Summer-induced Chlorosis

David DeVetter and Nick Christians

Introduction:

Chlorosis is a symptom observed in plants when tissue that is normally green turns yellow. Summer-induced chlorosis is sometimes observed on cool-season grasses during the summer months in the Midwest. An unusual aspect of this chlorosis is that it does not occur during the cooler periods of spring and fall. The problem is most common on grass that is grown in sand-based media, but can also occur on finer textured soils. Another characteristic of summer-induced chlorosis is that it will disappear after summer months without treatment. Experiments are being conducted to determine what conditions cause summer-induced chlorosis and also how to control and prevent it.

Experiments:

Various things can cause chlorosis. A lack of nitrogen is the most common. It is also observed on grass grown on soils that are deficient in iron (Fe), magnesium (Mg) sulfur (S), and some of the other micronutrients. It can also result from stresses including disease, insect, and the environment. A preliminary study was conducted August 2006 to observe the response of chlorotic turf to various nutrients. Nutrients used in this study included: nitrogen, iron, sulfur, magnesium, manganese, calcium and molybdenum. An experimental soil conditioner and the plant growth regulator trinexapac-ethyl (Primo) were also used as treatments in this experiment. This study found that iron was the only nutrient that would visually improve chlorosis symptoms. Visual chlorosis ratings from this experiment are shown in table 1.

Another preliminary study looked at visual response to iron applied at different rates. This study was conducted in August 2006. Results showed that increasing rates of iron led to lower incidence of chlorosis. Application of iron at rates higher than 0.66 lbs/acre did not improve chlorosis further. Results for this experiment are shown in table 2.

A greenhouse study will be conducted during the spring of 2006 to test the hypothesis that high soil temperatures cause chlorosis during the summer months. Plugs of Kentucky bluegrass were taken from the Iowa State University Horticulture Research Station from turf that is known to show summer chlorosis. The plugs will be subjected to temperature treatments by using water baths to maintain soil temperatures at 65, 75 and 85 degrees F. Turf will be evaluated visually for overall quality and chlorosis. Clippings will be collected weekly, and chlorophyll content will be measured at the end of the study.

From June through August of 2007, an experiment will be conducted to determine the effectiveness of preventive iron treatments on a Kentucky bluegrass turf area that is known to become chlorotic during summer months. This experiment will have treatments of iron being applied at label rate at different dates during the experiment before chlorosis begins. The goal is to determine when is the best time to apply iron to prevent or lessen chlorosis.

There will also be studies conducted on the turf area following the onset of chlorosis to determine the best rates of iron to eliminate the symptoms once they have developed. Speed of recovery, duration of effect, and level of chlorosis will be used to assess treatments.

Table 1. Visual assessment of chlorotic Kentucky bluegrass turf after application of nutrients; 9=green turf, 6=acceptable, and 1=extreme yellowing and necrosis.

		Chlorosis Rating								
Treatment	**Rate**	**day 0**	**day 1**	**day 2**	**day 3**	**day 4**	**day 5**	**day 6**	**day 10**	**day 15**
Control	**Na**	6.0 a	6.0 a	5.7 cde	5.7 cd	6.0 b	6.0 bcd	6.0 bc	5.3 d	6.0 cde
Nitrogen	**1 lbs/1000 ft^2**	5.7 a	5.7 a	5.7 cde	5.7 cd	5.7 b	5.7 cde	5.7 cd	5.7 cd	6.0 cde
Nitrogen	**2 lbs/1000 ft^2**	5.7 a	5.3 a	5.7 cde	5.7 cd	5.7 b	5.3 ed	5.3 d	5.7 cd	5.3 e
Nitrogen	**3 lbs/1000 ft^2**	6.3 a	5.7 a	5.3 de	5.7 cd	5.7 b	5.0 e	5.7 cd	5.7 cd	6.7 bc
Iron	**1 lbs/A**	5.7 a	6.0 a	6.3 abc	6.3 bc	6.3 b	6.7 b	6.3 b	6.7 b	7.3 ab
Iron	**2 lbs/A**	6.3 a	6.0 a	6.7 ab	7.0 ab	8.0 a	7.7 a	7.7 a	7.7 a	7.7 a
Iron	**3 lbs/A**	6.0 a	6.0 a	7.0 a	7.3 a	8.0 a	7.7 a	8.0 a	8.0 a	8.0 a
Sulfur	**1 lbs/A**	6.0 a	5.3 a	5.7 cde	6.0 cd	6.0 b	6.3 bc	6.0 bc	6.3 bc	6.3 cd
Sulfur	**2 lbs/A**	6.0 a	5.7 a	5.3 de	5.3 d	6.0 b	5.7 cde	5.7 cd	5.3 d	6.3 cd
Sulfur	**3 lbs/A**	6.3 a	6.0 a	6.0 bcd	6.0 cd	6.0 b	6.0 bcd	6.0 bc	6.0 bcd	6.0 cde
Magnesium	**2 lbs/A**	6.3 a	5.7 a	5.3 de	6.0 cd	6.3 b	5.7 cde	6.0 bc	6.0 bcd	6.0 cde
Magnesium	**3 lbs/A**	6.0 a	5.3 a	5.3 de	5.7 cd	5.7 b	5.7 cde	6.0 bc	5.7 cd	5.7 de
Manganese	**0.5 lbs/A**	6.3 a	6.0 a	6.0 bcd	6.0 cd	6.3 b	6.0 bcd	6.0 bc	6.0 bcd	6.0 cde
Manganese	**1 lbs/A**	6.0 a	6.0 a	6.0 bcd	6.0 cd	5.7 b	6.0 bcd	6.0 bc	6.0 bcd	6.0 cde
Calcium	**2 lbs/A**	6.0 a	5.3 a	5.0 e	6.0 cd	6.0 b	5.7 cde	5.7 cd	5.3 d	6.0 cde
Molybdenum	**0.05 lbs/A**	6.0 a	5.3 a	5.3 de	5.7 cd	6.0 b	5.7 cde	6.0 bc	5.7 cd	6.0 cde
Soil Conditioner	**40 lbs/1000 ft^2**	5.7 a	5.7 a	6.0 bcd	6.0 cd	6.0 b	6.0 bcd	6.0 bc	6.0 bcd	6.7 bc
Growth Regulator	**0.60 fl. oz./1000 ft^2**	5.7 a	5.3 a	5.7 cde	5.7 cd	6.0 b	6.0 bcd	6.0 bc	6.0 bcd	6.0 cde

Table 2. Visual assessment of chlorotic Kentucky bluegrass turf after application of iron; 9=green turf, 6=acceptable, and 1=extreme yellowing and necrosis.

	Chlororsis Rating		
Rate of Iron (lbs/1000 ft^2)	**Day 0**	**Day 6**	**Day 11**
0.0	6.7 a	7.0 b	6.0 d
0.075	6.3 a	7.7 ab	6.7 c
0.33	6.0 a	7.7 ab	8.0 b
0.66	6.0 a	8.0 a	8.7 a
1.0	6.3 a	8.0 a	9.0 a