

Liming for Improved Nutrient Utilization and Weed Management in Wheat



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BACKGROUND

Soil Acidification in Eastern Idaho: Prolonged use of ammonium-based fertilizers has led to a decline in soil pH, causing aluminum toxicity and nutrient imbalances that inhibit crop growth and reduce yields.

Impact on Key Crops: Barley and spring wheat, critical to the region’s agriculture, are particularly affected, with compromised root development and poor stand establishment in acidic soils.

Potential Solution: Sugar beet lime (precipitated calcium carbonate) is being explored as a cost effective lime amendment to raise soil pH, mitigate soil acidity, and improve soil health and crop performance.

OBJECTIVES

- Evaluate the effectiveness of sugar beet lime in raising soil pH.
- Assess its impact on crop yields and plant health.
- Provide recommendations for farmers on lime application techniques.

MATERIALS & METHODS

This study was conducted over a four-year period, from 2021 to 2024, across four field sites located in Fremont and Bingham Counties, Idaho. Lime treatments were applied in the fall of 2021 at rates of 0, 1, 2, and 4 tons per acre. Soil pH was monitored in the upper 12 inches of the soil profile to evaluate the effectiveness of the lime in neutralizing acidity. In addition, crop yields were measured to assess the impact of lime application on plant growth and productivity. Observations were made on stand establishment and overall plant health to provide further insight into the benefits of lime amendments under varying soil and cropping conditions.

RESULTS & DISCUSSION

Soil pH Improvements:

- When incorporated in the soil, precipitate calcium carbonate reacts quickly to neutralize soil acidity, predominantly in the top 4 to 6” of the soil profile.
- Measured soil pH values (0-6”) increased with increasing lime application rates.
- Soil pH in the top 6” of the soil was slightly more acidic in 2024 than in 2023 except at the 6 ton/ac rate.

Crop Yield and Growth:

- Lime-treated plots showed higher yields 2-3 years after lime application and improved stand establishment.
- Yield benefits were most pronounced in soils with severe acidity.
- Lime incorporation is required to modify soil pH at depths >2”.

Farmer Feedback:

- Challenges: Precise spreading and incorporation required.
- Benefits: Long-term soil health and yield improvements outweigh challenges.

CONCLUSIONS

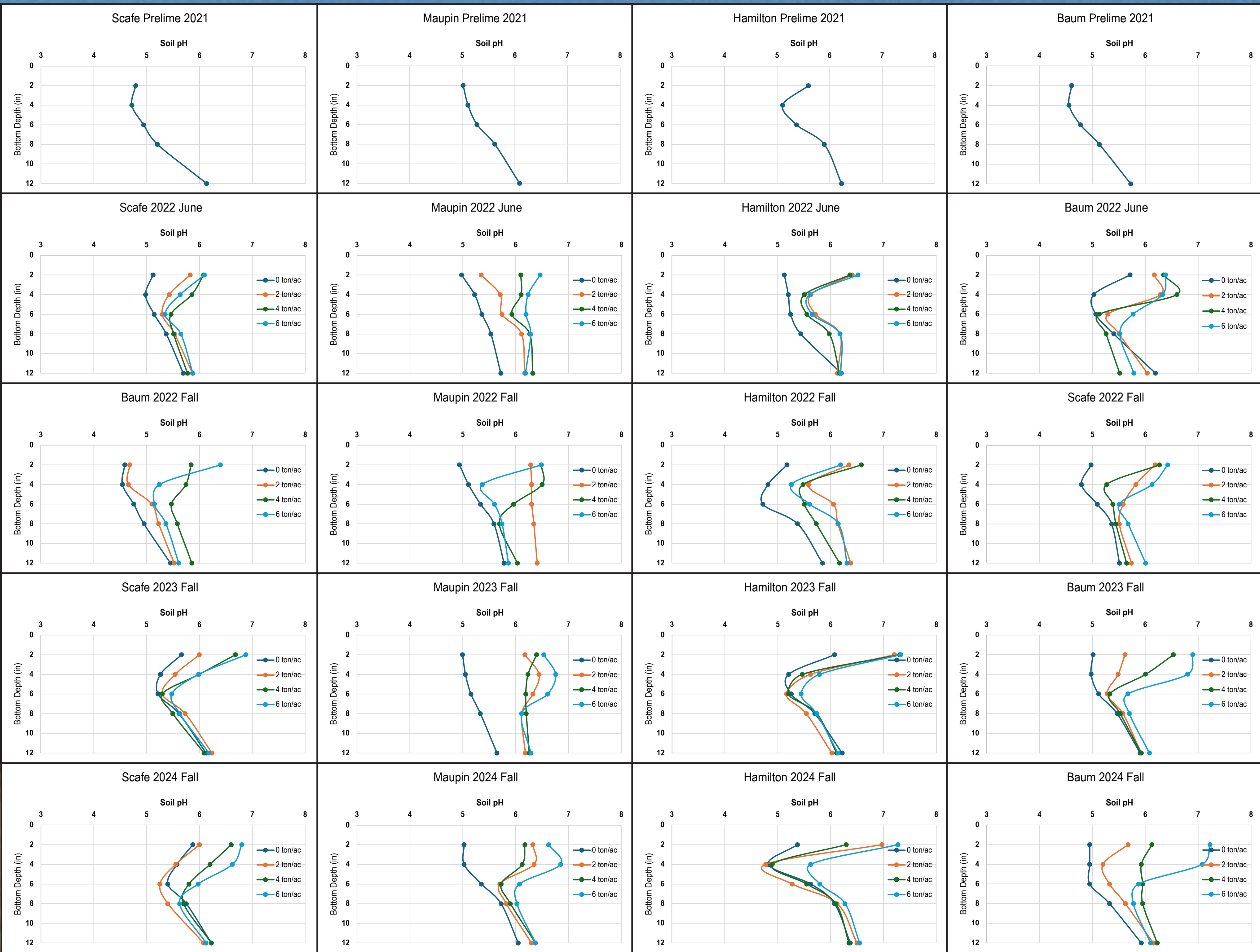
- **Improved Soil Health and Crop Performance:** Sugar beet lime effectively raised soil pH, reduced aluminum toxicity, and improved nutrient availability, leading to better root development, stand establishment, and increased yields in both barley and wheat.
- **Optimal Application Rates:** Lime application rates of 4 tons per acre consistently resulted in the greatest improvements in soil pH and crop performance, though site specific conditions influenced results.
- **Adoption Potential:** Despite some challenges with application logistics, farmers showed strong interest in adopting sugar beet lime due to its cost-effectiveness and long-term benefits for soil health and sustainable crop production.

Table 1: Hard white spring wheat (HWSW), soft white spring wheat (SWSW), barley, potato, or canola seed yield responses to various precipitated calcium carbonate application rates applied on an “as-is” basis at four locations in southeastern Idaho.

PCC Lime Rate (ton/ac)	Scafe			Maupin			Hamilton			Baum		
	2022	2023	2024	2022	2023	2024	2022	2023	2024	2022	2023	2024
	HWSW	Barley	Barley	SWSW	Potato	Wheat	Barley	Canola	Barley	HRSW	Barley	Barley
	Bu/ac	Bu/ac	Bu/ac	Bu/ac	CWT/ac	Bu/ac	Bu/ac	lb/ac	Bu/ac	Bu/ac	Bu/ac	Bu/ac
0	NA	91.5	159b	137	258	125	79	4368	63	177	33	119b
2	NA	87	169ab	132	260	144	83	5032	71	119	30	152a
4	NA	78	175ab	127	277	130	92	6448	57	120	32	159a
6	NA	61.3	193a	138	260	142	76	4973	68	138	32	157a
P>F	NA	0.46	0.08	0.80	0.86	0.64	0.42	0.50	0.81	0.80	0.986	0.01

Table 2: Hard white spring wheat (HWSW), soft white spring wheat (SWSW), barley, potato, or canola straw biomass production responses to various precipitated calcium carbonate application rates applied on an “as-is” basis at four locations in southeastern Idaho.

PCC Lime Rate (ton/ac)	Scafe			Maupin			Hamilton			Baum		
	2022	2023	2024	2022	2023	2024	2022	2023	2024	2022	2023	2024
	HWSW	Barley	Barley	SWSW	Potato	Wheat	Barley	Canola	Barley	HRSW	Barley	Barley
	Ton/ac											
0	NA	3.2	2.5b	6.2	NA	2.8	3.0	6.0	1.6ab	5.2	4.7	1.8b
2	NA	3.6	2.9ab	6.6	NA	3.2	3.3	6.1	0.8b	5.2	5.7	2.9a
4	NA	3.9	3.0ab	5.9	NA	3.0	3.9	5.4	2.4a	4.9	5.8	3.2a
6	NA	4.3	3.3a	6.8	NA	3.2	3.4	5.8	1.6ab	6.2	5.8	3.4a
P>F	NA	0.26	0.06	0.80	NA	0.64	0.47	0.87	0.07	0.48	0.17	<0.01



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