FRST Lime Pilot Project Update

Robert O. Miller, PhD
ALP Technical Director
Fort Collins, CO

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ALP
Agricultural Laboratory Proficiency Program

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FRST lime pilot incubation study

Objective: Evaluate two lime sources, six lime rates and incubation period on soil pH utilizing three acid soils.

Three soils selected: pH $_{1:1\ H2O}$ 4.1 – 5.3; textures sandy loam, silt loam and silty clay loam.

Lime sources: $CaCO_3$ and $Ca(OH)_2$

Lime rates: 0.0, 0.25, 0.50, 1.0, 2.0, and 4.0 $CaCO_3$ tons ac^{-1} equivalent.

Incubation times: $CaCO_3$ 4, 8, 16, 30, 60 days

$Ca(OH)_2$ 2, 4, 8, 16, 30 days

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Lime pilot study - soils

Parameter	BR [1] SRS - 2113	SGS SRS - 2308	Hwk SRS - 2401
pH (1:1) H2O	4.05	5.12	5.33
Sikora Buf pH	6.61	6.70	6.14
SOM-LOI (%)	1.32	2.36	5.73
CEC (cmol/kg)	5.1	11.1	22.9
50% WFPS (%)	22.2	28.5	31.8
Texture	Sandy loam	Loam	Silty clay L

[1] Selected soils from ALP program standard reference archive.

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Pilot study lime treatments

Each soil treatment consisted of 2100 g of soil, 12 lime source x rate treatments, 3 replications, total 855 samples. Lime blended using cone blender, 10 minutes per treatment.

Incubations conditions: 24-26 ^{o}C, RH 20-25%. Temperature monitored with data logger.

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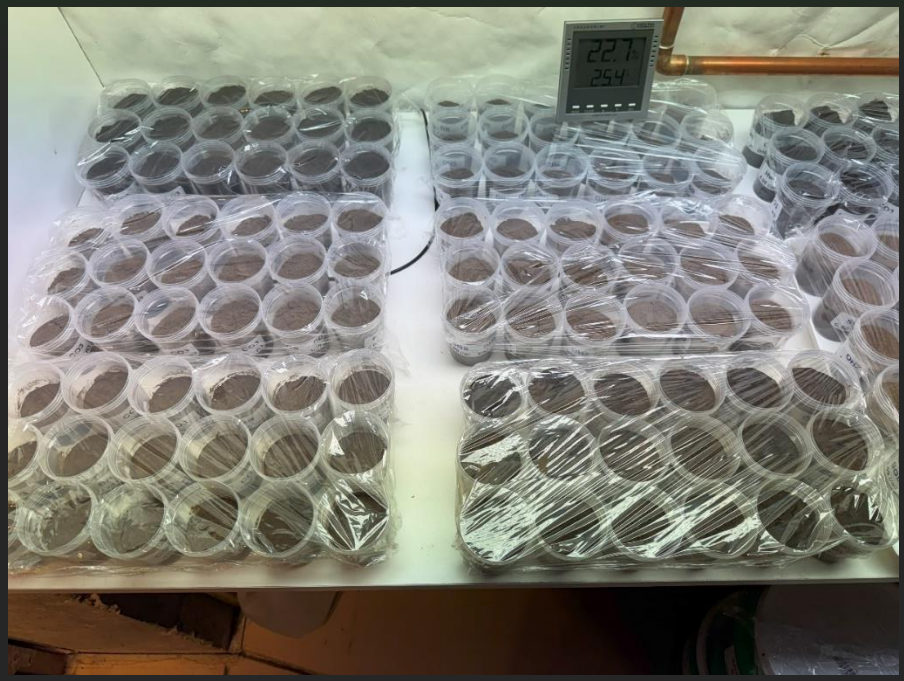
Right, 120 ml specimen cup containing 100 g soil, moistened to 50% water filled pore space (WFPS) moisture, lime treatment 0.25 t/ac, 8 day incubation.

Samples covered with saran wrap to minimize evaporative loss. Moisture adjusted with DI water every 72-96 hrs.



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Pilot lime incubations

At completion of incubation period, soils dried at 50 ^{o}C in forced air oven for 8 hrs or until soil moisture was < 2%.

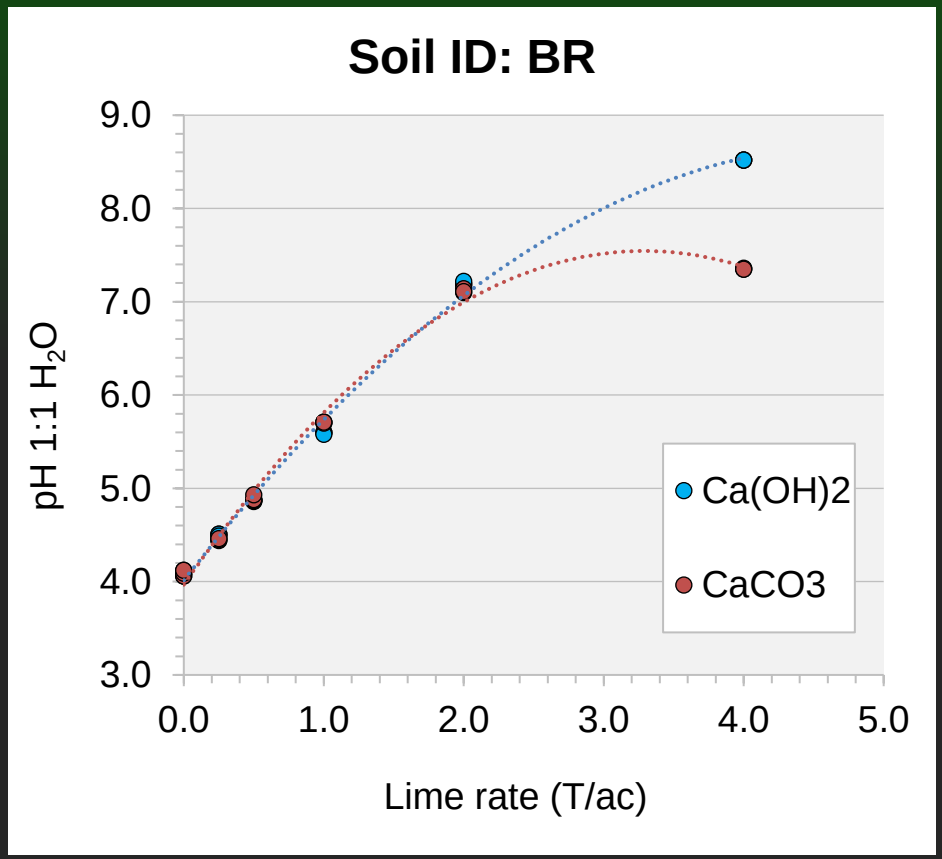
Soil ground using mortar-pestle and mixed. Analysis completed by Best Test Analytical, Moses Lake, WA.

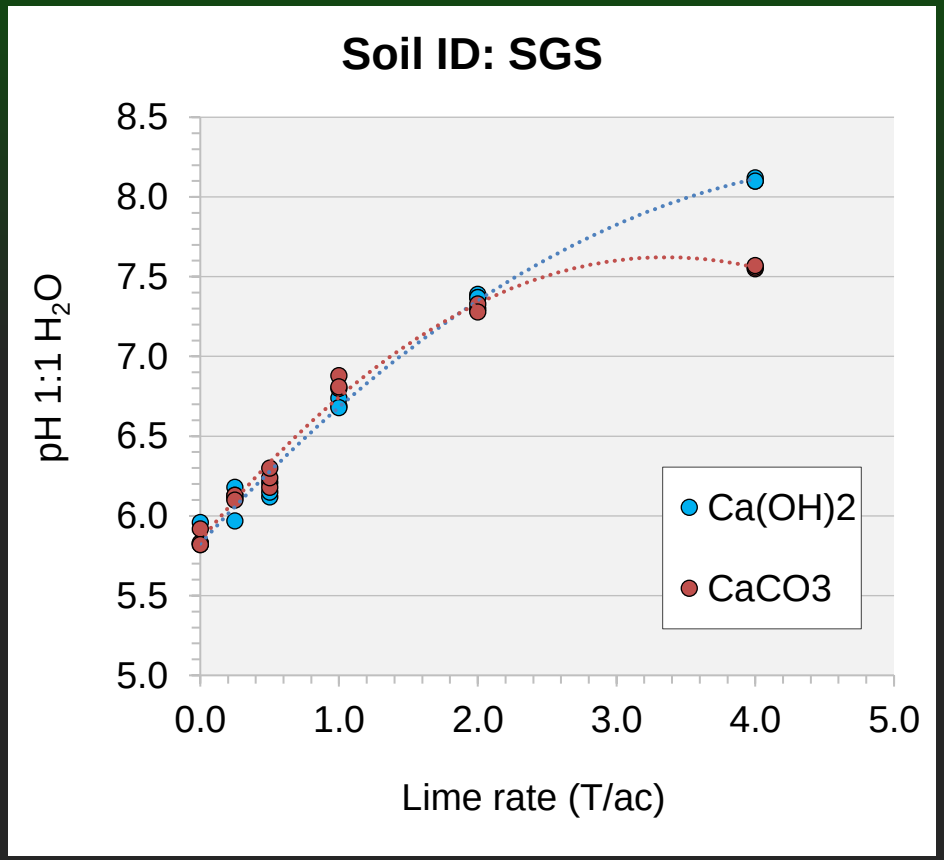
Lab analysis: $pH_{1:1\ H2O}$; $pH_{0.01\ CaCl2}$; Sikora Buf pH; $EC_{1:1}$; KCl exctrable NH_4-N, NO_3-N, Al, Mn; Exch-Ca, and $Ca_{1:1\ H2O}$.

Review data and prepare a data set for statistical analysis. Preliminary observations.

Pilot study: $Ca(OH)_2$ vs $CaCO_3$

Incubation period 8 days





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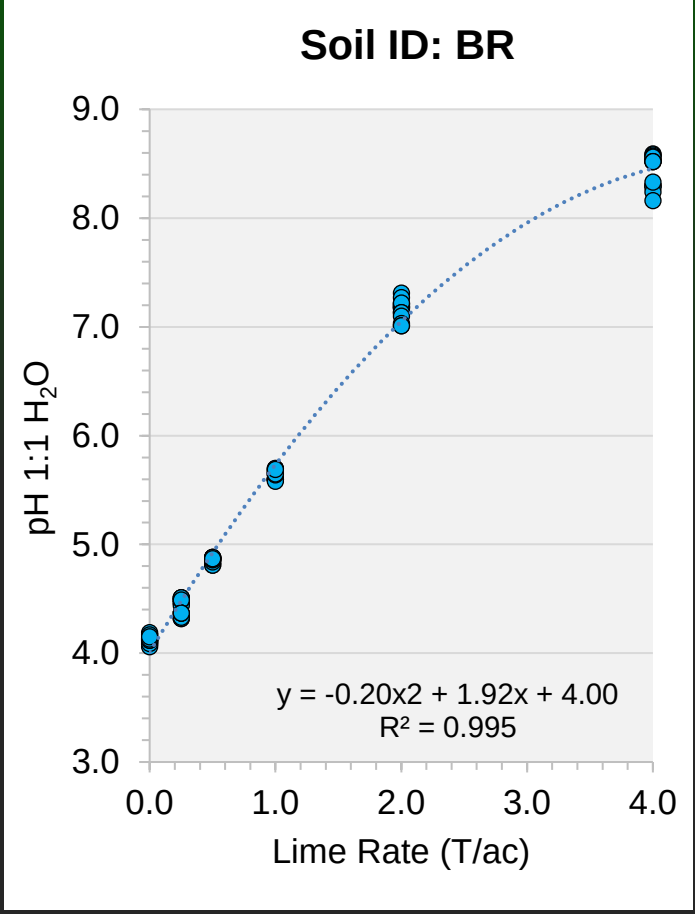
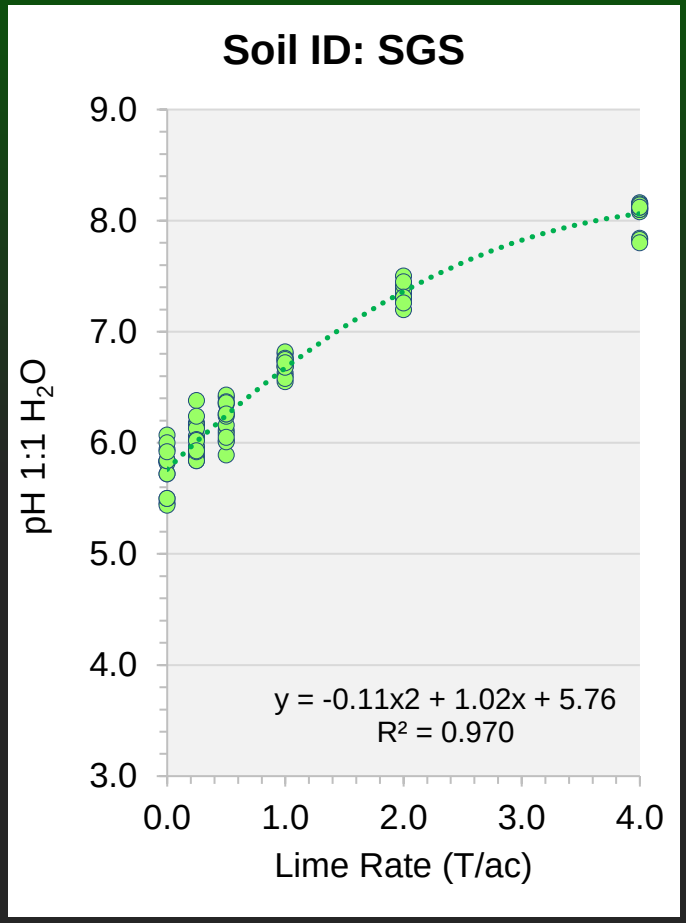
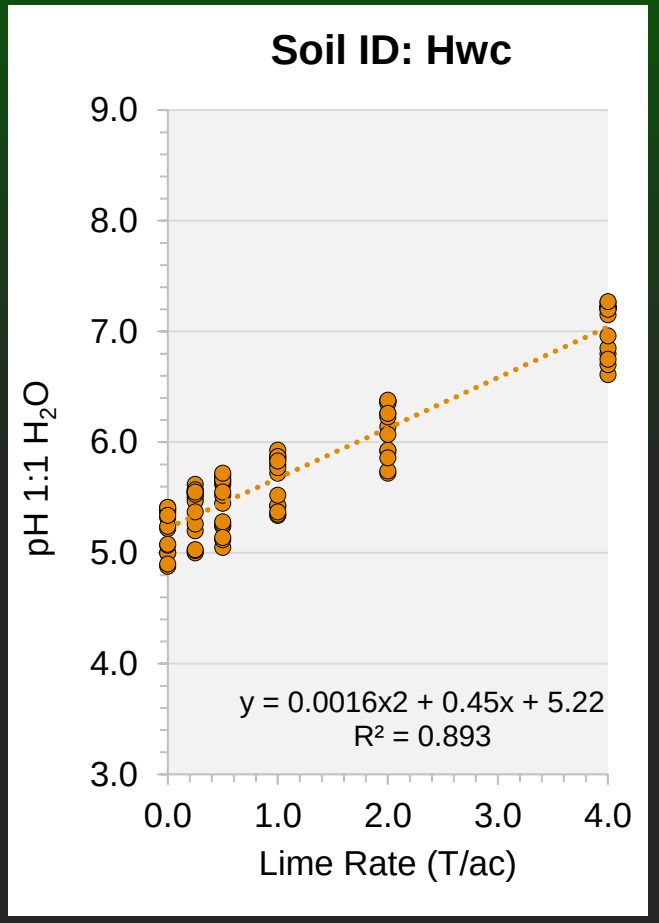
Pilot study: $Ca(OH)_2$ vs pH, three soils







Data shown across all incubation days (2-30) and replications (3).

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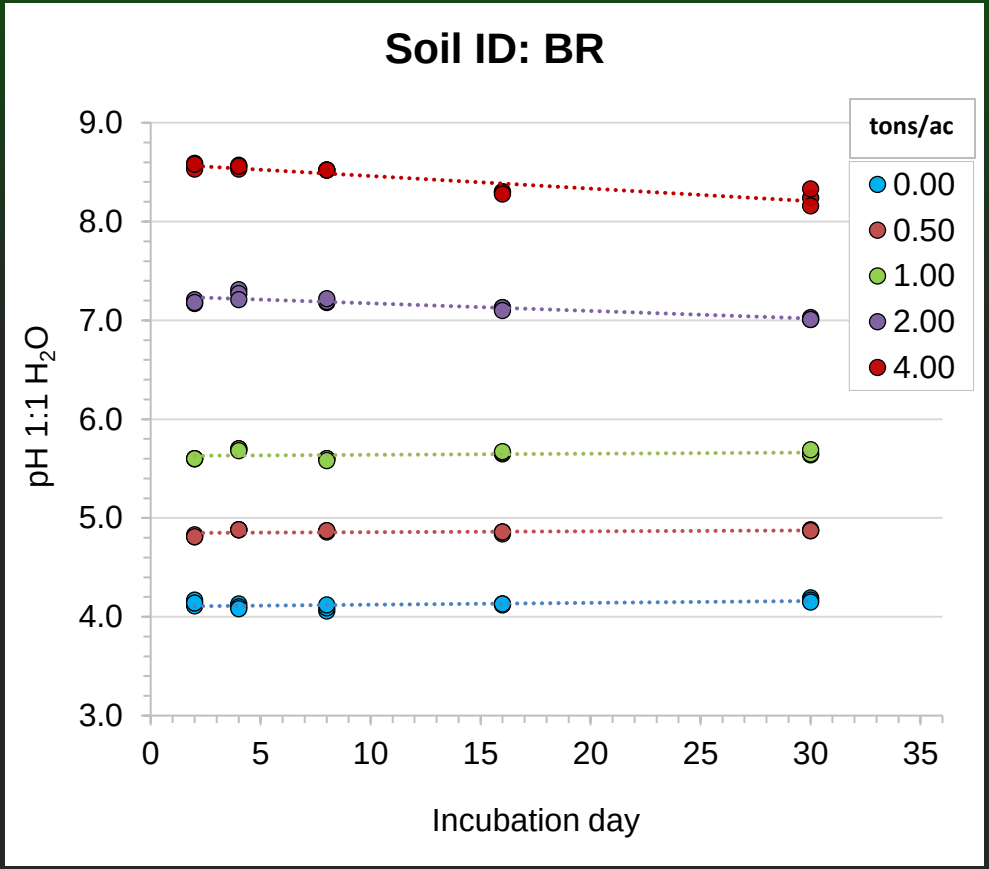
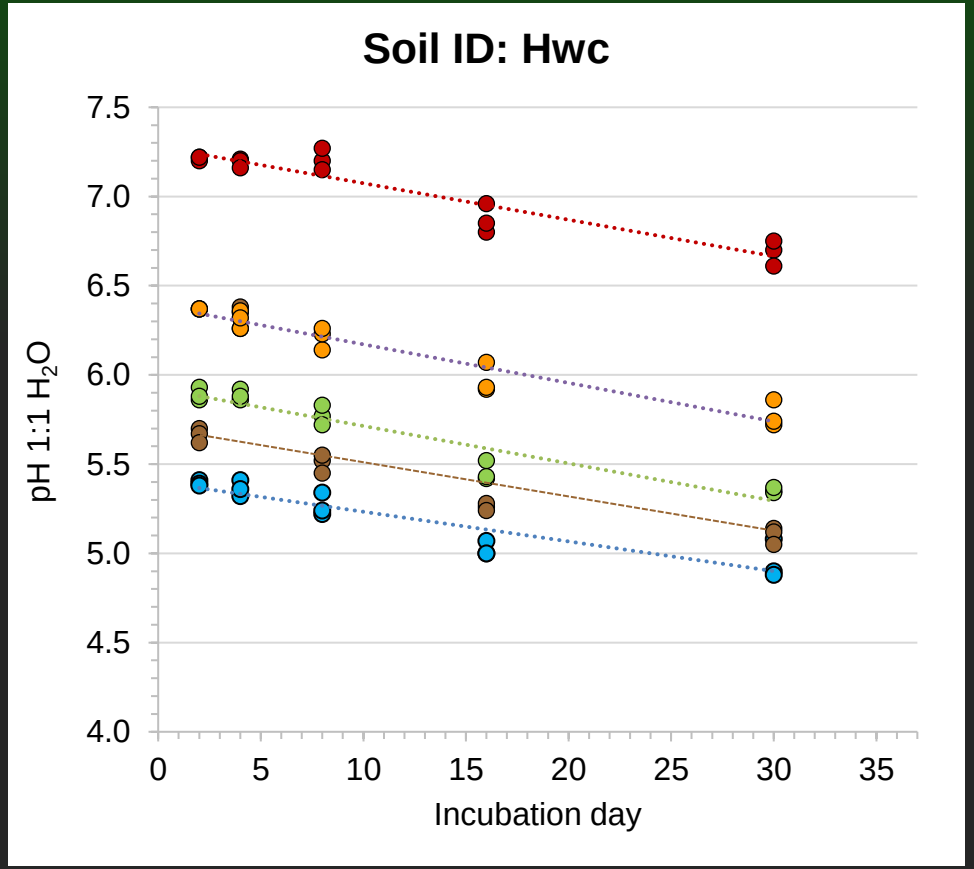
Pilot study results: $pH_{1:1\ H2O}$

Incubation period vs $Ca(OH)_2$ rate





Data shown across replicates (3).

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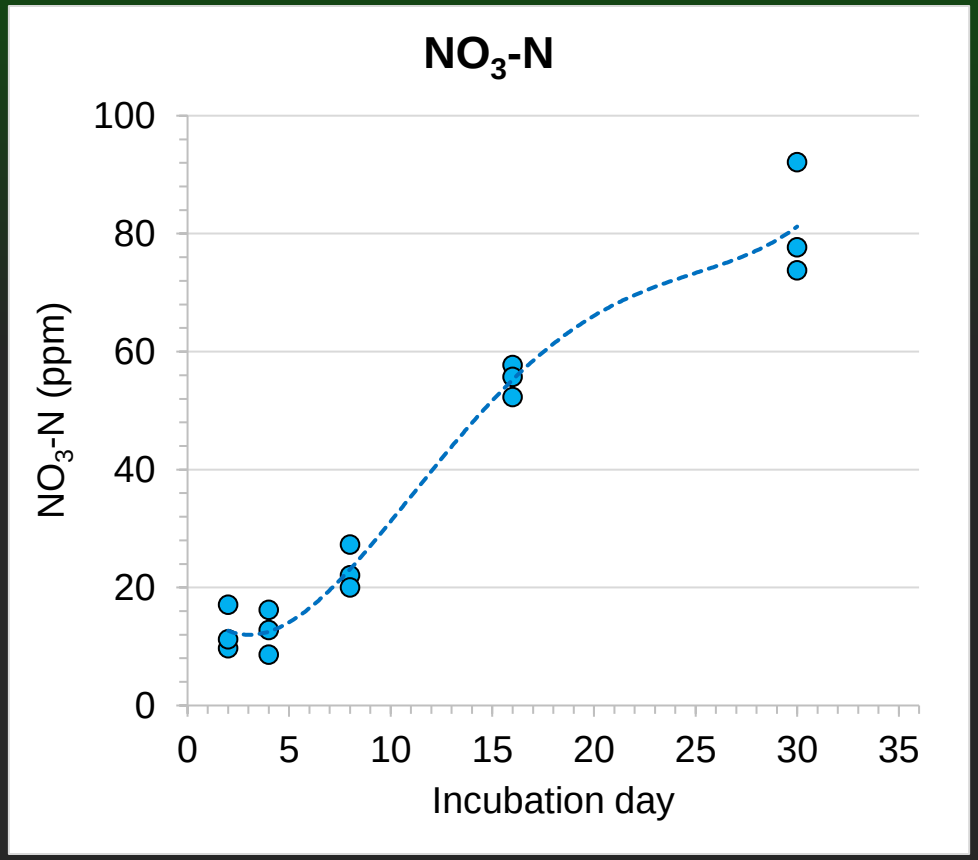
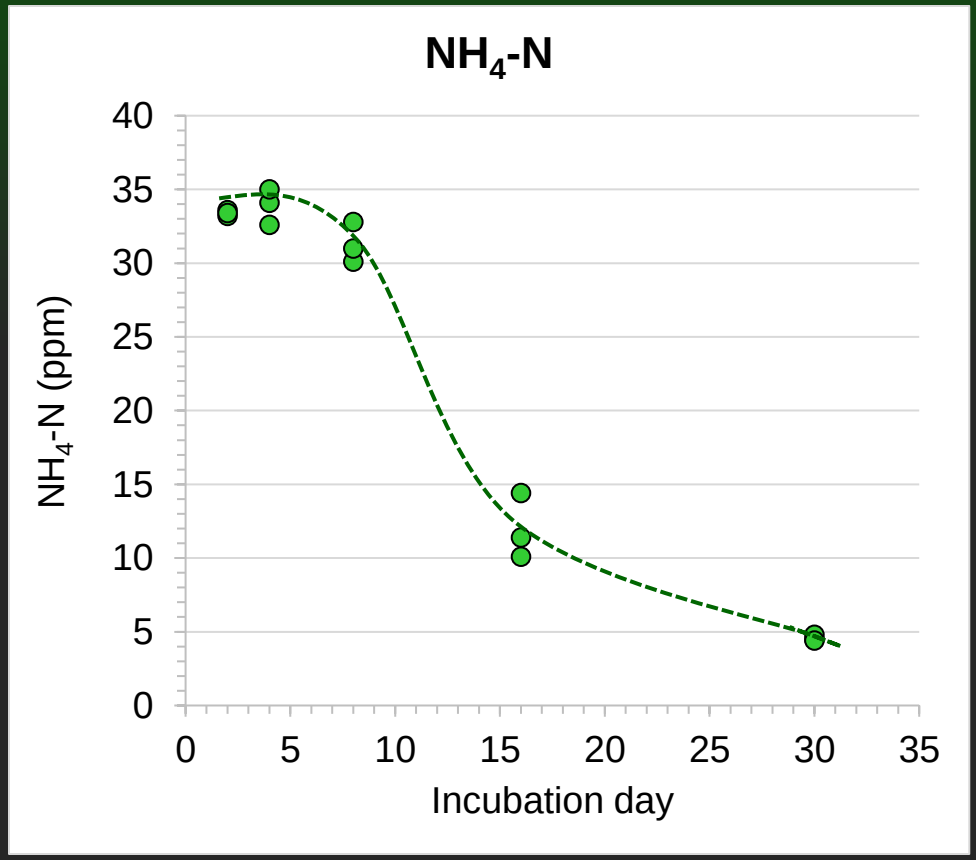
Pilot study: NH_4-N and NO_3-N

Soil ID Hwc, 0.5 ton/ac, incubation period 2-30 days





Data shown across replicates (3).

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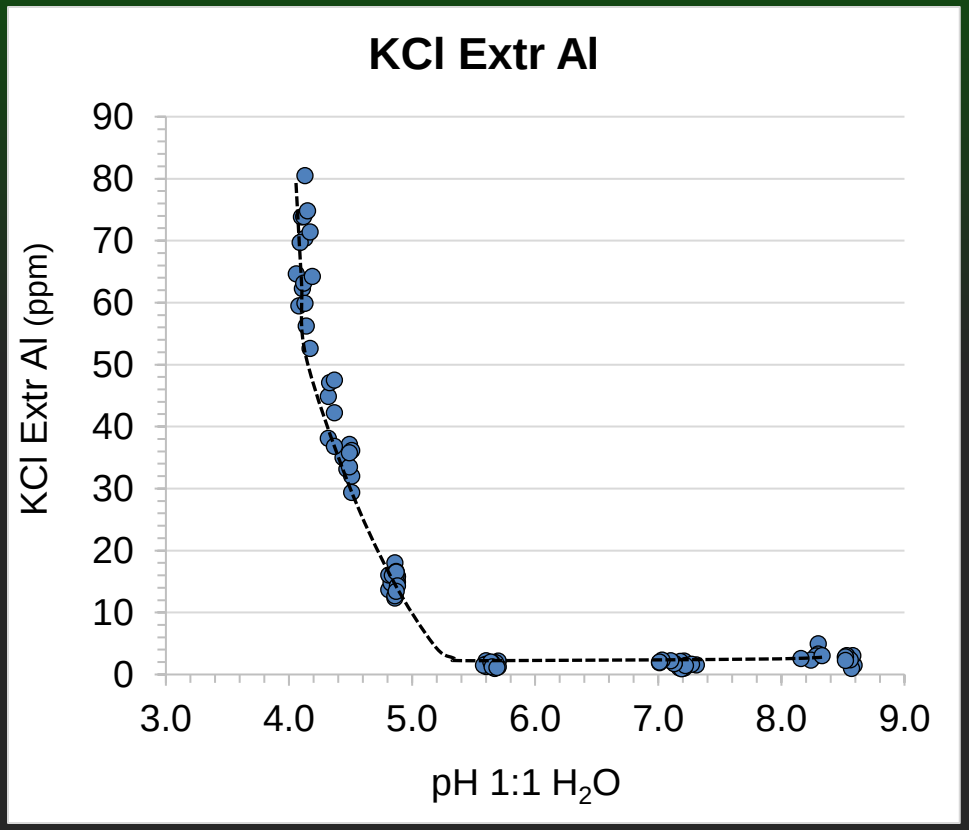
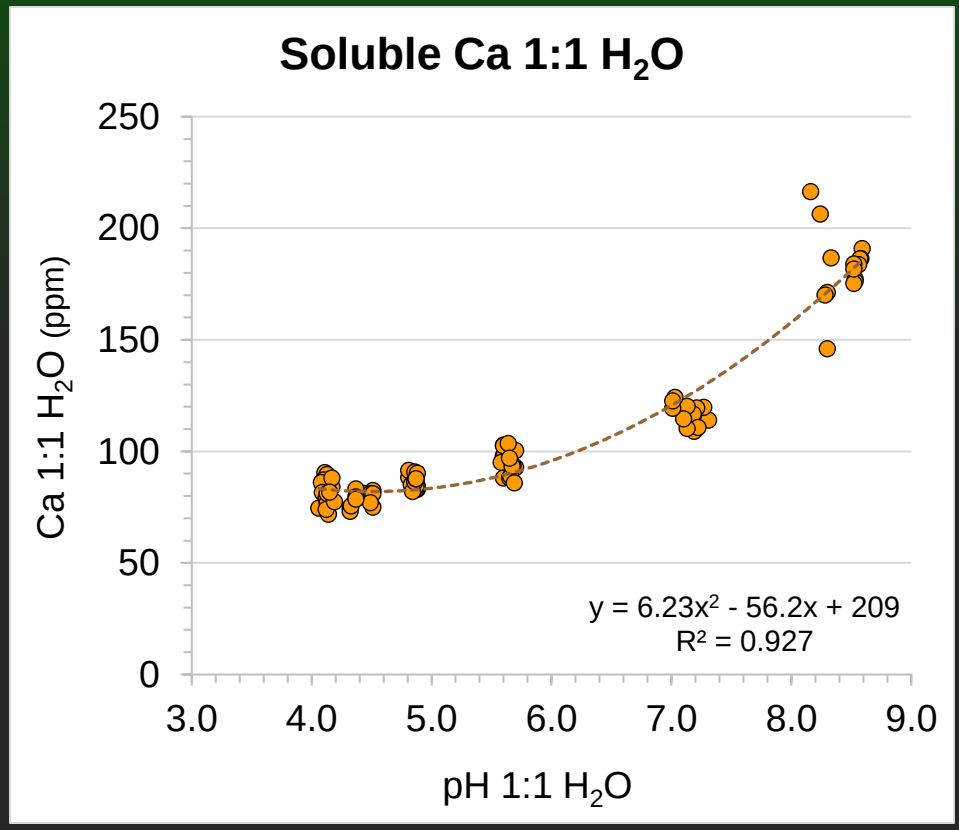
Pilot study: extracable Al and soluble Ca

Soil ID BR, lime source $Ca(OH)_2$

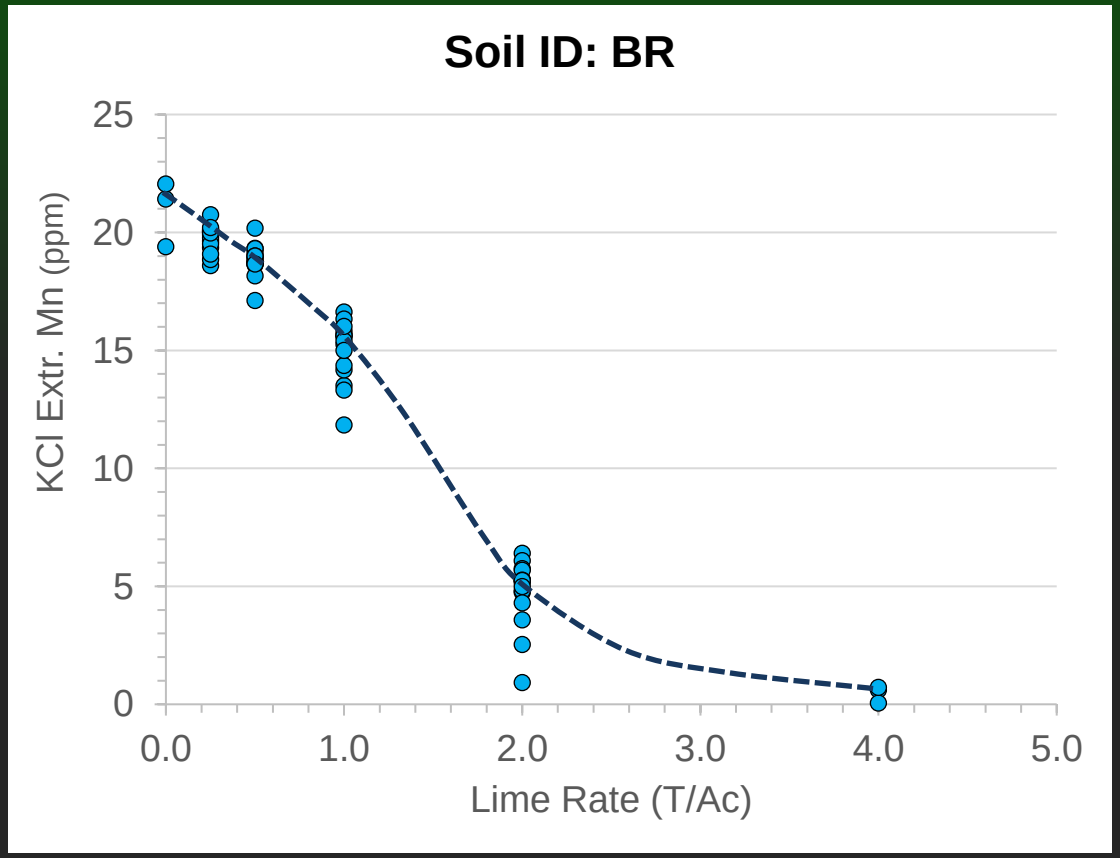




Data summarized across all incubation periods (2-30) and replications.

Pilot study: extractable Mn

Soil ID BR, lime source $Ca(OH)_2$



Data summarized across all incubation periods (2-30) and replications.

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Observations

- Lime rates ≤ 2.0 tons/ac, $Ca(OH)_2$ and $CaCO_3$, resulted in equivalent soil pH values across soil incubation periods.
- Lime rate increased pH on all soils, least on the highest CEC soil, silty clay loam texture.
- Nitrification increased with incubation time, and was associated with a lower soil pH. Soil Hwc pH decreased 0.5 units over 30 days.
- Increasing lime rate reduced soil extractable Al and Mn, increased 1:1 H_2O soluble Ca on all soils.
- pH precision was highest using 1:1 0.01 M $CaCl_2$ measurements.

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FRST Lime Project

Review Pilot study lab analysis and lab analysis QC.

Compile data set for Lime pilot study statistical analysis.

Develop lime incubation experimental study recommendations for FRST Lime national study using 130 soils.