

Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports
Project #:

Progress Report Year: __3__ of __3__ (maximum of 3 year funding cycle)

Title: Assessment of soil acidity on soil-borne pathogens, weed spectrum, herbicide activity, yield, and crop quality on dryland wheat production.

Principal Investigators:

Christina Hagerty, Assistant Prof. of Cereal Pathology, OSU, CBARC, Pendleton, OR
Paul Carter, Associate Prof., Regional Extension Soil Specialist, WSU, Columbia County, WA

Cooperators:

Kurt Schroeder (U of I), *Tim Murray* (WSU), *Stephen Van Vleet* (WSU), *Judit Barroso* (OSU), *Stephen Machado* (OSU), *Don Wysocki* (OSU).

Executive summary: To initiate this long-term research effort, 24 x 50ft. plots were established in fall 2016 and treated with four ultrafine liquid calcium carbonate treatments (0, 600, 1200, and 2400 lbs/acre) with 4 replications. The plots were soil tested spring 2017, 2018, and 2019. Soil test results indicate the lime applications successfully established different soil acidity levels ranging from pH 4.85 to pH 6.65. Micro-nutrients were applied based on soil test results and included Zinc, Boron, and Copper. The plots were established in three distinct production zones in order to make the results of this research effort applicable to a wide audience of producers, provide a robust multi-location dataset, and understand how the effects of liming and soil acidity may differ regionally. The three locations include: CBARC Sherman Station in Sherman County, OR (11 in. annual rainfall), the CBARC Pendleton Station in Umatilla County, OR (16 in. annual rainfall), and in Whitman County, WA at the Palouse Conservation Field Station and in a farmer's field (18 in. annual rainfall).

Impact: Soils below a threshold of pH 5.2 are considered poor management and below the critical level for optimum grain production. Most dryland wheat production soils of the PNW are at or below the pH 5.2 critical threshold. This study will help quantify the impact of soil acidity to local wheat production and will serve as a foundation to develop solutions to affordably address soil acidity in the dryland PNW.

The measureable impacts in the most recent funding cycle:

1. Preliminary results indicate that modest applications of agricultural lime are effective to buffer acidic soils in the dryland wheat production region.
2. This project is increasing the awareness about the issue of soil acidity in the PNW. In addition, the project has assured producers that the PNW wheat research community is addressing the soil acidity problem, and ultimately working on economical solutions to help manage soil acidity.

The major themes we see at this point in time are:

1. At all four locations, the lime application in fall 2016 created a pH gradient at the soil surface (0-3in). The gradient at Pendleton (pH 4.87 – 5.93) may be most compelling.
2. At all four locations, the lime application in 2016 has yet to impact soil pH below 3in.
3. At all four locations, there was no yield response to the lime application in harvest 2019. However, we expect to observe a yield response in time, as the lime treatment moves down further into the soil profile.

Harvest 2020 will be our last harvest of these plots under support from Washington Grain Commission and the Oregon Wheat Commission. We will continue to seek other funding opportunities for the plots, and plan to continue to monitor the plots at a basic level to understand changes and impact of liming over time. Oregon plots will “rest” unplanted for the 2020-2021 seasons, but will remain “intact” for future studies. No determination has been made for the plots in Washington at this time, although the farmer plot will continue to be farmed and we could possibly return at a later date to evaluate soil changes and possible future plot harvest of the farmer seeded crop.

Around this time next year, we will be compiling 2016-2020 data from all four locations and writing a summary manuscript(s). In addition, Dr. Paulitz, Dr. Yin, and Dr. Schlatter are collaborating on a soil microbiome study to investigate soil bacterial and fungal community ecology as a function of pH – the microbiome work is supported by funding from USDA-ARS.

There are four figures attached for each of the four locations to graphically illustrate our main findings. Results are preliminary.

We sincerely thank the WGC and OWC for funding to further understand the impact of soil acidity on our production system. This work continues to generate tremendous interest and support from the producer clientele of OR and WA wheat.

Outputs and Outcomes:

See attached Excel template

Use the Excel template provided to report on the following. Ideally, you simply update your spreadsheet from previous reports. The objectives and deliverables identified in the spreadsheet should be consistent with the original objectives and deliverables described in the project proposal.

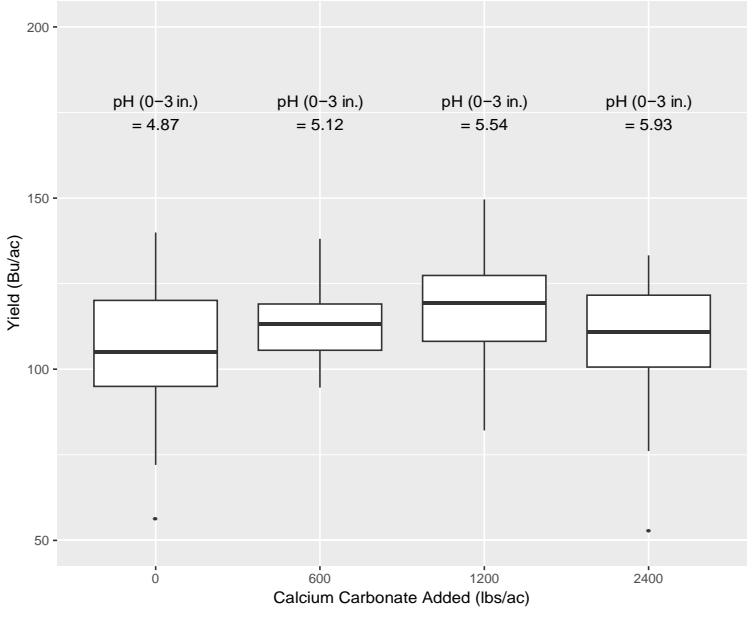
- A. Progress: For each objective and deliverable, describe the current status/progress towards completing the stated objective? If there have been delays or problems with progress, please keep the WGC informed through the current proposal, annual progress report and quarterly reports. Delays or failures are an expected part of research; however, the WGC would like to know when they occur.
- C. Timeline: State when the deliverable will be or was produced.
- D. Communication: State the method of communicating results to growers. (A listing of refereed publications, presentations, articles and field day/tour participation should be included in the report block).

WGC project number:
WGC project title: Assessment of soil acidity on soil-borne pathogens, weed spectrum, herbicide activity, yield, and crop quality on dryland wheat production.
Project PI(s): Christina Hagerty and Paul Carter
Project initiation date: July 1, 2017
Project year (X of 3-yr cycle): This year 3 of 3

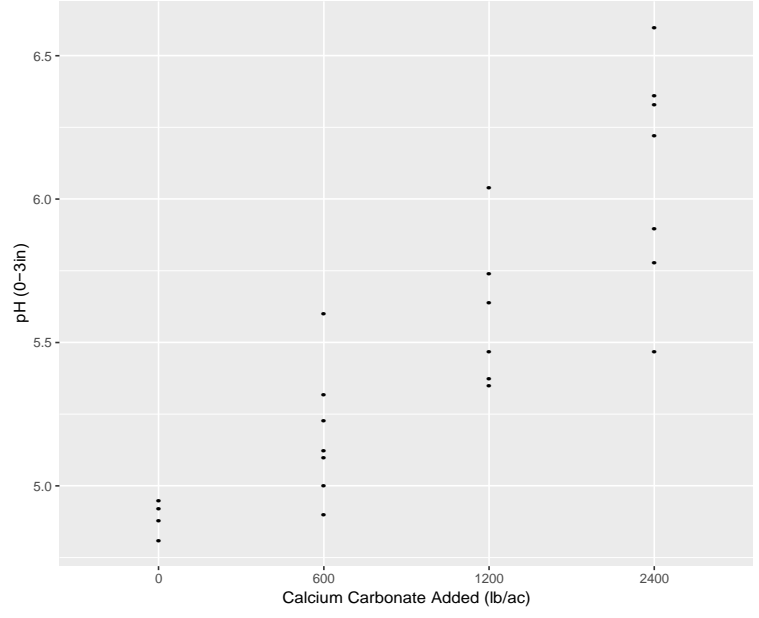
Objective	Deliverable	Progress	Timeline	Communication
Quantify impact of soil acidity on soil borne pathogens	Quantify disease in each soil pH treatment, statistically evaluate the relationship between pathogens and pH	Disease quantification has occurred in Spring 2018, and Spring 2019, and will occur in Spring 2020.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience
Quantify impact of soil acidity on weed spectrum	Quantify weed spectrum in each soil pH treatment, statistically evaluate the relationship between weeds and pH	Weed spectrum quantification has occurred in Spring 2018, and Spring 2019, and will occur in Spring 2020.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience
Quantify impact of soil acidity on herbicide activity	Quantify herbicide activity in each soil pH treatment, statistically evaluate the relationship between herbicide activity and pH	Weed spectrum quantification has occurred in Spring 2018, and Spring 2019, and will occur in Spring 2020.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience
Quantify impact of soil acidity on yield	Quantify yield in each soil pH treatment, statistically evaluate the relationship between yield and pH	Yield quantification has occurred in Spring 2018, and Spring 2019, and will occur in Spring 2020.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience
Quantify impact of soil acidity on crop quality	Quantify crop quality in each soil pH treatment, statistically evaluate the relationship between quality and pH	Grain quality samples will be submitted after harvest 2020.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience
Understand more about the total picture of the impact of soil acidity on the dryland wheat production system	Synthesize the parameters listed above to understand more about the total impact of soil acidity on the Columbia Basin dryland wheat production region.	Data compilation is ongoing.	Fall 2020 synthesize and compile results	Extension programming to communicate results directly to grower clientele and peer reviewed publications to communicate results to the scientific audience

Do not use a font size less than 10 point. Let the template break over pages if necessary. The formatting will be retained when saved as a pdf file.

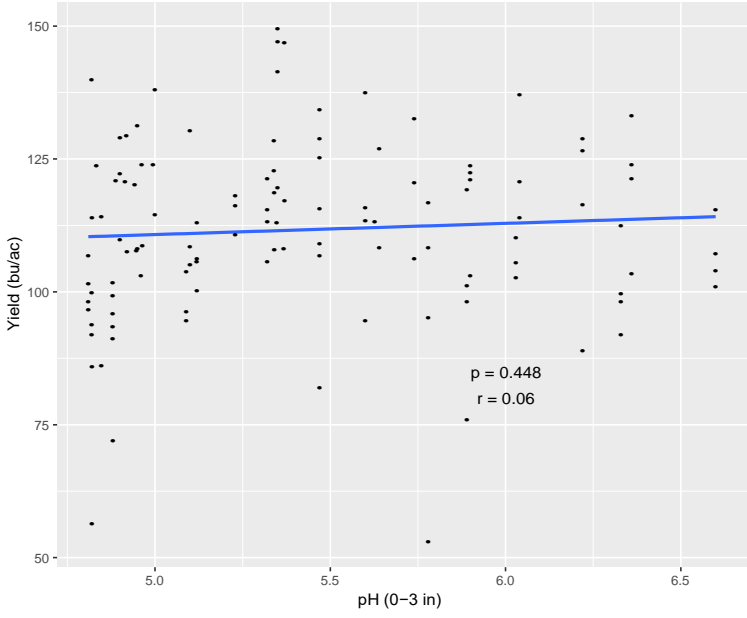
Pendleton, OR – Winter Wheat



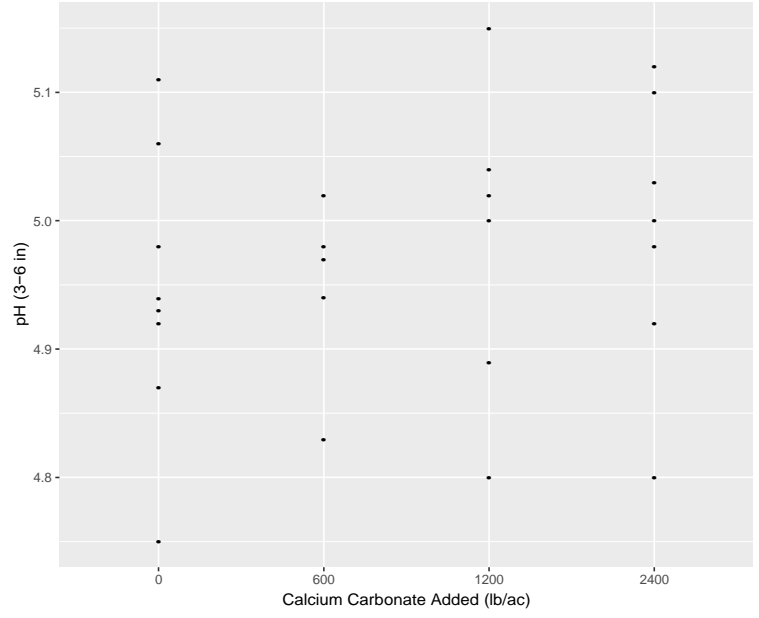
Pendleton, OR



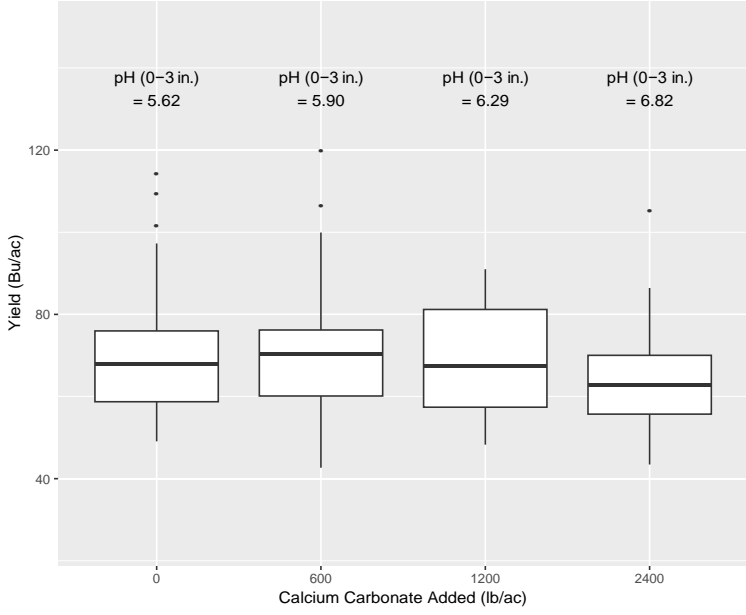
Pendleton, OR – Winter Wheat



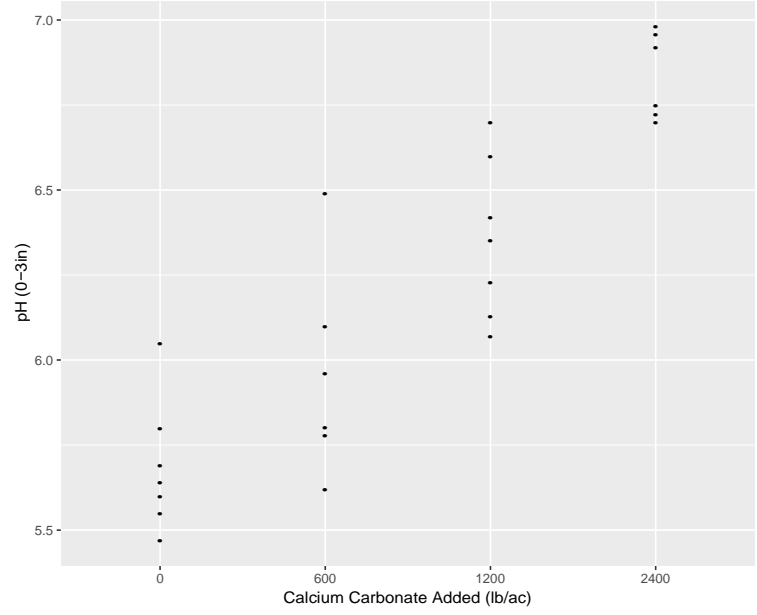
Pendleton, OR



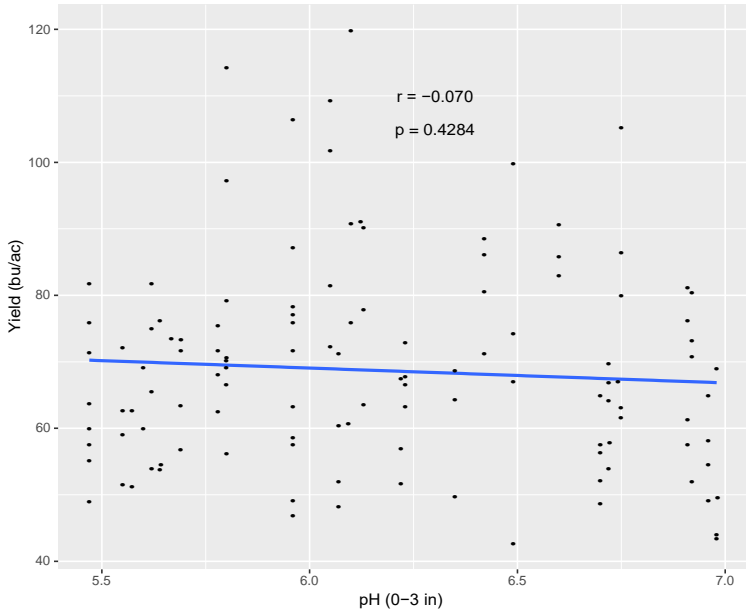
Moro, OR – Winter Wheat



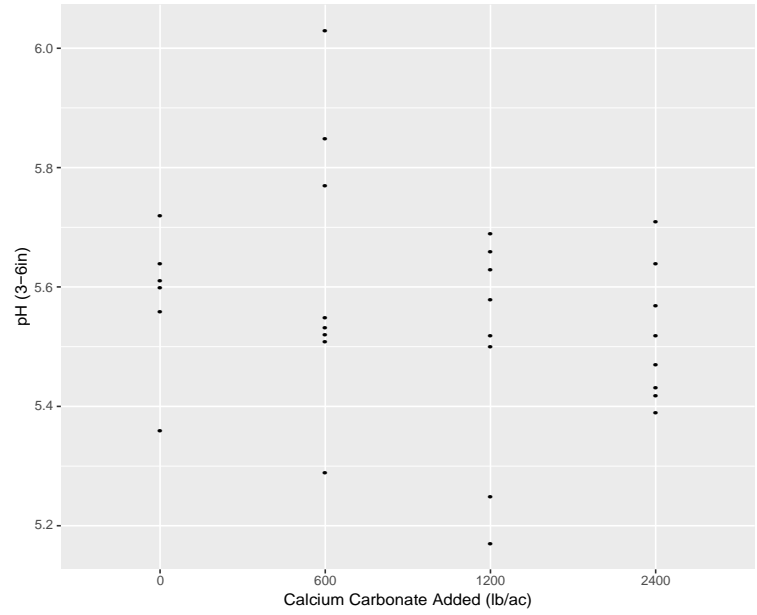
Moro, OR



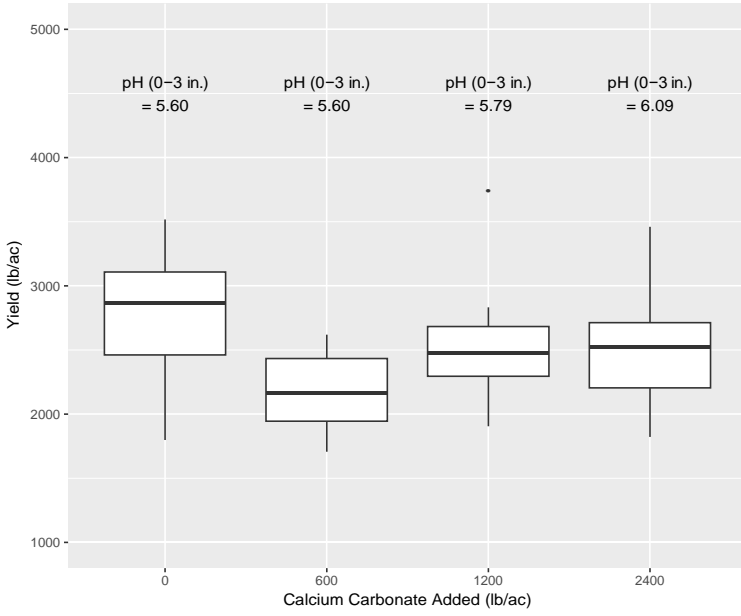
Moro, OR – Winter Wheat



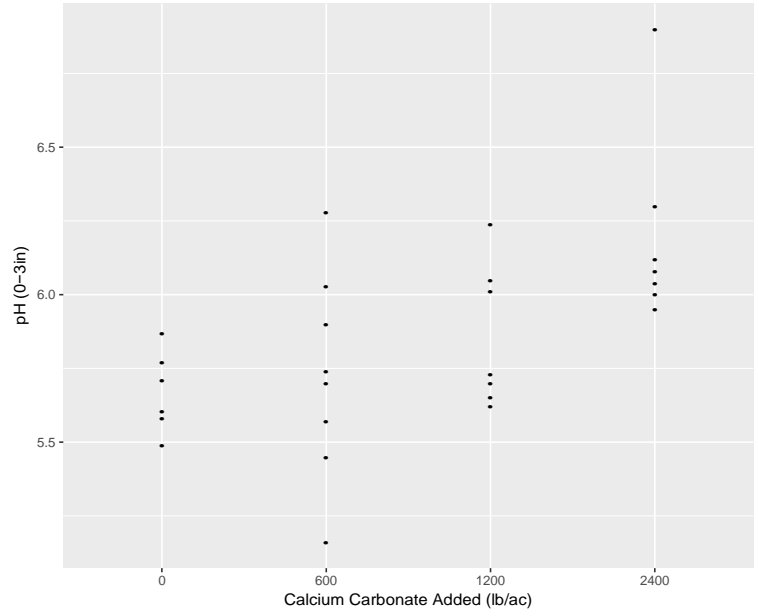
Moro, OR



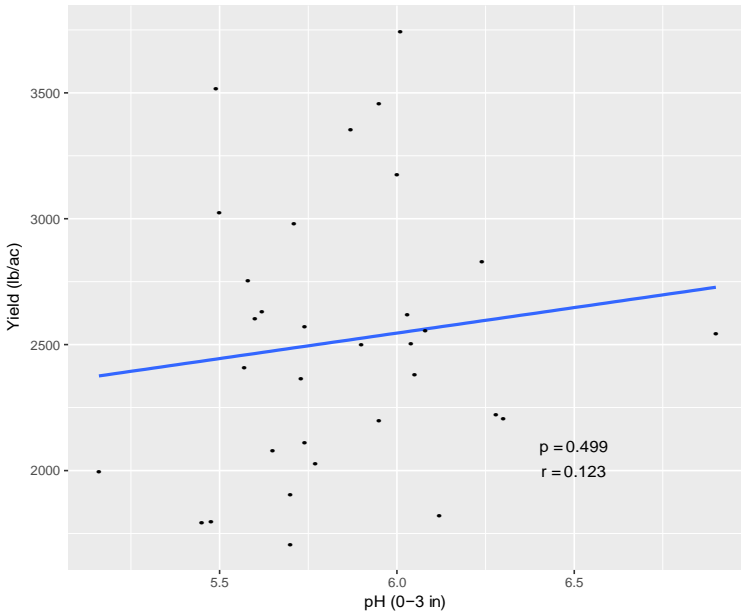
Clark Farm, WA – canola



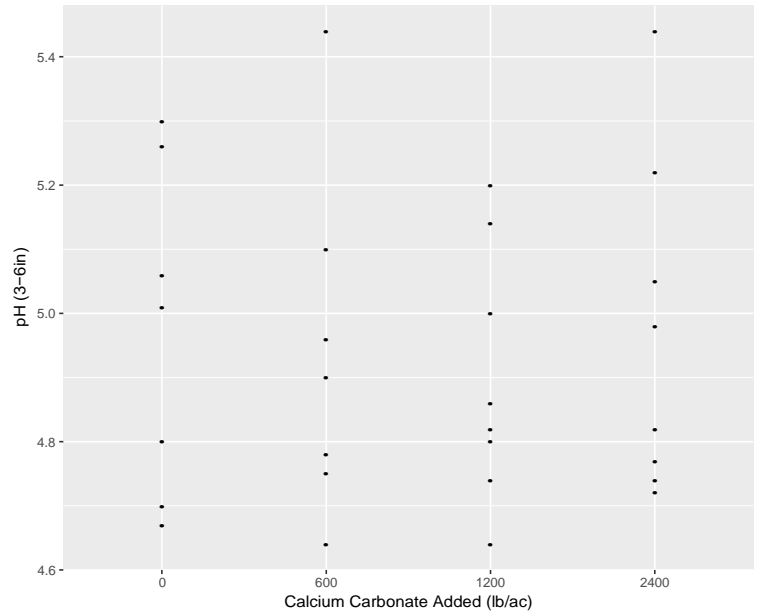
Clark Farm, WA



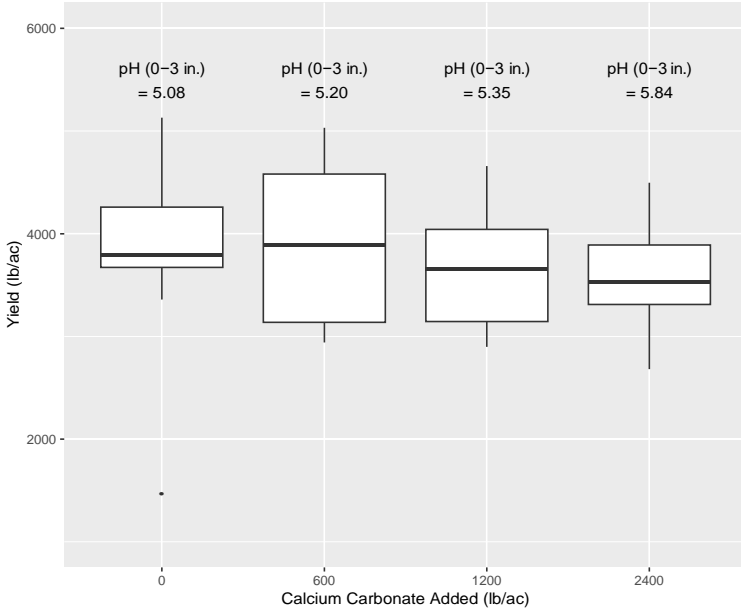
Clark Farm, WA – canola



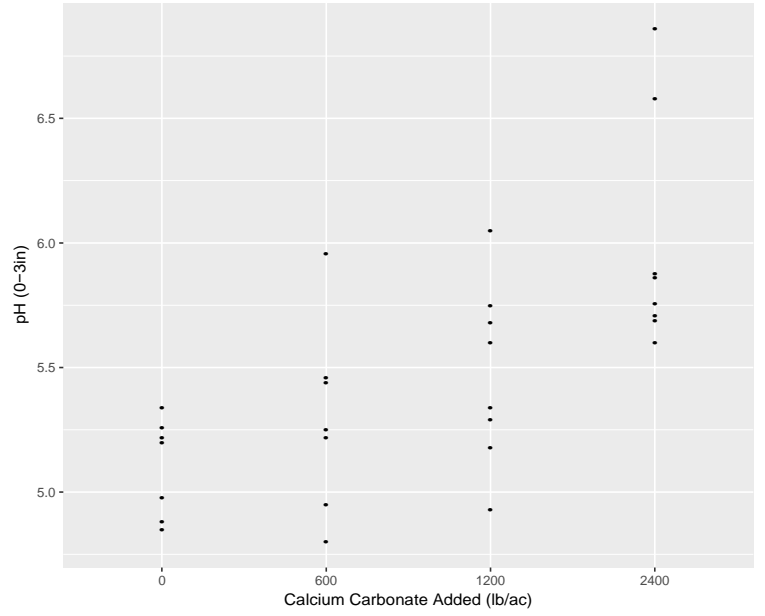
Clark Farm, WA



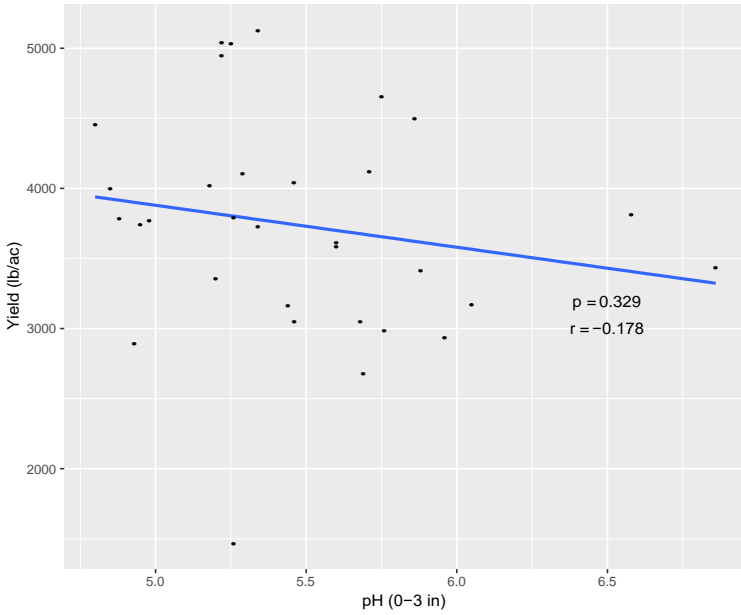
PCFS, WA – Spring Barley



PCFS, WA



PCFS, WA – Spring Barley



PCFS, WA

