some significant exceptions, however. Fylking was highly susceptible to Fusarium blight injury. Although there was not a clear response in susceptibility to Fusarium blight observed due to heavy spring nitrogen, we do strongly suggest N programs which emphasize fall and late fall N (1 pound N each in September and November) with lighter rates of N starting in late May to June (0.5 pound N per 1000 square feet) monthly until the September treatment). This N program accompanied by adequate irrigation should result in a Kentucky bluegrass turf which is less susceptible to Fusarium blight.

One problem which should be emphasized is that once significant thinning has occurred from Fusarium blight or from other causes it may be necessary to alter the N fertility program to utilize more spring N to encourage the grass to grow and fill in those open areas left by the disease. The Fylking plots at Traverse City are an example. When little or no N was applied to the thinned plots in the spring the quality ratings (Table 3) were very poor in contrast to those receiving liberal spring N (contrast treatment 8 with treatments 5, 6 and 7). The percent of dead grass on August 11 also was reflected in the quality ratings. It is pointed out that much of the recovery which occurred was caused by the nitrogen response of volunteer grasses (fine fescue and Poa annua), however, and not the Fylking. Overseeding with a more desirable cultivar would be suggested for such a diseased turf.

The effect of timing of fall applications of nitrogen applied as urea on Nugget Kentucky bluegrass is given in Table 9. These rates of N are quite high, but it is clear that the spring residual effect from the fall N is excellent even when applied as early as September 1. There was no snowmold observed on any of these plots.

Several nitrogen carriers were evaluated on a blend of Kentucky bluegrasses grown on sand soil at Traverse City. The plots were irrigated as needed to prevent serious wilt. Appreciation is expressed to Tom Mead, golf superintendent at the Traverse City Country Club for his cooperation on this project. Dwell is a nitrification inhibitor. Urea-treated Dwell gave somewhat slower but longer responses compared to urea alone. The Dwell was applied at 1 pound active ingredient per acre. IBDU responded typically with very slow short term response, but excellent long term residual effects (note the November 5 rating). When IBDU was mixed with soluble N (see 24-4-12 ratings) there was good response, both short and long term. The sulfur-coated urea products (CIL, 18-8-18, 9-6-18, 28-3-9) gave good season long response. The combined treatment of 1.5 pounds N each from powder blue and urea gave good season long response. Other materials responded as expected.

A timing of N fertilization study on Nugget Kentucky bluegrass in the shade was conducted at the shade research area (90+% shade). Clearly fertilization programs which emphasize spring N are detrimental to turf quality during the summer (Table 11). A drought condition in mid-summer resulted in severe wilting and thinning of the plots receiving N in April and May. Those plots receiving N in early October provided the best turf year round. It should be pointed out, however, that the untreated plots ranked about as well as other treatments, emphasizing the importance of using little or no N under intense shade conditions. When the same treatments were applied to A-20-6 Kentucky bluegrass (Table 12) in an adjacent area which received a little more sunlight, the results were not as marked as with Nugget.

Using Sulfur to Reduce Soil pH

Applying elemental sulfur to lower soil pH on the sand at Traverse City (Table 13) reduced soil pH most dramatically when applied as flowers of sulfur (powder). Significant injury occurred on the turf receiving 10 or 20 pounds S per 1000 square feet the following July (after the October application). Recovery of the grass was slow and there was still poor quality turf on the plots receiving 20 pounds S per 1000 square feet in June, 1980, 20 months after application. Soil pH reduction was greater with the powder form than with the ground (or chip) form of S. At the higher rates of application the use of sulfur toreduce soil pH is an alternative for the turf manager, but is suggested only where pH is high enough to cause a significant problem and then should be practiced carefully. Several reports of injury have been received, especially on greens. Often there has been injury to the grass around the individual particles where dramatic pH drop and, possibly, a short term soluble salt effect apparently occurs. The injury almost always occurs the following summer when the population of sulfur oxidizing organisms increase to sufficient numbers to cause a sudden conversion of elemental S to the sulfate form and when there are high temperature and moisture stresses occurring. Use elemental sulfur at low rates and be patient if you plan to reduce pH. Recheck your pH regularly. Remember, the pH change is most dramatic at the soil surface and significant injury can occur.

Table 13. Effect of sulfur applications on Kentucky bluegrass grown on sand at Traverse City. Treatments applied October 20, 1978. Averages for 3 replications.

Treatment		Soil pH, Nov/79		Turf Quality Rating (9 = best)		
S Source	Rate lbs/M	0-2 inch	4-6 inch	Sept 79	Dec 79	Jun 80
None	---	6.9	6.6	9.0 a*	6.3 a	8.8 a
Powder	5	6.4	6.2	9.0 a	7.0 a	8.7 a
Powder	10	5.4	6.0	6.5 b	5.7 a	7.7 a
Powder	20	4.6	5.8	1.0 c	2.0 c	3.2 b
Chip	5	6.5	6.3	9.0 a	6.7 ab	9.0 ce
Chip	10	6.6	6.6	9.0 a	6.7 ab	8.8 a
Chip	20	6.0	6.2	9.0 a	6.7 ab	7.8 a

*Means followed by the same letter in columns are not significantly different from each other using Duncan's New Multiple Range Test at the 5% level.