2008 Annual Bluegrass Fertility Trial

Oregon State University

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NTA Final Report

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Purpose

By using balanced NPK + micros applied at a low rate (3.25 lbs N/1,000 sq ft/yr) or a high rate (6.5 lbs N/1,000 sq ft/yr), we are trying to determine if total annual NPK with or without added calcium, sulfur, or humates has any measurable impact on putting green turf quality, *Microdochium* patch disease, anthracnose disease, and/or turf species composition.

Note: This trial was initiated in 2006. A detailed review of this trial (including soil test values) from initiation through the end of 2008 is available on the OSU website found at the following link:

http://hort.oregonstate.edu/research_extension/turf_management/research_reports

Scroll down to the middle of the page under the heading:

2008 Oregon State University/Washington State University Turfgrass Field Day Reports

Click on: Annual Bluegrass Fertility Trial 2006 – 2008

Methods

A 90/10 greens grade sand/organic mix 12" deep was placed over a previously prepared native soil sub-surface and was planted in April of 2004 with aerifier plugs taken from greens at Corvallis Country Club. The grass was approximately 80% annual bluegrass and 20% Penn A-4 creeping bentgrass. The area was fertilized as needed during 2004 to develop functional putting turf. Maintenance fertilizer applications are made every two weeks as liquid sprays. Lime and gypsum (Huma Cal & Huma Phos) are applied twice a year after coring in granular form.

Turf was mowed at 0.100″ five days a week during the spring and summer season and 0.130″ during the winter season. Irrigation is applied as needed to produce healthy turf that is on the dry side. Coring and heavy topdressing is performed twice annually in spring and fall. Light sand topdressings are applied every other week during the spring, summer, and fall and approximately monthly during the winter. In the spring of 2008, all plots were verti-grooved with a Graden verticut machine to a depth of 1 inch in April to reduce the development of layering.

Fertilizer treatments were initiated in 2005 and are slated to continue for a minimum of 5 years or longer if funds are available to continue. Details for the fertilizer treatments are outlined below:

Trial 1: Low Nitrogen (Pounds of Ingredients/1,000 sq ft/yr)

Trt #	N	P_2O_5	K_2O	Monthly Sulfur	Biannual Sulfate*	Ca	Humates
1	3.25	0.6	2.1	0.00	0	0	0
2	3.25	0.6	2.1	0.00	0	8.75	0
3	3.25	0.6	2.1	0.00	1.25	4.50	8.75
4	3.25	0.6	2.1	0.00	1.25	5.00	3.50
5	3.25	0.6	2.1	1.50	0	0	0
6	3.25	0.6	2.1	1.50	0	8.75	0
7	3.25	0.6	2.1	1.50	1.25	4.50	8.75
8	3.25	0.6	2.1	1.50	1.25	5.00	3.50
9	3.25	0.6	2.1	3.00	0	0	0
10	3.25	0.6	2.1	3.00	0	8.75	0
11	3.25	0.6	2.1	3.00	1.25	4.50	8.75
12	3.25	0.6	2.1	3.00	1.25	5.00	3.50

Trial 2: High Nitrogen (Pounds of Ingredients/1,000 sq ft/yr)

Trt #	N	P_2O_5	K_2O	Monthly Sulfur	Biannual Sulfate*	Ca	Humates
1	6.5	1.2	4.2	0.00	0	0	0
2	6.5	1.2	4.2	0.00	0	8.75	0
3	6.5	1.2	4.2	0.00	1.25	4.50	8.75
4	6.5	1.2	4.2	0.00	1.25	5.00	3.50
5	6.5	1.2	4.2	1.50	0	0	0
6	6.5	1.2	4.2	1.50	0	8.75	0
7	6.5	1.2	4.2	1.50	1.25	4.50	8.75
8	6.5	1.2	4.2	1.50	1.25	5.00	3.50
9	6.5	1.2	4.2	3.00	0	0	0
10	6.5	1.2	4.2	3.00	0	8.75	0
11	6.5	1.2	4.2	3.00	1.25	4.50	8.75
12	6.5	1.2	4.2	3.00	1.25	5.00	3.50

***** The sulfate comes from gypsum in Huma Cal and Huma Phos.

Observations and Results Through 2007

Important Note: Because of space limitations, nitrogen treatments were not replicated. Therefore, comments comparing the High N Trial with the Low N Trial are only observations and are not statistically supported.

- The original low rate of nitrogen (3.25 lbs N/1,000 sq ft/yr) was too low to produce an adequate stand of turf on the new sand based root zone. During 2005 and 2006, the low fertility plots received additional nitrogen to enhance turf cover and increase competition with moss. The minimum rate of nitrogen to produce a functional putting turf on a new sand based root zone appears to be about 4.5 lbs of N/1,000 sq ft/yr. As of 2007, the standard application rate of nitrogen has been dropped back down to approximately 3.25 lbs of N/1,000 sq ft/yr. The high nitrogen plots are receiving 6.5 lbs of N/1,000 sq ft/yr.

- Turf quality has been higher in the high nitrogen plots and usually rates about one whole point higher. Low nitrogen plots are plagued with silvery thread moss but high nitrogen plots are largely moss free.

- *Microdochium* patch has been more severe on the high nitrogen plots than on the low nitrogen plots.

- In the high nitrogen plots, *Microdochium* patch disease increased on plots receiving supplemental lime at 8.75 lbs Ca/1,000 sq ft/yr. In general, increasing sulfur resulted in less *Microdochium* patch disease.

- There have been no apparent impacts from the humates thus far.

- Under low nitrogen fertilization with higher levels of calcium, there appears to be an increase in the percentage of bentgrass in treated plots.

2008 Results

Note: The 2008 data was analyzed for main effects and interactions between sulfur and calcium. An interaction occurs, for example, when for a given calcium treatment, different disease severity is observed based on the rate of sulfur applied. As an example, in 2008 we have seen, on plots treated with lime, a decrease in *Microdochium* patch disease when sulfur was applied.

Microdochium Patch Severity

In the High N Trial, there was an interaction between calcium treatments and sulfur treatments on all three rating dates – February, October, and November. The plots treated with lime had an increase in *Microdochium* patch disease, but when sulfur was applied at the medium or high rate, there was less disease. However, the plots treated with lime and sulfur still had more disease than plots that did not receive any calcium applications.

On plots treated with lime and sulfur, there was no decrease in disease when the rate of sulfur increased from the medium to the high rate. Sulfur additions did not decrease *Microdochium* patch disease on plots treated with Huma Phos (calcium sulfate).

On plots that did not receive any calcium, the high rate of sulfur decreased *Microdochium* patch disease, but only on the February rating date.

Anthracnose Severity

Calcium and sulfur did not interact to affect anthracnose severity. However, in the High N Trial, plots treated with any calcium source had less anthracnose disease than plots that did not receive calcium. Surprisingly, higher sulfur rates did not increase anthracnose disease.

In the Low N Trial, plots treated with lime or Huma Cal (mix of lime and calcium sulfate) had less disease than plots treated with Huma Phos (calcium sulfate). However, unlike the High N Trial, plots treated with lime and Huma Cal were not statistically better than plots receiving no calcium. The explanation may be that the anthracnose pressure was too low to bring out any differences.

After one year's worth of anthracnose data, it is too early to recommend calcium treatments as a way to reduce anthracnose disease; especially given that the data shows a large increase in *Microdochium* patch disease when lime is applied.

Plot Quality

There were two months – May and June – where the plots were not significantly affected by either *Microdochium* patch or anthracnose disease. During these two months there were no statistical differences in plot quality.

Observations (not supported by statistics) and Comments

- In February 2008, *Microdochium* patch was similar in both high and low nitrogen plots. This outcome may reflect the enhanced turf quality in low nitrogen plots caused by the increase in base nitrogen levels.

- We continue to see that *Microdochium* patch disease increases when higher rates of nitrogen are applied.

- For the first time in the trial, anthracnose symptoms developed in the summer of 2008. A likely reason for the anthracnose was extremely low mowing heights throughout the summer (0.100″) and no fertilizer applications from June 17th through August 23rd. These cultural practices were intentional and performed to encourage anthracnose development. However, this approach may have minimized the High N/Low N differences, and may have been responsible for the result that the high nitrogen plots had more anthracnose than the low nitrogen plots. It is possible that the moratorium on fertilizer applications during the summer impacted the high nitrogen plots more because they were used to regular, high nitrogen applications and the subsequent cessation of nitrogen was a bigger change, and thus more stress, than for the low nitrogen plots. The key to minimizing anthracnose may be consistent fertilizer applications throughout the summer rather than focusing on total annual nitrogen rates.

- Plots treated with lime had healthier turf during July and August. However, because of the presence of anthracnose, the plot quality ratings did not reflect this fact.

Summary

Although the nitrogen levels were not replicated in this trial, given our results in the last 3 years, it seems safe to say that lower nitrogen applications decrease *Microdochium* patch disease, especially when lime is applied. However, as the *Microdochium* patch data on February 14, 2008 shows, lower rates of nitrogen do not completely prevent the infection, but may reduce the number of fungicide applications necessary.

Additionally, if lime is being applied for cultural reasons, sulfur applications can substantially decrease *Microdochium* patch disease, but not below the disease level that would have occurred had lime not been applied.

Therefore, the overall strategy to decrease *Microdochium* patch disease would be to:

1. limit fertilizer applications in late summer to the minimum necessary to allow the aerification holes to heal,
2. minimize fertilizer applications during fall, winter, and spring,
3. apply sulfur monthly at rates of 0.125 lbs of elemental sulfur per 1,000 sq. ft., or as an alternate strategy, apply a rate of 0.25 lbs of elemental sulfur per 1,000 sq. ft. for the 6 month period from September through March.

Surprisingly, monthly sulfur applications did not increase anthracnose disease. Given that we have heard many reports from superintendents indicating that high rates of sulfur increase anthracnose, it may be that our sulfur rates are not high enough to cause this effect.

In the High N Trial, we did see that all calcium applications reduced anthracnose disease which was a surprise. However, in the Low N Trial, an increase in anthracnose disease occurred on the plots that received Huma Phos (calcium sulfate). There were no differences in anthracnose disease between the untreated plots and the plots treated with either lime or Huma Cal (mix of calcium carbonate and calcium sulfate). Hopefully, the 2009 results will help clear up this confusion.

Trial Plans for 2009

The trial for 2009 has been reconfigured. First, because the late summer anthracnose injury was interfering with *Microdochium* patch ratings in the fall, we decided to use one nitrogen rate (4.5 lbs N/1,000 sq ft./yr) and split the green by disease. Additionally, because Huma Cal and Huma Phos were no longer available from our supplier, we replaced these products with gypsum and

Cal Phos, which do not have humates in them (we have not seen any effects from humates after 3 years). The Cal Phos is straight calcium phosphate and does not have gypsum in it.

Source Materials:

Soluble fertilizer is applied every two weeks except as noted during the summer.

- Basic N-P_2O_5-K_2O from Andersons 28-5-18 water soluble sprayable product with B (0.02%), Cu (0.07%), Fe (0.10%), Mn (0.05%), and Zn (0.05%)

Sulfur applied monthly from elemental sulfur – 3 Rates:

- No Sulfur (Treatments 1- 4)
- 0.125 lbs elemental sulfur per month (Treatments 5 – 8)
- 0.25 lbs of elemental sulfur per month (Treatments (9-12)

Calcium Products applied twice a year with coring at 12.5 lbs product per 1,000 sq. ft.

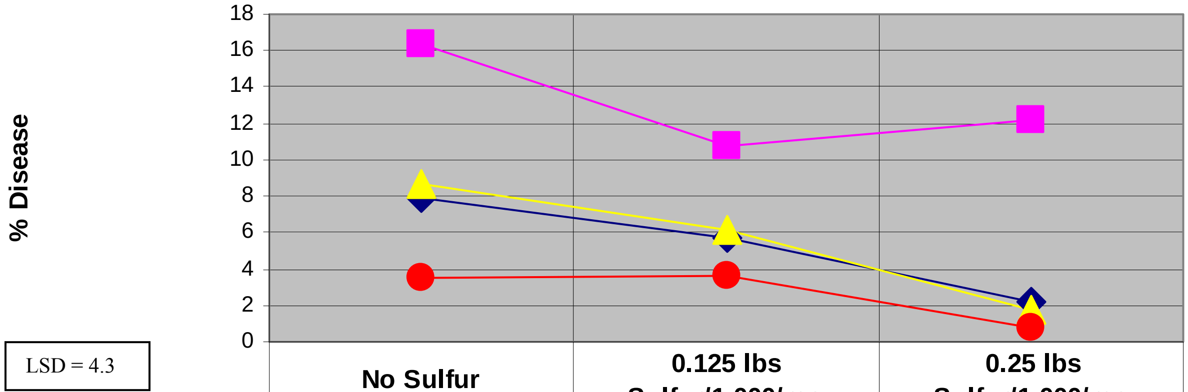
- Calcium from calcium carbonate (lime) (35% Ca)
- Huma Cal (18% Ca from gypsum and lime, 5 % Sulfur, 35 % humic substances
- Huma Phos (5% P_2O_5, 20% Ca from gypsum, 5% sulfur, 10% SiO_2, 14% humic substances

Acknowledgements:

We would like to thank the Western Canada Turfgrass Association and the Northwest Turfgrass Association for their continuing financial support of this trial. We would also like to thank Walrath Sand Products for donating the greens mix.

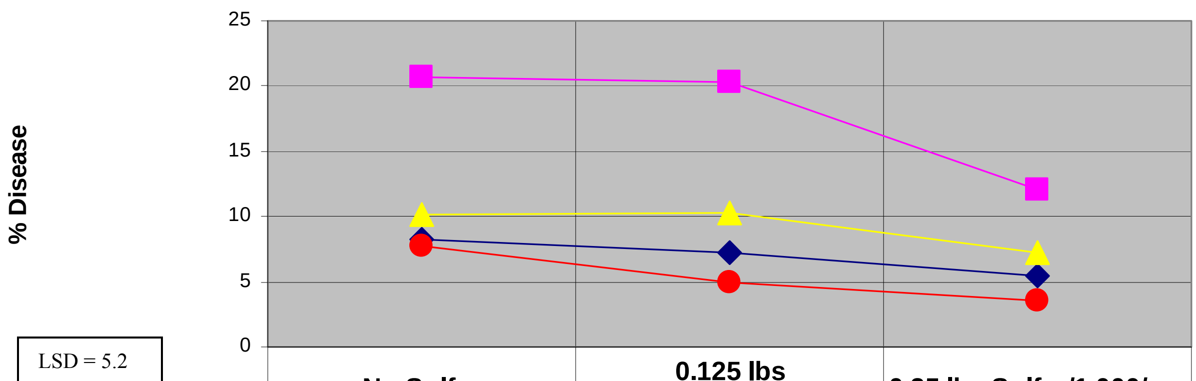
Microdochium Patch Tables

Table 1: High N Trial - Percent *Microdochium* Patch (2/14/08)



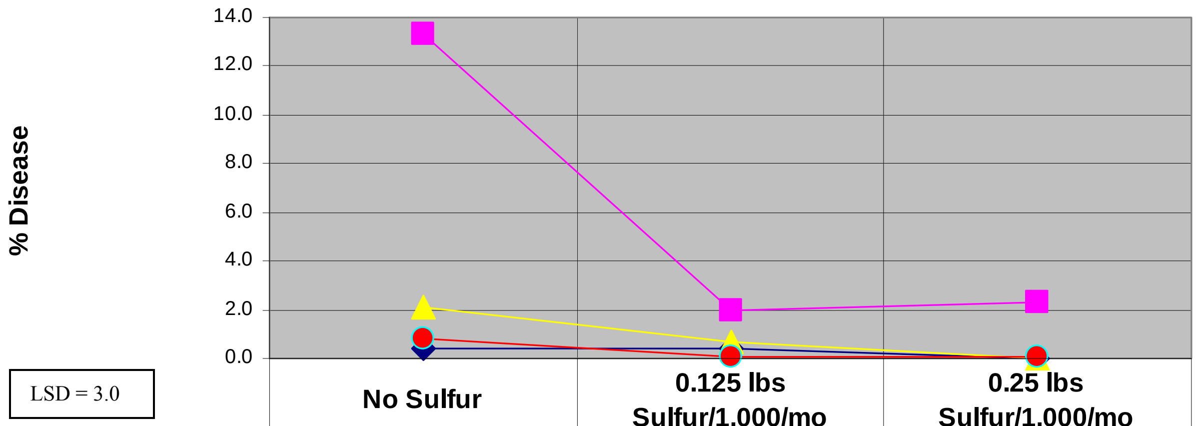
	No Sulfur	0.125 lbs Sulfur/1,000/mo	0.25 lbs Sulfur/1,000/mo
Untreated	7.9	5.7	2.2
Lime	16.4	10.8	12.2
Huma Cal	8.7	6.2	1.8
Huma Phos	3.5	3.6	0.8

Table 2: Low N Trial - Percent *Microdochium* Patch (2/14/08)



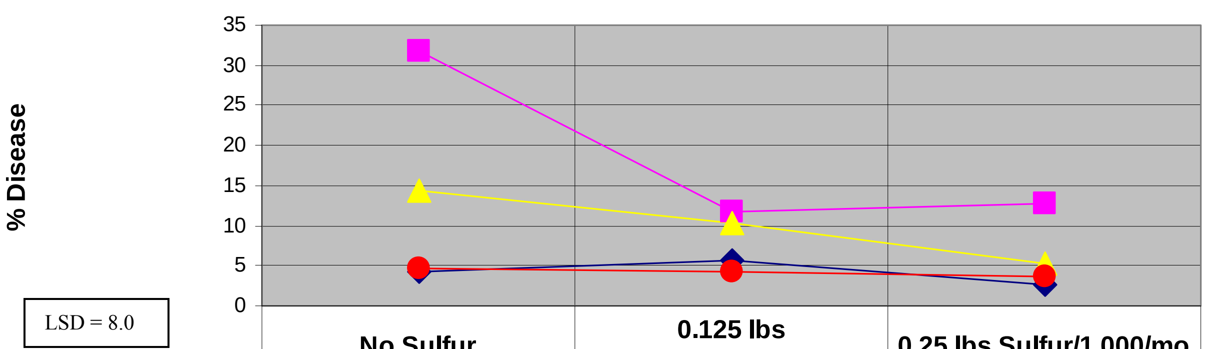
	No Sulfur	0.125 lbs Sulfur/1,000/mo	0.25 lbs Sulfur/1,000/mo
Untreated	8.2	7.2	5.5
Lime	20.7	20.3	12.0
Huma Cal	10.1	10.3	7.2
Huma Phos	7.8	5.0	3.5

Table 3: High N Trial - Percent *Microdochium* Patch (10/6/08)



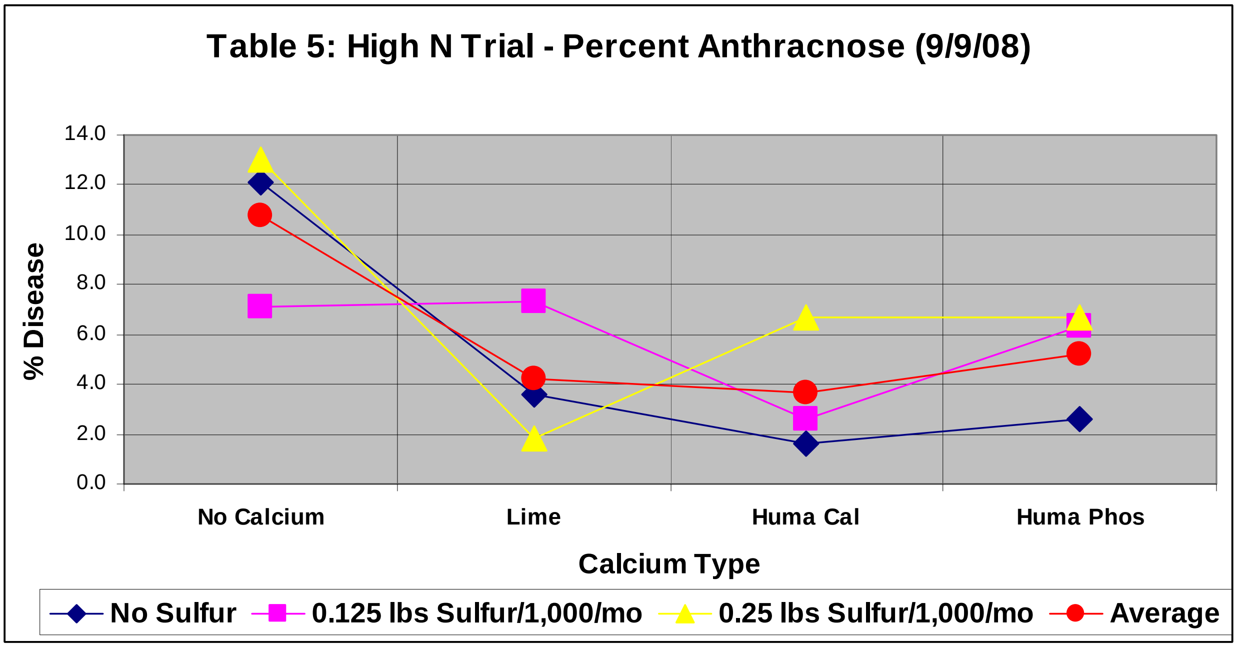
	No Sulfur	0.125 lbs Sulfur/1,000/mo	0.25 lbs Sulfur/1,000/mo
Untreated	0.4	0.4	0.0
Lime	13.3	2.0	2.3
Huma Cal	2.1	0.7	0.0
Huma Phos	0.8	0.1	0.1

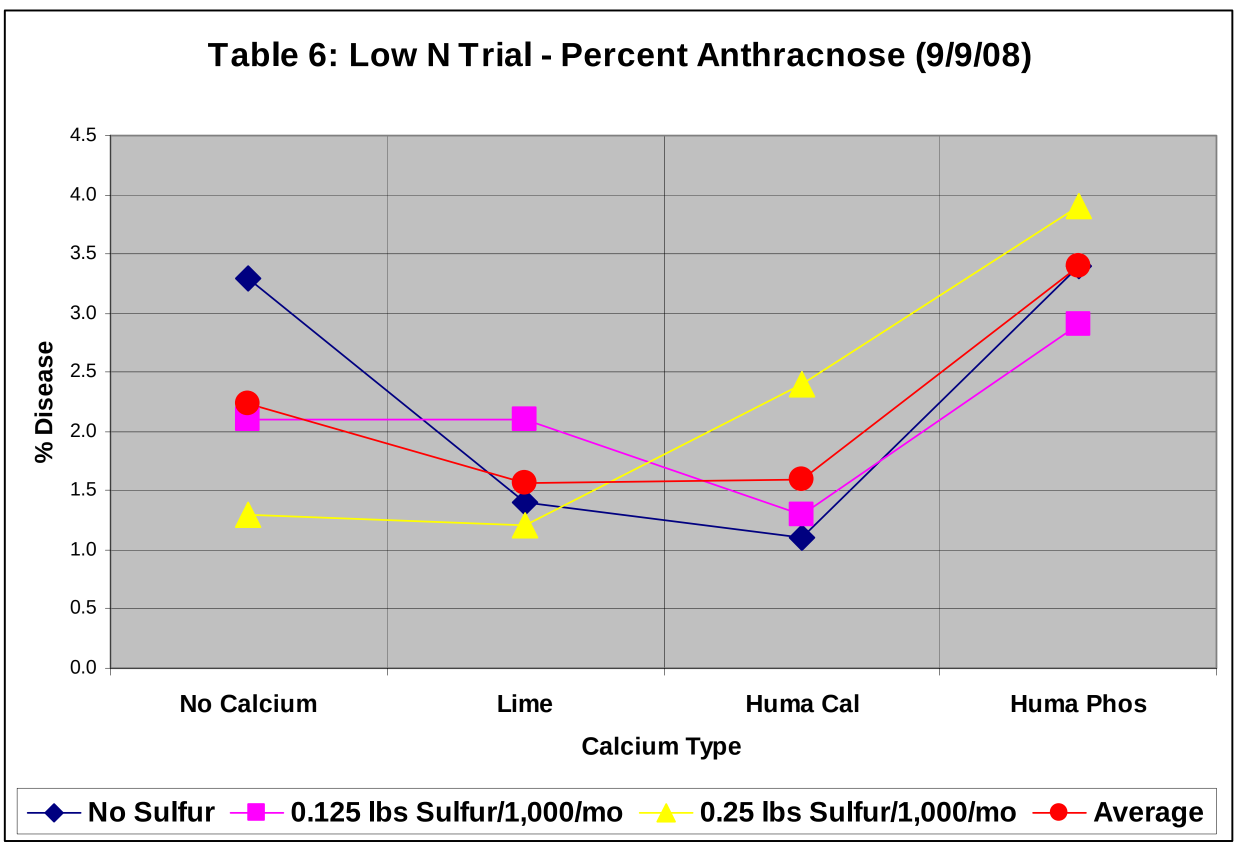
Table 4: High N Trial - Percent *Microdochium* Patch (11/14/08)



	No Sulfur	0.125 lbs Sulfur/1,000/mo	0.25 lbs Sulfur/1,000/mo
Untreated	4.3	5.7	2.7
Lime	31.7	11.7	12.7
Huma Cal	14.3	10.3	5.3
Huma Phos	4.7	4.3	3.7

Anthracnose Tables





Supplemental Information

High N Trial vs. Low N Trial Comparisons

Note: Nitrogen rates were not replicated so differences between Low N and High N have not been statistically tested.

Percent ***Microdochium*** patch

	February 14, 2008	Monthly Sulfur Levels		
		lbs/yr	Low N	High N
1	N, P, K	0	8.2	7.9
2	N, P, K + Cal (lime)	0	20.7	16.4
3	N, P, K + Huma Cal	0	10.1	8.7
4	N, P, K + Huma Phos	0	7.8	3.5
5	N, P, K	1.5	7.2	5.7
6	N, P, K + Cal (lime)	1.5	20.3	10.8
7	N, P, K + Huma Cal	1.5	10.3	6.2
8	N, P, K + Huma Phos	1.5	5.0	3.6
9	N, P, K	3.0	5.5	2.2
10	N, P, K + Cal (lime)	3.0	12.0	12.2
11	N, P, K + Huma Cal	3.0	7.2	1.8
12	N, P, K + Huma Phos	3.0	3.5	0.8
		LSD @ .05	5.2	4.3

Supplemental Information

High N Trial vs. Low N Trial Comparisons

Note: Nitrogen rates were not replicated so differences between Low N and High N have not been statistically tested.

Percent ***Microdochium*** patch

	October 6, 2008	Monthly Sulfur Levels		
		lbs/yr	Low N	High N
1	N, P, K	0	0.0	0.4
2	N, P, K + Cal (lime)	0	0.1	13.3
3	N, P, K + Huma Cal	0	0.8	2.1
4	N, P, K + Huma Phos	0	0.0	0.8
5	N, P, K	1.5	0.0	0.4
6	N, P, K + Cal (lime)	1.5	0.0	2.0
7	N, P, K + Huma Cal	1.5	0.0	0.7
8	N, P, K + Huma Phos	1.5	0.0	0.1
9	N, P, K	3.0	0.0	0.0
10	N, P, K + Cal (lime)	3.0	0.0	2.3
11	N, P, K + Huma Cal	3.0	0.0	0.0
12	N, P, K + Huma Phos	3.0	0.0	0.1
		LSD @ .05	ns	3.0

*ns = not significant

Supplemental Information

High N Trial vs. Low N Trial Comparisons

Note: Nitrogen rates were not replicated so differences between Low N and High N have not been statistically tested.

Percent *Microdochium* patch

	November 14, 2008	Monthly Sulfur Levels		
		lbs/yr	Low N	High N
1	N, P, K	0	.9	4.3
2	N, P, K + Cal (lime)	0	.8	31.7
3	N, P, K + Huma Cal	0	1.5	14.3
4	N, P, K + Huma Phos	0	1.1	4.7
5	N, P, K	1.5	.8	5.7
6	N, P, K + Cal (lime)	1.5	1.0	11.7
7	N, P, K + Huma Cal	1.5	1.5	10.3
8	N, P, K + Huma Phos	1.5	1.5	4.3
9	N, P, K	3.0	1.1	2.7
10	N, P, K + Cal (lime)	3.0	1.7	12.7
11	N, P, K + Huma Cal	3.0	.9	5.3
12	N, P, K + Huma Phos	3.0	.8	3.7
		LSD @ .05	ns	8.0

*ns = not significant

Supplemental Information

High N Trial vs. Low N Trial Comparisons

Note: Nitrogen rates were not replicated so differences between Low N and High N have not been statistically tested.

Percent Anthracnose

	September 9, 2008	Monthly Sulfur Additions		
		lbs/yr	Low N	High N
1	N, P, K	0	3.3	**12.1**
2	N, P, K + Cal	0	1.4	3.6
3	N, P, K + Huma Cal	0	1.1	1.6
4	N, P, K + Huma Phos	0	3.4	2.6
5	N, P, K	1.5	2.1	7.1
6	N, P, K + Cal	1.5	2.1	7.3
7	N, P, K + Huma Cal	1.5	1.3	2.6
8	N, P, K + Huma Phos	1.5	2.9	6.3
9	N, P, K	3.0	1.3	**13.0**
10	N, P, K + Cal	3.0	1.2	1.8
11	N, P, K + Huma Cal	3.0	2.4	6.7
12	N, P, K + Huma Phos	3.0	3.9	6.7
		LSD @ .05	2.3	7.7