

# ANNUAL REPORT

**Grant Code:** AP5458

**Title:** Liming for Improved Nutrient Utilization and Weed Management in Wheat

**Personnel:** Drs. Jared Spackman and Albert Adjesiwor

**Collaborators:** Jacob Bevan, Kaone Mookodi, Joseph Sagers, Sean Maupin, Alan Baum, Nathan Scafe, Clark Hamilton, Greg Blaser, Paul Stukenholtz

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## Accomplishments

The objectives of this study were:

Objective 1: Evaluate how liming modifies soil nutrient availability, plant nutrient uptake, and grain quality and yield.

Objective 2: Evaluate the effect of liming on weed pressure.

Objective 3: Perform a survey of southern Idaho acidic soils' physical and chemical properties and weed seed census.

This fall, Joseph Sagers, Jacob Bevan, Albert Adjesiwor, and Jared Spackman were able to successfully establish four on-farm field experiments. Three experiments are in Ashton on



Image 1. Sugar beet lime (gray) applied to a recently harvested potato field in Ashton, Idaho on October 11, 2021 with a surface soil pH of 5.4. The liming rates were 4, 0, and 2 tons/acre (closest to furthest plots, respectively).

irrigated fields, and one is in Swan Valley under dryland conditions. We applied lime at rates of 0, 2, 4, and 6 ton/ac to 50x100 ft plots. Prior to the lime application, we took soil samples from the 0-2, 2-4, 4-6, 6-8, and 8-12" depths. These samples were dried and ground to pass through a 2 mm sieve. They will be analyzed for soil pH and electrical conductivity after we collect our spring soil samples. We also took soil samples at the 0-12" depths and analyzed them for a complete nutrient analysis. A 0-6" soil sample was collected and will be analyzed for the weed seed census and herbicide resistance. A

subsample of the lime applied to each field was collected and analyzed for nutrient composition and lime composition. We found that the sugar beet lime had a fine particle size, contains 61% calcium carbonate, and supplies 20, 420, and 40 lb of nitrogen, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O, respectively per ton of applied lime (Stukenholtz lime analysis, 2021).

In our interactions with small grain producers across southern Idaho, we have identified 5 locations that have low soil pH including sites in Soda Springs, Swan Valley, Ashton, Lake Channel, and Freedom. Dr. Jared Spackman is continuing to work with Paul Stukenholtz and

Bryan Miller from Valley Wide in Ashton to identify additional locations that have soils with a pH <5.5. This spring, we will collect 10 gallons of soil from the 0-6" depth at each location to include in our lime requirement study.

We successfully hired one graduate student, Kaone Mookodi, in January of 2022. She will use these projects for her Master's thesis. She is currently conducting a literature review and will begin collecting soil samples in May. She is a bright student and we are looking forward to working with her to successfully conduct these long-term studies.



*Image 2. A sugar beet lime pile ready for application at Alan Baum's field site.*

We hired Jacob Bevan as a research technician in July 2021. He had recently completed his MS at the University of Idaho in Jianli Chen's wheat breeding program. Because of his research background and experience with wheat, he was able to rapidly adjust to the Barley Agronomy program and hit the ground running. He is an essential member of the Barley Agronomy research program and is doing an excellent job of keeping the project samples organized and processed in a timely manner. He has shown dedication to the program by putting in early mornings and late nights with Dr. Spackman to travel to and from Ashton and Swan Valley collecting soil samples and assisting in the lime applications, even in snowy and windy conditions.

**Projections:** To increase the scope of this project, we have written supporting grants for the Idaho Potato, Barley, and Alfalfa commissions to support additional on-farm field sites and soil analyses. The grant written to the Potato Commission would add two field sites in the Chester-Plano region that have sandier soils and weaker buffering capacity than Ashton soils. The Barley Commission grant will add two on-farm dryland sites east of Ashton in the Squirrel-Driggs region. The Alfalfa Commission grant would allow us to collect 7 additional soils for the laboratory lime requirement study. In addition to our previously outlined research goals, we plan to increase the value from the study by evaluating if soil pH modifies germination vigor of five different weed species including wild oat, kochia, and lambsquarters. We will utilize the lime-amended incubation soils for this analysis.

In addition to the Idaho Wheat Commission, there is interest at a national level to re-evaluate lime recommendations. Dr. Jared Spackman is participating with the USDA funded Fertilizer Recommendations Support Tool team (FRST) on developing and conducting a national liming rate recommendation study. Information and progress about this study will be shared with the Idaho Wheat Commission as the FRST team develops the project study plan.

With today's fertilizer prices, we will be evaluating the cost-benefit of applying sugar beet lime as a soil amendment and nutrient source compared to the cost of lime transportation and application. This information will be shared at the 2022 Cereal School. As previously mentioned, sugar beet lime contains 420 lb P<sub>2</sub>O<sub>5</sub> per ton of lime. Given that sugar beet lime has a pH of 8.5 and high calcium content, it is uncertain how plant available the phosphorus in the lime is. Future

research may evaluate how much sugar beet lime phosphorus is available to the crop and how its availability changes as the lime neutralizes acidic soil.

**Publications:**

This project will be described at the 2022 Winter Cereal School. We will potentially present information from the incubation study at the 2022 American Society of Agronomy-Crop Science Society of America-Soil Science Society of America annual conference.



*Image 3: Jacob Bevan collecting pre-lime application soil samples at Clark Hamilton's field site in Swan Valley.*