NITROGEN RESPONSES AND ARSENIC STUDIES ON TURF

Paul E. Rieke

Mixtures of Kentucky bluegrass and creeping red fescue are recommended for many turf sites in Michigan. The red fescues are better adapted to shade conditions than the Kentucky bluegrasses. The nitrogen requirements of the Kentucky bluegrasses, especially Merion and many of the improved cultivars, are higher than for the red fescues. In a mixed stand of Merion Kentucky bluegrass and Pennlawn red fescue established in 1969 at Traverse City the percentage of red fescue in the turf has decreased as the rate of nitrogen increased (Table 1). Spring applications resulted in more Merion than fall applications because of better utilization of the nitrogen applied. Milorganite resulted in a higher Merion percentage than ammonium nitrate treatments. Summer applications also encourage Merion at the expense of Pennlawn.

Higher nitrogen rates encouraged Poa annua infestation of irrigated Pennlawn red fescue at Traverse City (Table 2). Milorganite also tended to increase the amount of Poa annua compared to ammonium nitrate.

At East Lansing an infestation of stripe smut severely thinned Merion Kentucky bluegrass in June. The incidence of the disease was greater with higher nitrogen rates resulting in thinner turf and poorer quality ratings (Table 3).

The incidence of Fusarium snowmold (Fusarium patch) on Merion in April, 1972 was increased with higher nitrogen rates (Table 4). The 3/4-inch mowing height also showed increased susceptibility to Fusarium compared to the 1 1/2-inch height.

Six years of ammonium nitrate applications to turf caused acidification of a fine sandy loam at East Lansing. Eight pounds of nitrogen or more per 1000 square feet annually reduced pH in the 0-2 inch depth while the pH of the 4-6 inch depth was affected by the 12 and 14 pound treatments (Table 5).

A comparison of several nitrogen treatments with a number of carriers and dates of application for 1972 studies at East Lansing and Traverse City is shown in Table 6. The plots at East Lansing were newly laid sod so differences were small this first year.

In the concluding study on soil arsenic relationships by Dr. Robert Carrow, now at the University of Massachusetts, five acid soils were used in a greenhouse study. The soils were loamy sand, sandy loam, loam, silty clay loam, and a peat soil. Each was limed to approximate pH levels of 5.0, 6.5, and 7.5. Tricalcium arsenate was applied at rates of 0, 10, and 20 pounds per 1000 square feet. Increasing arsenic rates decreased Poa annua growth. Raising pH from 5.0 to 6.5 or 7.5 decreased the effectiveness of the arsenate to control Poa annua. The soil arsenic tests indicated that increasing soil pH also decreased the amount of arsenic which could be extracted. The degree of arsenate effectiveness in controlling Poa annua and the amount that

could be extracted from the soil varied with the soil. Such factors as texture, organic matter, drainage, phosphorus level, and aluminum level are important.

Conclusions from these and previous studies are:

1. Increasing soil phosphorus decreases the effectiveness of calcium arsenate in controlling Poa annua.

2. Poa annua is more susceptible to arsenate toxicity than other grasses but the other grasses studied (Penncross creeping bentgrass, Cohansey creeping bentgrass, and Merion Kentucky bluegrass) also exhibited some injury from the arsenate when applied at high rates.

3. High arsenate applications increase soil phosphorus tests quite markedly. The standard soil phosphorus tests used in many soil testing laboratories do not differentiate between phosphorus and arsenic.

4. Increasing soil pH to near neutral (pH 7.0) or above decreases the effectiveness of calcium arsenate in controlling Poa annua and decreases the amount of arsenate which can be extracted from the soil for soil testing pruposes.

5. Other factors, such as soil texture, organic matter content, drainage and extractable iron and aluminum levels also are important in predicting the amount of calcium arsenate which would be needed for effective control of Poa annua.

Because of the complexity of interpreting the effects of all these variables we are not using soil tests for predicting the amount of calcium arsenate that would be needed to control Poa annua in a given turf.

TABLE 1. EFFECT OF NITROGEN TREATMENT ON DENSITY COUNTS IN A MERION KENTUCKY BLUEGRASS-PENNLAWN RED FESCUE POLYSTAND ON SAND SOIL AT TRAVERSE CITY.

Treatment			Percent red fescue	
Carrier	Rate[a]	Time of application	9/70	10/72
- - -	0	- - -	88	89
33-0-0	2	Monthly	76	65
33-0-0	4	Monthly	62	50
33-0-0	6	Monthly	46	44
33-0-0	8	Monthly	46	30
33-0-0	12	Monthly	34	24
33-0-0	4	Apr	70	53
33-0-0	4	Aug	76	61
33-0-0	4	Apr, Aug	68	45
33-0-0	4	Apr, May, Aug	60	40
33-0-0	8	Apr	67	27
33-0-0	8	Aug	80	86
33-0-0	8	Apr, Aug	52	36
33-0-0	8	Apr, May, Aug	40	19
33-0-0	8	Monthly (summer)[b]	43	4
6-3-0	4	Apr, May, Aug	35	35
6-3-0	8	Apr, May, Aug	39	5
6-3-0	8	Monthly (summer)[b]	27	10

a pounds nitrogen per 1000 square feet per year. If more than one application was made this amount was divided equally among dates of application.

b 50% of the nitrogen was applied during June and July

TABLE 2. EFFECT OF NITROGEN TREATMENT ON VISUAL ESTIMATES OF *POA ANNUA* INVASION OF PENNLAWN RED FESCUE AT TRAVERSE CITY OCTOBER 1972.

Treatment			% *Poa annua* in turf
Carrier	Rate[a]	Time of application	
-------	0	-------	0
33-0-0	1.5	Monthly	10
33-0-0	3.0	Monthly	20
33-0-0	4.5	Monthly	25
33-0-0	3.0	Apr	18
33-0-0	3.0	Apr, Aug	23
33-0-0	3.0	Apr, June, Aug	20
6-3-0	3.0	Apr	25
6-3-0	3.0	Apr, Aug	45
6-3-0	3.0	Apr, June, Aug	55
38-0-0	3.0	Apr	15
38-0-0	3.0	Apr, Aug	13
38-0-0	3.0	Apr, June, Aug	23

[a] pounds nitrogen per 1000 square feet per year.

TABLE 3. EFFECT OF NITROGEN RATE ON RELATIVE DEGREE OF STRIPE SMUT INFESTATION OF MERION KENTUCKY BLUEGRASS AT EAST LANSING. 1972.

Nitrogen rate lbs/1000 sq. ft.	Relative turf density[a]	Average quality ratings (1 = best)
3	91	4.4
6	83	5.3
12	62	6.5

[a] lower numbers indicate turf was thinned due to stripe smut injury

TABLE 4. EFFECT OF NITROGEN RATE AND MOWING HEIGHT ON THE RELATIVE INCIDENCE OF FUSARIUM SNOWMOLD ON MERION KENTUCKY BLUEGRASS TURF AT EAST LANSING. RATED APRIL 4, 1972 WITH J. M. VARGAS, JR.

Nitrogen rate lbs N/1000 sq. ft.	Mowing height, inches	
	3/4	1 1/2
0	3	0
2	14	3
4	60	24
6	48	28
8	63	20
10	78	40
12	63	23
14	78	20

TABLE 5. EFFECT OF 6 YEARS OF AMMONIUM NITRATE APPLICATIONS TO MERION KENTUCKY BLUEGRASS TURF ON SOIL PH OF FINE SANDY LOAM AT EAST LANSING

Nitrogen rate	Depth of sample, inches		
lbs N/1000 sq. ft.	0-2	4-6	8-10
0	7.4	7.4	7.4
2	7.5	7.6	7.4
4	7.4	7.6	7.5
6	7.3	7.5	7.6
8	6.6	7.5	7.5
10	6.4	7.4	7.5
12	5.6	7.2	7.3
14	5.0	7.1	7.3

TABLE 6. 1972 AVERAGE QUALITY RATINGS FOR MERION KENTUCKY BLUEGRASS TREATED WITH SEVERAL NITROGEN CARRIERS

Treatment		Quality ratings (1=best)	
Carrier	Time of application	E. Lansing[a]	Traverse City[b]
24-4-8(IBDU)	Apr	3.0	2.6
24-4-8(IBDU)	Apr, Aug	2.6	2.2
24-4-8(IBDU)	Apr, June, Aug	2.5	2.5
24-4-12(IBDU)	Apr	2.2	3.0
24-4-12(IBDU)	Apr, Aug	2.5	2.4
24-4-12(IBDU)	Apr, June, Aug	2.3	2.4
24-0-12(IBDU)	Apr	2.4	2.8
24-0-12(IBDU)	Apr, Aug	2.5	2.6
31-0-0(fine)	Apr	1.9	2.2
31-0-0(fine)	Apr, Aug	2.2	2.2
31-0-0(coarse)	Apr	2.4	2.5
31-0-0(coarse)	Apr, Aug	2.4	2.4
Sulfur coated urea	Apr	1.9	- -
Sulfur coated urea	Apr, Aug	2.3	- -
19-6-13(Sierra coated)	Apr	1.7	2.7
19-6-13(Sierra coated)	Apr, Aug	1.9	1.8
16-7-12(Sierra coated)	Apr, Aug	2.3	- -
6-3-0	Apr, Aug	3.0	- -
Ureaformaldehyde	Apr, Aug	3.5	- -
32-0-8(Scott's)	Apr, Aug	2.8	- -
30-3-10(Scott's)	Apr, Aug	2.7	- -
33-0-0	Apr, Aug	- -	3.2

a nitrogen was applied at the rate of 5 pounds per 1000 square feet

b nitrogen was applied at the rate of 6 pounds per 1000 square feet