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Winter Ice Cover Problems?

James B Beard

The injury mechanism and factors influencing low-temperature kill of turfs were discussed in the January–February 1998 Turfax™. During the past four decades numerous writers have included ice cover damage caused by oxygen suffocation under the ice layer as being a major cause of winterkill. A survey of the turfgrass research literature on this subject reveals no valid scientific data to support this ill-founded concept.

Misinterpreted Research. A commonly published guideline advises removal of an ice cover after 20 days in place. There is no validity to this guideline as related to the fibrous roots and small meristematic crowns of perennial grasses. The 1960s origin of this 20-day maximum is based on University of Wisconsin research with the very fleshy, high-carbohydrate, taprooted alfalfa species (*Medicago sativa*). Physiologically, the root-crown system of this legume is drastically different from that of a turfgrass, including the respiration rate.

Clarifying Research Conducted: Specific published studies[2,3,4] and numerous "real-world" field observations demonstrate that C_3, cool-season, perennial turfgrasses can survive more than 75 days under dense ice cover with no injury. Typically, an ice cover would be in place for a shorter duration than 150 days. The most complete ice cover study was conducted at Michigan State University by J.B Beard and J.W. Eaton. Three species were compared: creeping bentgrass (*Agrostis stolonifera*) at a 0.25-inch (6.4 mm) cutting height, Kentucky bluegrass (*Poa pratensis*) at a 1.5-inch (38 mm) cutting height, and annual bluegrass (*Poa annua* var. *annua*) at a 1.0-inch (25 mm) cutting height. Mature turfs of these three turfgrasses were allowed to fully harden well into December in East Lansing, Michigan, and then 4-inch (100 mm) turf plugs were collected. The turfs were placed in quart jars, which were then filled with water and slowly frozen. Then the top of the ice was capped off with a small amount of water, the cover plate was screwed tight with a rubber gasket and jar sleeve, and the ice encasement system was frozen. There were four replications involved, with the turfs encased in ice held at 25°F (–4°C) for 15-day durations of up to 5 months. A set of 4 replications were removed at 15-day intervals, thawed slowly, and evaluated for turf survival in a glasshouse.

The results—summarized in Table 1—revealed that **both creeping bentgrass and Kentucky bluegrass survived 5 months, or 150 days, of dense ice encasement without significant injury.** In contrast, **the annual bluegrass was killed between the 75th and 90th days.** These results revealed that ice coverage for up to 150 days may not be of concern where creeping bentgrass and Kentucky bluegrass turfs are involved. However, for annual bluegrass an ice cover persisting for more than 75 days is of concern. In the case of the annual bluegrass the cause of death was probably a toxic accumulation of respiratory gases under the relatively impermeable ice cover.

Why the Confusion? A common occurrence associated with ice covers is low-temperature kill in a pattern

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directly associated with the ice cover that existed the previous winter. **This type of turf kill occurs under the following scenario: (a) prior to formation of the ice cover, (b) following a period of surface water accumulation, which increases the grass crown hydration level, and (c) with a subsequent very rapid freeze to below ~20°F (–7°C).** Turf kill may also occur during the thawing period, when the resultant standing water where the ice cover existed causes increased crown hydration and is then followed by rapid freeze to below 20°F (–7°C). These crown hydration situations followed by a rapid freeze typically occur in locations where ice covers have been observed during the winter. Thus the confusion, in which the ice covers are assumed to directly cause the turf injury, when in fact that is not the case.

There are also preventive activities that can be misinterpreted. For example, in the early 1960s the midwestern United States had extensive turf kill on the putting greens, which at that time was attributed to ice covers. Only one golf course superintendent removed the ice from the greens, and these greens were the only ones that were not severely injured. It was assumed that removing the ice sheet prevented the accumulation of toxic gases around the grass, thereby avoiding kill. Another more appropriate interpretation of that situation would be that the removal of the ice sheets was a means of mechanically removing the water, which upon thaw would have created a high crown-node hydration situation. Essentially, the water was being physically hauled off the putting greens prior to thaw.

Ice Cover Injury Prevention. Cultural practices that will reduce the turf injury caused by an ice cover include: (a) maintain a moderately low nitrogen level and (b) ensure a high potassium level. Soil management preventive practices include the following: (a) provide surface drainage by proper contours, catch basins, and ditches, (b) provide subsurface drainage by drain lines, slit trenches, dry walls, and possibly soil modification to a high-sand root zone, and (c) cultivate turf by coring as needed to sustain favorable soil infiltration rates. Specific protectants that might be utilized include placing a continuous polyethylene cover over the putting greens to minimize water accumulation and contact with the turfgrass tissues, which results in crown hydration.

If a substantial snow or ice accumulation occurs that will persist for too long a period of time, efforts should be made to remove the excess snow and ice by powered-mechanical means down to within 1 inch (25 mm) of the turf surface. Once temperatures rise sufficiently after removal of the excessive ice and snow cover, the application of a black charcoal or fertilizer material at temperatures of ~30°F (–1°C) and higher will aid in absorbing solar radiant energy, resulting in an enhanced rate of ice thaw.

Crown Hydration. Note that crown hydration is not the cause of turf kill, but it is a key precondition. The concept of winterkill crown hydration effects on turfgrasses is not new, as the original research was published in the 1960s.[1,2,5]

Ice Rinks. Numerous ice rinks are constructed across Northern America without injury to the turfgrasses. These are allowed to stay in place for extended periods of time over the winter period—certainly longer than 20 to 50 days. Some keys to success in this regard are as follows:

- Select a location where rapid drainage of water will occur in the spring at the time of thaw.
- Preferably apply the ice sheets to an area where the dominant turfgrass species is Kentucky bluegrass or a Kentucky bluegrass blend.
- Wait until at least a 2 inch (50 mm) snow cover has occurred.
- At night when temperatures are well below 32°F (0°C), start the application of water to build up an ice cover. Initially make light syringe applications of water, which will allow rapid freezing and ice formation. Gradually build up the ice cover over time during the nocturnal period until an ice sheet of the desired depth has been achieved.
- Typically, the areas most prone to damage associated with ice rinks are the entrance and exit points where freezing and thawing of the ice is more likely

Table 1. The percent plant survival after being encased in ice at 25°F (–4°C) from 60 through 150 days.

	Days Encased in Ice						
Turfgrass	**60**	**75**	**90**	**105**	**120**	**135**	**150**
Creeping bentgrass	100	100	100	100	100	100	100
Kentucky bluegrass	100	100	100	100	100	100	100
Annual bluegrass	100	100	0	0	0	0	0

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FEATURE ARTICLE

Year-End Report Card on New Turf Insecticides

Daniel A. Potter

Despite years of research and field testing that precede registration of insecticides, the strengths and limitations of new products often aren't fully revealed until they're put to use by turfgrass professionals. Here are some of the patterns that emerged from 1998:

Halofenozide (MACH 2®), the newest soil insecticide, was registered for use in most states in 1998. MACH 2® belongs to a new class of synthetic insecticides called Molt Accelerating Compounds (MACs) which disrupt the hormonal system that controls growth and molting in target insects. It has very low vertebrate toxicity and is one of the least toxic materials you can use for grub control. **Professionals have obtained excellent preventive control of Japanese beetle and masked chafer *(Cyclocephula)* grubs, as well as black turfgrass ataenius, with MACH 2® applied any time from mid-May to early August.** MACH 2® also kills billbug larvae, and the liquid (2SC) formulation has performed well against sod webworms and cutworms.

Despite advertised claims that it is effective for curative control, we know now that **MACH 2® works too slowly against large grubs to put a stop to digging by skunks, raccoons, birds, or other vertebrate predators.** Although large (3rd instar) grubs stop feeding soon after ingesting MACH 2®, it may take 3 weeks or longer before they die and decompose to the point that they no longer attract digging varmints. Remember, MACH 2® works by disrupting molting, so it works best if applied early—before or soon after egg hatch—to target small grubs that are actively growing. **Once grubs are large enough to cause noticeable damage, you're better off with a fast-acting, short-residual product such as Dylox® (trichlorfon).** Also, recent research has shown that **MACH 2® is less active against European chafer and Asiatic garden beetle grubs than against other grub species.** So, it pays to know what kind of grubs you're dealing with, especially with this product.

Merit® (imidacloprid) continues to give excellent preventive grub control when applied any time from May until egg hatch (early August). Some golf course superintendents reported failure of Merit® for grub control this last season. Usually, these problems were traced to too-early an application (March or April) motivated by the intent to multiple-target the first generation of black turfgrass ataenius grubs, which hatches in mid- to late May. These early spring applications do not kill the large, overwintered grubs of Japanese beetle, masked chafers, European chafer, or other annual species, and the product "runs out of gas" by August when the new brood of these grubs arrives. The same problem can also occur with MACH 2®. **In most areas, the optimal window for preventive control of annual grub species with either product is from early June to mid-July.** If your intent is to control both black turfgrass ataenius and annual grubs with the same treatment, wait until mid-May before making the application.

Both Merit® and MACH 2® are more forgiving than other grub insecticides if not immediately watered in. However, both products, especially the sprayable formulations, are susceptible to photodegradation upon prolonged exposure to sunlight, and neither can kill grubs unless the

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to occur during high traffic periods. A solution to this problem is the use of protective wooden-floor entrance ways at these locations.

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