Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports
Format
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(Begin 1 page limit)
Project #: 3019-4387
Progress Report Year: *_3___ of _3___ (maximum of 3 year funding cycle)*
Title: Cultural Management of Soil Acidification and Aluminum Toxicity in Wheat-Based Systems of E. Washington
Investigators: D. Huggins, K. Schroeder and T. Paulitz

Cooperators: R. Koenig, T. Brown, C. McFarland

Executive summary:

- Field trials with different rates (100-2000 lbs/ac of $CaCO_3$) of fluid and dry lime were established in fall 2013 on prairie (Conservation Farm and private farm near Pullman, WA) and forest (private farm near Rockford, WA) soil. Crop and soil responses to treatments were monitored. No yield differences were measured, however, hail damage reduced the utility of these results. Soil samples revealed that treatments were only effective to a less than 1 inch depth, however, soil monitoring with depth will be continued. Field trials were coordinated with Kurt Schroeder (Univ. of Idaho) and similar treatments were established in N. Idaho. Seed-placed lime was also evaluated for spring crops at the Cook Agronomy Farm, however, no yield responses were noted.
- Limitations of Veris technology used to map soil pH were identified (poor accuracy, limited field "windows" for operation). Spatial variability of soil pH was considerable with fields ranging 2 or more soil pH units (e.g. soil pH of 4.5 to 7.0 in single field). Similar spatial variability in soil pH was measured for soil samples from the Cook Agronomy Farm. These data support variable lime applications that target within-field differences in lime requirements.
- Laboratory studies were conducted to develop a new lime requirement determination to replace current recommendations which are not adequate.
- Farm sites in WA and ID where lime applications have been initiated were identified to further assess spatial responses of soil, yield and economic results.
- A new fluid lime applicator was developed to target stratified soil acidity at the 3-4 inch depth.

Impact:

- Our liming trials, using novel formulations and application techniques are providing growers with immediate information about the efficacy of these methods under our conditions.
- Spatial characterization of soil pH and liming requirement will help target lime applications and lead to greater economic performance of crops.
- New soil tests for determining lime recommendations will replace current recommendations.

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WGC project number: 3019-4387
WGC project title: Cultural management of soil acidification and aluminum toxicity in wheat-based systems of E. Washington
Project PI(s): David Huggins, Kurt Schroeder, Tim Paulitz
Project initiation date: 7/1/2013
Project year: Year 3

Objective	Deliverable	Progress	Timeline	Communication
Objective 1. Evaluate crop response to band and broadcast lime on low pH soil.	(a) Efficacy of relatively low quantities of banded lime and (b) effectiveness of fluid versus pelitized lime with and without soil incorporation on ameleorating adverse soil acidification effects.	Field trials with different rates (100-2000 lbs/ac of $CaCO_3$) of fluid and dry lime established in fall 2013 on prairie (Conservation Farm and private farm near Pullman, WA) and forest-derived (private farm near Rockford, WA) soil. Field trials were coordinated with Kurt Schroeder (Univ. of Idaho) and similar treatments were established in N. Idaho. Crop yields were harvested and additional soil samples collected to assess soil and crop responses to treatments. A seed-placed fluid lime study was conducted for spring pea, chickpea and wheat at the Cook Agronomy Farm. A new fluid lime applicator was developed to target stratified soil acidity. This applicator will be integrated into new field studies in 2015.	Initiate field trials in year 1, complete in year 3.	Twelve presentations (over 900 growers/industry personnel in audiences) and written products (e.g. Wheat Life article) aimed at raising awareness and understanding of soil acidification issues made to wheat industry, Soil Conservation Districts, and as a part of 2014 PNDSA conference. Extension guides addressing a suite of soil scidification issues was initiated. Preliminary results were presented at the American Society of Agronomy meetings (2014).
Objective 2. Evaluate use of soil pH sensing technology (Veris Technologies, Inc.) to map the spatial variability of soil pH and to develop management zones.	Determine effectiveness of soil pH mapping to develop useful management zones for liming.	Veris Technology used to map spatial variability of soil pH in fields and evaluated to assess strengths and limitations. Significant limitations of the equipment in terms of accuracy and adequate field "windows" for operation discovered. Spatial variability of soil pH was considerable with fields often ranging 2 or more soil pH units (for example, soil pH of 4.5 to 7.0 in single field). Soil samples were also collected and analyzed acroiss the Cook Agronomy farm which showed nearly a 2 pH unit range in variability. These data support the idea that variable lime applications may be beneficial to target differences in lime requirements. However, we initiated soil tests to determine lime requirements adequate for the Palouse region.	Evaluation of Veris technology will be completed in year 2. Development of soil pH management zone guidelines in years 2 and 3.	Five of the presentations listed under Objective 1 included data and information on the spatial variability of soil pH and use of Veris Technology to assess spatial variability.
Objective 3. Apply appropriate lime source site-specifically using soil pH maps and lime requirement and assess soil, yield and economic results.	Development and value (yield and economic) of precision agricultural liming	Farm sites in WA and ID where lime applications have been initiated were identified to further assess spatial responses in terms of soil, yield and economic results. Variable rate application of lime was established in one grower field. These data as well as results from Objective 2 will be used to develop and assess precision lime applications.	Initiate in year 2, complete in year 3	Future presentations.