Annual bluegrass fertility trial 2006-2008

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Note:
The information presented below is in the form of a progress report and all data are considered preliminary.

Purpose:

Using balanced NPK + micros applied at a low rate (3.25 lbs N/1000 sq ft/ yr) or a high rate (6.5 lbs N/1000 sq ft/yr), we are trying to determine if total annual NPK with or without added Ca, S, or humates has any measurable impact on turf quality, Microdochium patch disease, Anthracnose disease, and/or turf species composition.

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 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 a functional putting turf. Maintenance fertilizer applications are made every two weeks as liquid sprays. Lime and gypsum are applied twice per year after coring in granular form.

Turf is maintained via mowing at 0.100" five days per week during the spring summer season and 0.130" during winter season. Irrigation is applied as needed to produce healthy turf that is on the dry side. Coring and heavy topdressing with sand is performed twice annually in spring and fall. Light sand topdressings are applied every other week all year long and are preceded by grooming to open the surface slightly. In spring 2008 all plots were vertigrooved with a Graden verticut machine to a depth of 1" in April to reduce 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 in table 1.

Data collection for turf quality was initiated in 2006 and data for 2006-2008 are presented in table 2.

Data on Fusarium patch disease has been recorded spring and fall at the outset and end of the disease season. Mid winter ratings have been difficult to obtain due to residual damage from earlier outbreaks. Our current plan is to allow damage to occur naturally in fall and to make strategic fungicide applications after initial ratings so we can rate again in midseason during subsequent attacks. Disease data are presented in table 3.

Soil samples are taken each spring prior to coring and major spring applications of lime or gypsum. Soil test results for 2008 are presented in tables 4 & 5. Selected comparisons of soil test data for the high N plots from 2006-2008 are presented in table 6.

Observations:

1. The original low rate of N (3.25 lbs N/1000 sq ft/yr) was too low to produce an adequate stand of turf on the new sandbased rootzone. During 2005 and early 2006 the low fertility plots received additional N to enhance turf cover and increase competition with moss. The minimum rate of N to produce functional putting turf on a new sandbased rootzone appears to be about 4.5 lbs N/1000 sq ft/yr. As of 2007, the standard application rate of N has been dropped back down to approximately 3.25 lbs N/1000 sq ft/yr. High N plots are receiving 6.5 lbs N/1000/yr.

Turf quality is higher in the high N plots and usually rates about one whole point higher for similar treatments in the low N plots. High N turf quality scores are presented in table 2. Low N plots are plagued with silvery thread moss but high N plots are largely moss free.

2. From 2006through 2007, Microdochium patch was more severe on the high N plots than on the low N plots. In February 2008, Microdochium patch was similar in both high and low N plots. This may reflect the enhanced turf quality in low N plots caused by the increase in base N levels.

3. In the high N plots, Microdochium patch appears to be worse on plots receiving supplemental Ca at 8.75 lbs Ca/1000 sq ft/ yr. In general, the higher the rate of sulfur, the lower the Microdochium patch disease incidence. In spring 2008, the lowest levels of Microdochium patch were observed in plots receiving high N, high S, and moderate Ca from gypsum. The highest levels of disease were observed in plots receiving high or low N, low S, and high Ca from Calcium Carbonate. Plots receiving Ca from gypsum had less Microdochium patch than plots receiving Ca from Calcium Carbonate.

Note: To avoid excessive turf loss from Microdochium patch we spray with appropriate fungicides in fall after the first notable outbreak of disease and again in late winter after the next notable outbreak. If disease is left alone to run its course turf injury is generally so severe that turf quality suffers negatively. No Anthracnose has been observed at this point in time.

4. There were no discernible changes in soil fertility values after one full year of treatments. Samples taken in spring 2007 after two full years of treatments indicate that the lime treatments are raising the soil pH while the sulfur treatments are reducing soil pH. 2008 soil test data tables 4,5 & 6 show definite increases in soil Ca from $CaCO_3$ applications and a trend toward higher soil pH in these plots. High S plots have lower pH values but have not dropped dramatically. Changes in acidity may be buffered by the pH of rain water and our irrigation water.

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

6. Under low N fertilization with higher levels of Ca, there appears to be an increase in the percentage of bentgrass in treated plots.

Final notes:

As this trial matures the turf quality is getting closer to that observed on mature Poa annua/bent greens at older country clubs. Impacts of fertility treatments are becoming more pronounced and more consistent.

Acknowledgements:

We would like to thank the Western Canada Turfgrass Association and the Northwest Turfgrass Association for their continuing financial support of this trial.

Table 1: Target nutrient levels for treatment s in long term annual bluegrass fertility trial

Trial 1: Low nitrogen

Pounds of ingredients/1000 sq ft/year

trt #	N	P2O5	K2O	S	Ca	SiO2	Humates
1	3.25	0.6	2.1	0	0	0	0
2	3.25	0.6	2.1	0	8.75	0	0
3	3.25	0.6	2.1	1.25	4.5	0	8.75
4	3.25	0.6	2.1	1.25	5	2.5	3.5
5	3.25	0.6	2.1	1.5	0	0	0
6	3.25	0.6	2.1	2.75	8.75	0	0
7	3.25	0.6	2.1	2.75	4.5	0	8.75
8	3.25	0.6	2.1	2.75	5	2.5	3.5
9	3.25	0.6	2.1	3	0	0	0
10	3.25	0.6	2.1	4.25	8.75	0	0
11	3.25	0.6	2.1	4.25	4.5	0	8.75
12	3.25	0.6	2.1	4.25	5	2.5	3.5

Trial 2: High nitrogen

Pounds of ingredients/1000 sq ft/year

trt #	N	P2O5	K2O	S	Ca	SiO2	Humates
1	6.5	1.2	4.2	0	0	0	0
2	6.5	1.2	4.2	0	8.75	0	0
3	6.5	1.2	4.2	1.25	4.5	0	8.75
4	6.5	1.2	4.2	1.25	5	2.5	3.5
5	6.5	1.2	4.2	1.5	0	0	0
6	6.5	1.2	4.2	2.75	8.75	0	0
7	6.5	1.2	4.2	2.75	4.5	0	8.75
8	6.5	1.2	4.2	2.75	5	2.5	3.5
9	6.5	1.2	4.2	3	0	0	0
10	6.5	1.2	4.2	4.25	8.75	0	0
11	6.5	1.2	4.2	4.25	4.5	0	8.75
12	6.5	1.2	4.2	4.25	5	2.5	3.5

Source materials:

Basic N-P_2O_5-K_2O from Anderson's 28-5-18 water soluble sprayable product
also contains B (.02%), Cu (.07%), Fe (.10%), Mn (.05%), and Zn (.05%)

Sulfur from elemental S

Ca from Calcium Carbonate (35% Ca)
Huma Ca (18% Ca from Gypsum, 5% S, 35% humic substances)
Huma Phos (5% P_2O_5, 20% Ca from Gypsum, 5% S, 10% SiO_2, 14% Humic substances)

Table 2: Plot quality ratings for High N treatments on selected dates from 2006 to 2008.

Trt.	Fert.	S	Ca		Jul-06	Aug-06	Sep-06	Dec-06	Feb-07	Apr-07	May-07	May-08	Jun-08	Jul-08
1	NPK	0.0	0.0		6.3	6.7	5.8	5.6	5.9	6.7	7.1	7.0	6.3	7.5
2	NPK	0.0	8.8		6.1	7.7	5.6	5.4	4.6	6.6	6.8	6.9	6.2	7.4
3	NPK	1.3	4.5		6.4	7.6	5.6	6.4	5.4	6.7	7.2	7.0	7.0	7.9
4	NPK	1.3	5.0		5.9	7.3	5.6	6.1	5.5	6.8	7.1	6.8	6.8	7.7
5	NPK	1.5	0.0		5.7	7.3	5.3	5.9	5.8	7.2	7.2	7.3	6.9	7.9
6	NPK	2.8	8.8		6.1	7.1	5.3	5.9	5.7	6.4	6.8	6.9	6.6	7.9
7	NPK	2.8	4.5		6.2	7.6	6.2	5.8	5.9	7.4	7.1	7.3	7.3	7.7
8	NPK	2.8	5.0		5.8	7.2	5.4	6.5	6.0	7.2	7.1	7.0	6.8	7.4
9	NPK	3.0	0.0		5.6	6.9	5.3	6.0	6.3	7.7	6.8	7.2	6.8	7.4
10	NPK	4.3	8.8		6.7	7.5	6.0	6.2	5.7	6.8	7.2	7.4	7.3	7.8
11	NPK	4.3	4.5		6.4	7.1	5.3	6.3	6.1	7.9	7.2	7.0	6.8	7.4
12	NPK	4.3	5.0		6.0	6.9	5.7	6.3	6.1	7.9	7.2	6.8	6.8	7.1
		LSD @ .05			0.7	1.0	0.5	0.5	0.5	0.5	ns	0.5	0.7	0.9

Table 3: Spring and fall Microdochium patch activity on High N plots for 2006-2008

Basic N, P2O5, K2O*	S lbs/yr	Ca lbs/yr	SiO2 lbs/yr	Humates lbs/yr		# spots		Activity 1 to 9 1 = severe	% of plot affected
						Oct-06		Apr-07	Feb-08
N, P, K	0.0	0.0	0.0	0.0		4.0		4.7	**7.9**
N, P, K + Cal	0.0	8.8	0.0	0.0		17.0		4.0	**16.4**
N, P, K + Huma Cal	1.3	4.5	0.0	8.8		9.0		5.0	**8.7**
N, P, K + Huma Phos	1.3	5.0	2.5	3.5		6.3		4.7	**3.5**
N, P, K	1.5	0.0	0.0	0.0		3.3		5.7	**5.7**
N, P, K + Cal	2.8	8.8	0.0	0.0		6.7		4.0	**10.8**
N, P, K + Huma Cal	2.8	4.5	0.0	8.8		4.7		5.7	**6.2**
N, P, K + Huma Phos	2.8	5.0	2.5	3.5		2.7		5.3	**3.6**
N, P, K	3.0	0.0	0.0	0.0		1.0		7.7	**2.2**
N, P, K + Cal	4.3	8.8	0.0	0.0		8.7		5.0	**12.2**
N, P, K + Huma Cal	4.3	4.5	0.0	8.8		1.7		7.7	**1.8**
N, P, K + Huma Phos	4.3	5.0	2.5	3.5		3.3		7.0	**0.8**

* High N = 6.5 lbs N, 1.2 lbs P2O5, 4.2 lbs K2O

LSD @ 0.05 **ns** **ns** **4.9**

Table 4. 2008 Soil test levels for high N plots on the sand based annual bluegrass putting green

Sufficiency Level of Available Nutrients

Factor		T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10	T 11	T 12		Ave.
OM %		1.6	1.2	1.0	1.1	1.2	1.2	1.5	1.6	1.4	1.5	1.2	1.4		1.3
P ppm		11.0	13.0	30.0	10.0	11.0	14.0	12.0	14.0	20.0	21.0	10.0	12.0		14.8
K ppm		92.0	83.0	83.0	81.0	85.0	85.0	69.0	76.0	86.0	95.0	98.0	81.0		84.5
Mg ppm		161.0	94.0	95.0	107.0	122.0	100.0	98.0	117.0	131.0	115.0	117.0	108.0		113.8
Ca ppm		679.0	709.0	570.0	539.0	500.0	738.0	612.0	626.0	526.0	826.0	700.0	547.0		631.0
SO4 ppm		5.0	5.0	8.0	8.0	7.0	6.0	9.0	8.0	9.0	11.0	13.0	18.0		8.9
Na ppm		23.0	25.0	18.0	19.0	17.0	19.0	18.0	18.0	21.0	20.0	19.0	20.0		19.8
pH		6.4	7.0	6.5	6.3	6.1	6.9	6.3	6.2	6.0	6.7	6.3	6.1		6.4
Buffer index		7.2	7.4	7.3	7.3	7.3	7.4	7.4	7.4	7.4	7.4	7.4	7.3		7.4
CEC meq/100 gm		5.5	4.6	4.2	4.3	4.4	4.9	4.6	4.9	4.7	5.6	5.4	4.5		4.8

Base Cation Saturation Percentage

		T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10	T 11	T 12		Ave.
K		4.2	4.6	5.0	4.8	4.9	4.5	3.8	3.9	4.6	4.3	4.7	4.6		4.5
Mg		23.9	16.6	18.5	20.4	22.7	16.9	17.5	19.4	22.8	16.7	18.0	19.5		19.4
Ca		61.1	76.4	67.1	62.3	56.7	75.5	66.4	63.1	55.7	73.0	65.3	60.0		65.2
H		9.0	0.0	7.5	10.5	14.0	1.5	10.5	12.0	15.0	4.5	10.5	14.0		9.1
Na		1.8	2.4	1.9	1.9	1.7	1.7	1.7	1.6	1.9	1.5	1.6	1.9		1.8

Table 5. 2008 soil test values for low N plots on the sand based annual bluegrass putting green

Sufficiency Level of Available Nutrients

Factor		T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10	T 11	T 12		Ave.
OM %		1.5	1.2	1.5	1.4	2.2	1.5	0.8	1.2	1.2	1.1	1.2	1.1		1.3
P ppm		11.0	10.0	9.0	10.0	8.0	11.0	12.0	9.0	9.0	11.0	9.0	4.0		9.4
K ppm		59.0	45.0	52.0	53.0	61.0	51.0	55.0	50.0	53.0	52.0	50.0	53.0		52.8
Mg ppm		137.0	92.0	113.0	122.0	139.0	101.0	110.0	113.0	129.0	91.0	106.0	122.0		114.6
Ca ppm		534.0	695.0	650.0	574.0	529.0	714.0	620.0	539.0	493.0	696.0	647.0	609.0		608.3
SO4 ppm		4.0	3.0	9.0	6.0	6.0	7.0	9.0	5.0	11.0	12.0	10.0	7.0		7.4
Na ppm		22.0	19.0	21.0	18.0	18.0	18.0	20.0	21.0	20.0	19.0	20.0	19.0		19.6
pH		6.5	7.1	6.6	6.3	6.3	7.1	6.6	6.3	6.2	6.8	6.6	6.3		6.6
Buffer index		7.3	7.3	7.5	7.3	7.3	7.3	7.5	7.3	7.3	7.3	7.4	7.4		7.4
CEC meq/100 gm		4.4	4.4	4.7	4.6	4.5	4.6	4.5	4.3	4.3	4.6	4.6	4.8		4.5

Base Cation Saturation Percentage

Factor		T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10	T 11	T 12		Ave.
K		3.5	2.6	2.8	3.0	3.5	2.8	3.2	3.0	3.2	2.9	2.8	2.8		3.0
Mg		25.8	17.1	19.9	22.0	25.4	18.0	20.0	21.7	24.9	16.3	18.9	21.1		20.9
Ca		61.0	78.5	69.3	62.8	58.8	77.4	68.8	62.7	57.8	76.0	70.4	63.8		67.3
H		7.5	0.0	6.0	10.5	10.5	0.0	6.0	10.5	12.0	3.0	6.0	10.5		6.9
Na		2.2	1.8	1.9	1.8	1.8	1.7	2.0	2.1	2.0	1.8	1.9	1.8		1.9

Table 6. Impact of Calcium carbonate and Sulfur on soil test values and soil pH of high N plots from 2006 to 2008

	Rate /1000/yr		Soil test values		
	CaCO3	S	Ca*	SO4*	pH
Trt 1					
2006	0	0	669	14	5.5
2007	0	0	602	11	5.9
2008	0	0	679	5	6.4
Trt 2					
2006	25	0	770	16	5.8
2007	25	0	787	11	6.7
2008	25	0	709	5	7
Trt 6					
2006	25	2.75	636	7	5.7
2007	25	2.75	786	10	6.7
2008	25	2.75	738	6	6.9
Trt 10					
2006	25	4.25	595	13	5.8
2007	25	4.25	695	1	6.5
2008	25	4.25	826	11	6.7
Trt 12					
2006	0	4.25	593	21	5.2
2007	0	4.25	507	4	6
2008	0	4.25	547	18	6.1

* Soil test values in parts per million