the water is clear. Then refill the tank with water only, and repeat the process. Finally, clean the spray nozzle tips with a soft-bristle brush.

We paint after mowing, generally one to two days before the weekend games. And, when possible, we avoid painting when the grass is wet. Paint sticks best and lasts longer on dry turf.

We paint fields once a week so that the lines are always fresh and clear. Because mowing with a reel mower can cause lines to "move" and because accuracy is so important, we restring the fields every two weeks. For the in-between week, crews "trace over" the painted lines. Actual touch-up painting takes approximately one-half hour; preparation and cleanup add another half hour to the process.

The time and effort it takes to properly mark sports fields is paid back time and again in player pride - and in the knowledge that the fraction of an inch that decided a game was an accurate measure of the team's efforts.

Editor's Note: Kevin Vos is athletic facilities manager of the Muscatine Soccer complex, Muscatine, IA, a member of the national Sports Turf Managers Association and a board member of the Iowa Sports Turf Managers Association. This article is reproduced from *SportsTURF,* Vol. 11, Jan. 1995.

GTI HILITES

Endophyte Alkaloid Production In Turfgrass

In 1994 Prof. Steve Bowley of the Crop Science Dept. at the University of Guelph initiated an interesting program on alkaloids related to turfgrass. Alkaloids are organic chemicals which may be produced by endophytic fungi growing in association with turf species. Endophytes are any organism growing inside a plant and may be bacteria or fungi. They may be beneficial or a disease; in this case we are considering potentially beneficial fungi.

Many turf managers find it necessary to apply one or more applications of insecticides each year for the control of insect pest such as Chinch Bugs. A potential method to reduce the reliance on insecticides is to exploit a turfgrass-fungal endophytic and symbiotic association. The symbiotic association enhances the plants tolerance to insect attack, especially those insects which feed on above ground plant parts. The tolerance is due to the production of alkaloids by the fungi, specifically the alkaloids peramine, ergopeptine and paxilline, which are feeding deterrents, and lolitrem, which is toxic to insects.

Many turfgrass species are reported to have the endophytic-turfgrass symbiotic association and are retailed to the turf manager for their insect tolerance. Among these are cultivars of ryegrass and tall fescue.

The first phase of Prof. Bowley's project has the objective of quantifying the seasonal pattern of endophyte alkaloids (primarily peramine) in endophyte-infected perennial ryegrass and tall fescue. From this information he hopes to establish a method to predict periods of the season during which the endophytes have the potential to control insect pests and management techniques to enhance the control.

Turf trials, which were seeded in 1992 at Cambridge and Ridgetown, were used for measurement of endophyte level during the 1994 growing season. Two varieties of tall fescue (Mustang and Tribute at Cambridge and Rebel-3D at Ridgetown) and two varieties of perennial ryegrass (Yorktown III and Express at Cambridge and Yorktown III and Competitor at Ridgetown) were sampled on a weekly basis. Endophyte concentration was estimated by staining and direct count of fungal hyphae present on the sheath of the second youngest, fully expanded leaf of two tillers from each plot.

Bowley found significantly higher levels of endophytic infection in the ryegrass varieties than in the tall fescue varieties (Table 1). The density of the hyphae on the leaf was also higher for the ryegrass varieties than the tall fescue. There was a trend toward a higher percent of tillers infected and density of infection at Ridgetown than at Cambridge.

An example of the seasonal trend in percent of tillers infected is shown in Figure 1 for Cambridge. Somewhat similar trends were observed at a Ridgetown. No significant changes in the level was observed over the June to October period.

The low level of endophyte infection on tall fescue was not anticipated. Bowley suggests that Ontario is near the northern limit of adaptation of tall fescue, thus we may also be near the limit of adaptation of the tall fescue endophyte. American studies indicate a decline in endophyte during the cool seasons on tall fescue.

The high level of endophyte in ryegrass varieties throughout the season, many of which are adapted to our environment, warrants further effort on the part of Prof. Bowley.

Fig. 1: The percent of tillers of perennial ryegrass and tall fescue with endophyte at Cambridge over the June-October period.

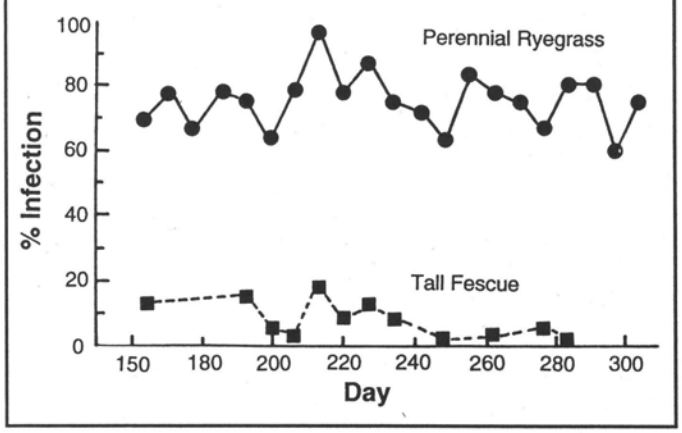

Table 1: The percent of infected leaves and the density of fungal hyphae on perennial ryegrass and tall fescue at Cambridge and Ridgetown.

	Infection		Density	
	Cambridge	Ridgetown	Cambridge	Ridgetown
	(%)		(counts/field)	
Perennial Ryegrass	75.1	65.3	2.6	1.5
Tall Fescue	9.8	0.5	0.4	0.01