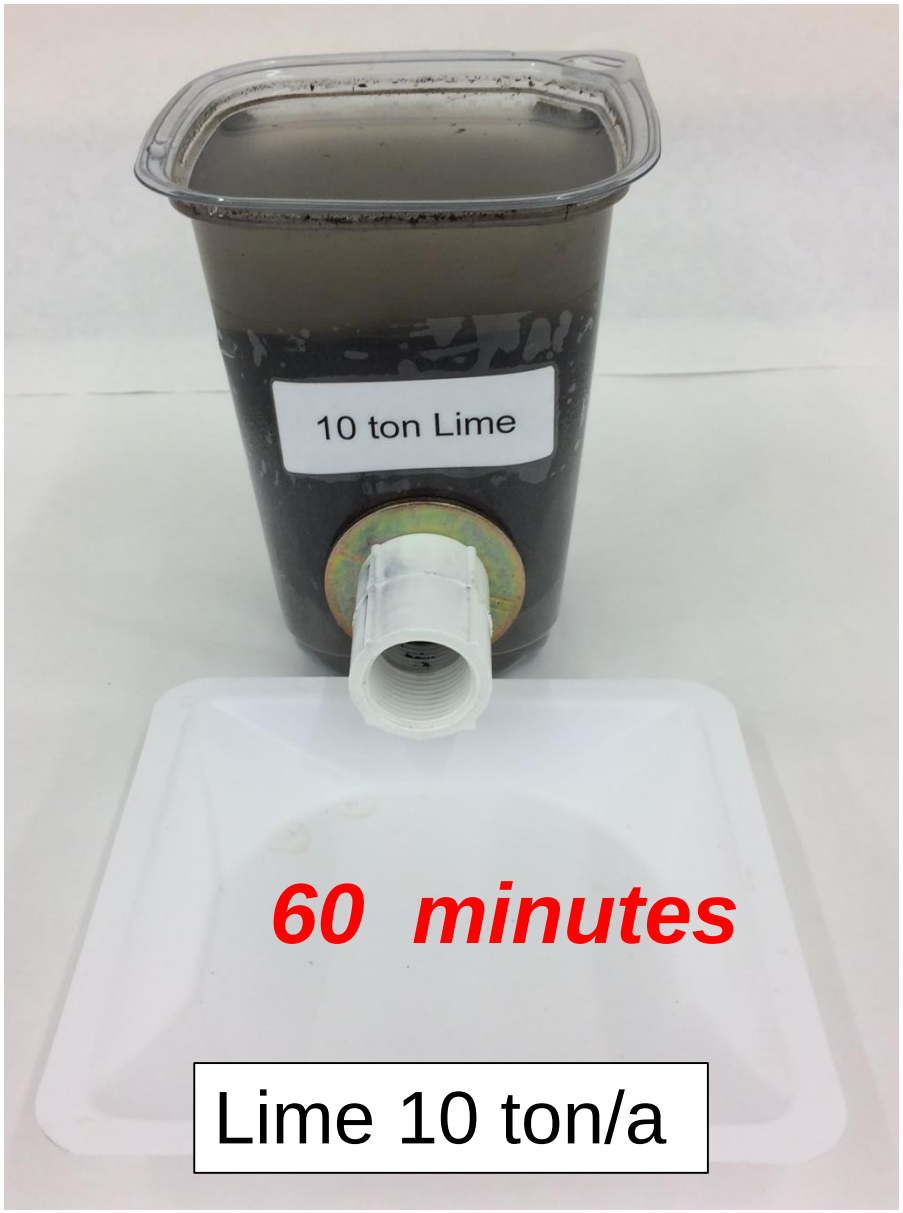


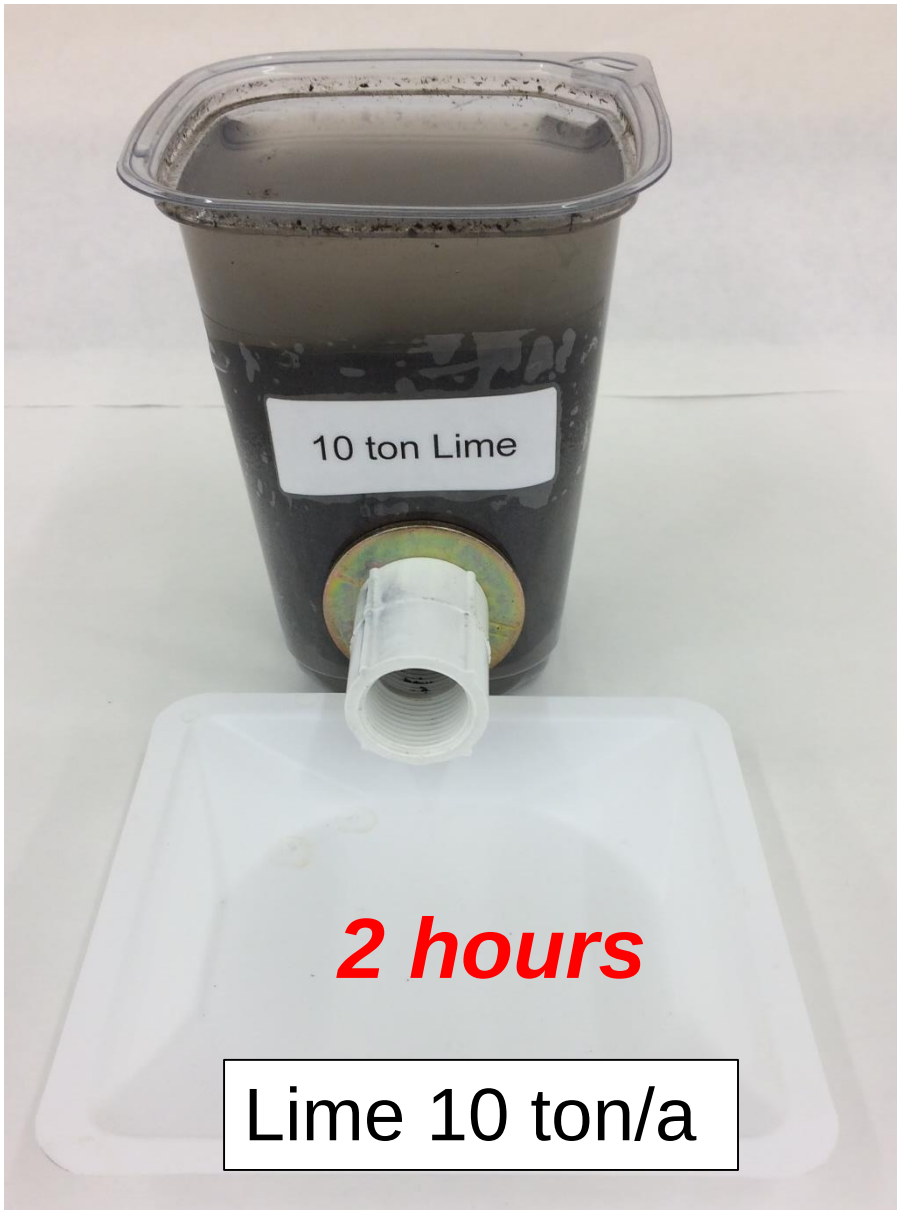
Lime 10 ton/a



Lime 10 ton/a

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





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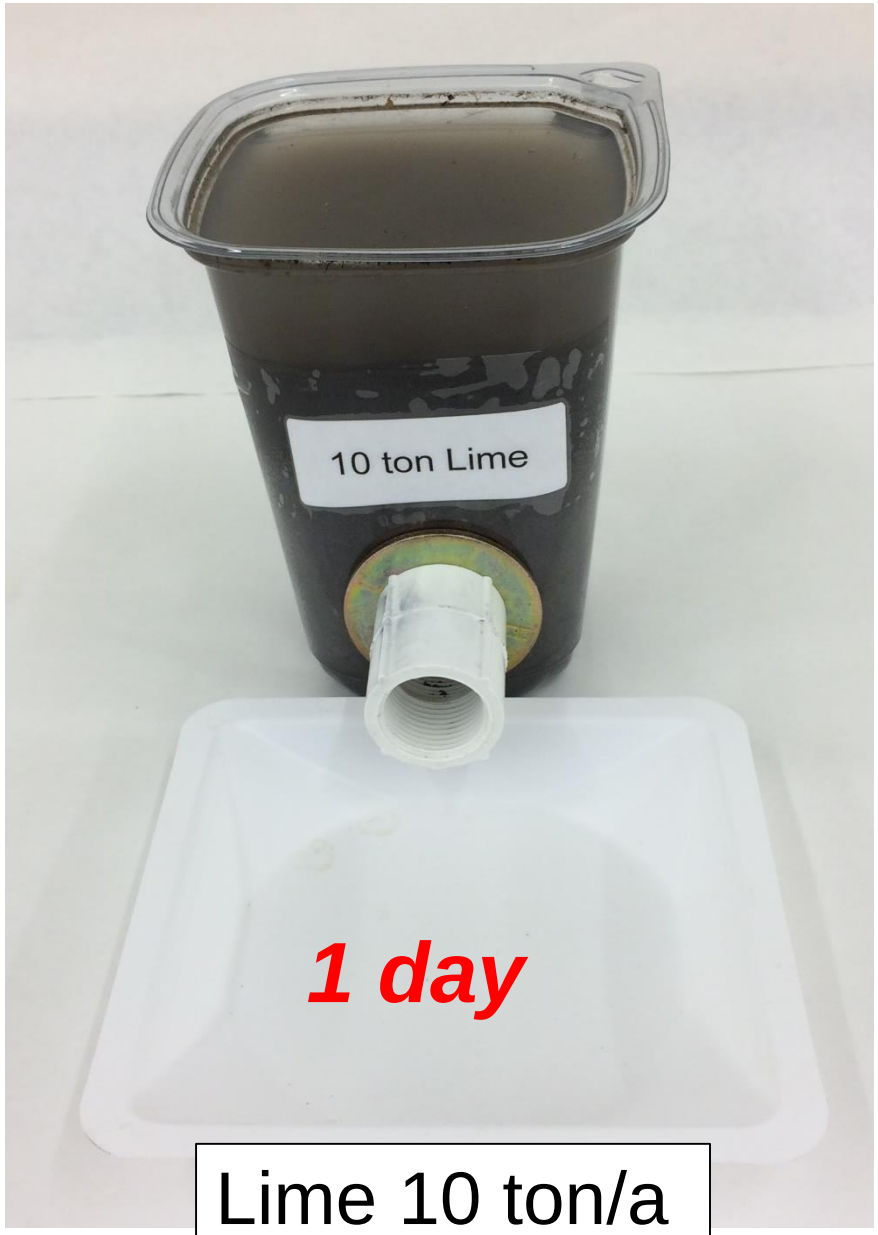
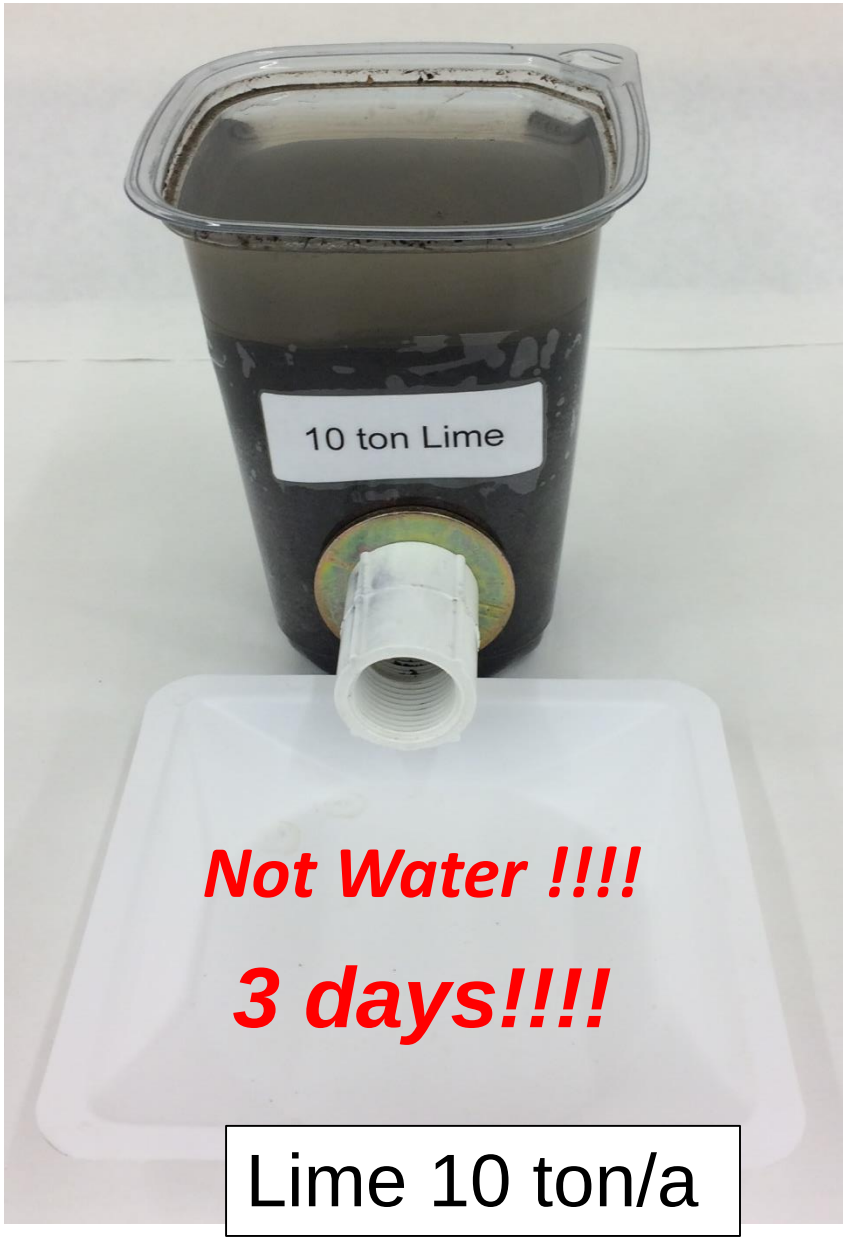


Lime 10 ton/a



Lime 10 ton/a

Conclusions

- High sodium & low salts can severely limit water flow!!!
- Gypsum ($CaSO_4$) can increase the flow of water through sodic soil right away (increases e.c.!!)
- Higher gypsum rates did increase the water flow a little
- Locally produced flue gas gypsum from ND power plant scrubber 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.
- Water flow in 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.