Optimizing Soil pH of Creeping Bentgrass through Elemental Sulfur Application

Derek Pruyne[1], Chase Rogan[2], Max Schlossberg[1]

(1) Center for Turfgrass Science, Penn State University (2) PureTurf Consulting, LLC

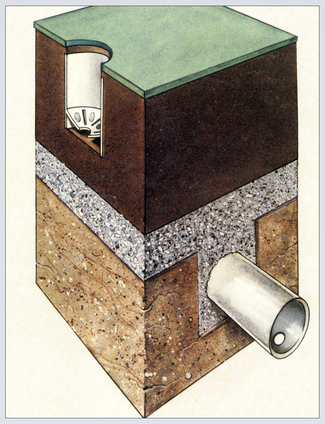
Background

Soil pH plays a major role in soil interactions, both chemically and biotically. Optimizing soil pH enhances the system and promotes a healthier stand of turfgrass.

Common name	Beard (1973)	Schlossberg (2009)
Annual Bluegrass	-	**6.4-7.4**
Creeping Bentgrass	**5.5-6.5**	**5.2-6.2**
Bermudagrass	-	5.2-6.0
Kentucky Bluegrass	6.0-7.0	6.5-7.5
Perennial Ryegrass	6.0-7.0	6.2-7.0
Tall Fescue	5.5-6.5	5.4-6.2
Velvet Bentgrass	5.0-6.0	5.2-6.4

- Optimum pH range varies dependent on species
- At plant's upper limit:
  - Nutrient deficiencies (Mn, Zn, Fe)
  - Weed pressure (annual bluegrass)
  - Disease pressure (pink snow mold, take-all patch, summer patch)
- Elemental sulfur as an acidifying agent:

$$2S + 3O_2 + 2H_2O \xrightarrow{\textit{thiobacillus}} 2\,H_2SO_4 \text{ (sulfuric acid)}$$



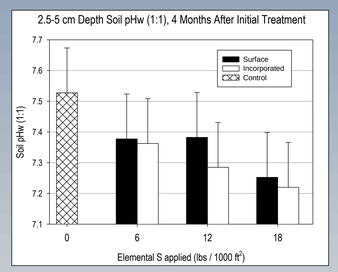
- A1/A4 creeping bentgrass
- Calcareous sand root zone
- Initial pH – 7.6
- Internally drained system

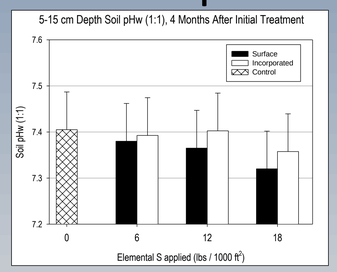
Objectives

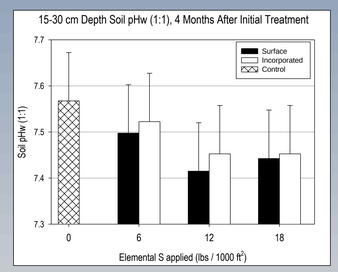
- Quantify acidifying characteristics of S_o
- Observe physiological benefits vs. burn potential
- Determine if pre-application coring accelerates acidification
- Determine if acidification increases nutrient uptake

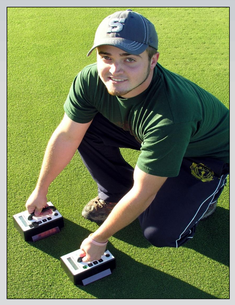
Results

Soil pH

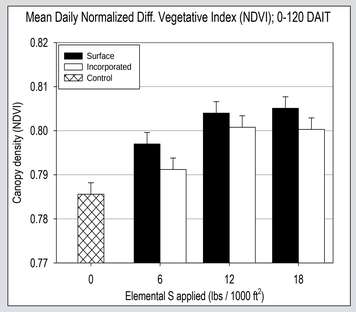


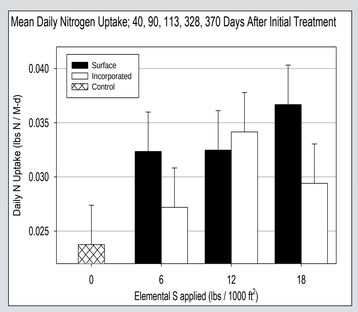


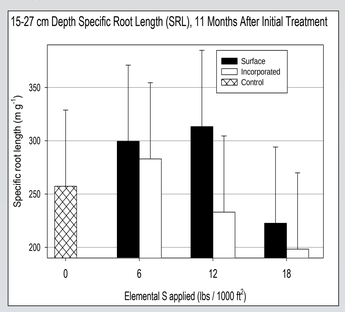


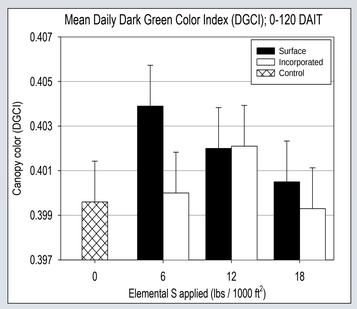


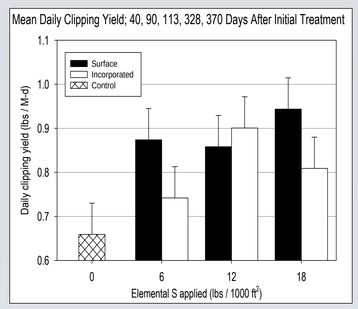
Putting Green Quality

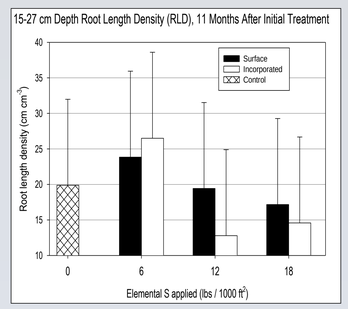




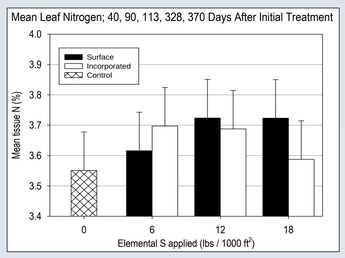


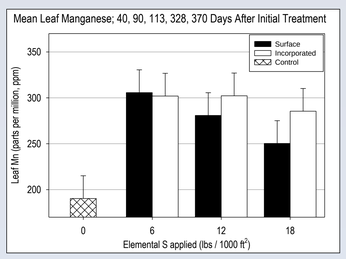


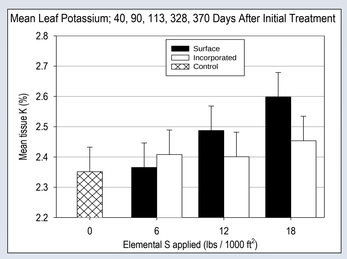


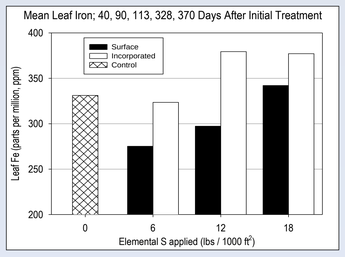


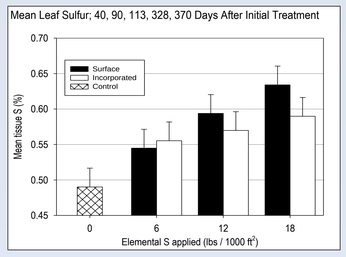
Leaf Concentration











Summary

- Elemental Sulfur is a slow, but effective acidifying agent
  - pH 7.6 to ~ 7.2
- No burn observed at any rate
- No black layer observed
  - More likely in poorly drained systems
- Leaf nutrient content and shoot/root growth significantly increased at 6 lbs/1000 ft^2 rate
- Overall putting green quality increased at all rates compared to the control
- Most significant acidification occurred in the 2.5-5 cm soil depth range

Materials and Methods

Rate	Cored
6 lbs. / 1,000 ft.^{2}	Yes
6 lbs. / 1,000 ft.^{2}	-
12 lbs. / 1,000 ft.^{2}	Yes
12 lbs. / 1,000 ft.^{2}	-
18 lbs. / 1,000 ft.^{2}	Yes
18 lbs. / 1,000 ft.^{2}	-

- 6 total treatments
- Half treatments core-aerified with 0.5" hollow tines; 2" centers and 2"deep

Data collected:

- Clipping yields throughout summer
- NDVI readings (Normalized differential vegetative index)
- Soil pH (2.5-5 cm, 5-15 cm, 15-30 cm)

Application:

- 90% S, fairway grade sulfur granules
- Applied 5/27/2011
- Mowing avoided for one week