

Renovating putting greens without methyl bromide

A granular soil fumigant may be an option for putting green renovation if methyl bromide is banned in the near future.

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Putting green renovation has increased in some areas of the northern United States because of problems associated with the encroachment of annual bluegrass (*Poa annua* var. *annua*) and the availability of new and improved creeping bentgrass (*Agrostis stolonifera*) cultivars. A popular means of renovating putting greens involves using the fumigant methyl bromide to kill established turf and annual bluegrass seed in soil before seeding the green with creeping bentgrass. Although this method of renovation is usually successful, methyl bromide may be banned in 2005 for use on turfgrass. If methyl bromide were banned, an alternative fumigant for putting green renovation would be a boon to superintendents.

A possible alternative to methyl bromide

Recently, some superintendents and researchers have experimented with a granular soil fumigant called Basamid Granular for golf turf renovation (4). The active ingredient in Basamid is dazomet, which comprises 99% of the product. In the presence of moist soil, dazomet converts to a gaseous compound called methylisothiocyanate (MITC), which is toxic to many soil-borne organisms, including weed seeds (1,2). Currently, not much is known about the effectiveness of surface applications of dazomet on germination of annual bluegrass seed, the main target of putting green fumigation in the northern United States.

KEY points

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In putting green turf renovations

in the northern United States, methyl bromide is often used to kill established turf and annual bluegrass seed in the soil before the green is seeded with creeping bentgrass.

Methyl bromide may soon be banned in the United States for turfgrass uses.

We tested a granular soil fumigant (Basamid Granular, a.i. dazomet) as a possible alternative to methyl bromide for renovating putting greens infested with annual bluegrass.

We completely controlled emergence of annual bluegrass seedlings by applying Basamid to the putting green surface at 350 pounds per acre and covering the treated green with plastic.

Runoff from Basamid-treated turf can be dangerous to surrounding turf and aquatic life.



Photos courtesy of Peter Landschoot

Figure 1. Emergence of annual bluegrass seedlings was completely controlled in plots treated with Basamid at 350 pounds per acre (392.3 kilograms/hectare) and covered with plastic sheets.

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The research

In 2000, we began a study at Penn State to evaluate Basamid as a fumigant for putting green renovation. We began by determining the optimal rate of surface-applied Basamid required for complete control of emergence of annual bluegrass seedlings. We also determined how covering treated areas with a plastic sheet (tarp) affected annual bluegrass seedling emergence. Finally, we attempted to determine the waiting period between fumigation of a putting green with Basamid and safe seeding of that green with creeping bentgrass.

Controlling annual bluegrass seedling emergence

Materials and methods

The seedling emergence study was designed to determine the effects of Basamid rate and plastic covering on the emergence of annual bluegrass seedlings. The test area was a 20-year-old stand of creeping bentgrass and annual bluegrass maintained as a putting

green. The soil was a sandy loam heavily infested with annual bluegrass seed.

Because preliminary tests showed that Basamid rates lower than 350 pounds per acre (392.3 kilograms/hectare) did not provide complete, uniform kill of established turf, Roundup PRO was applied to the test area (3 quarts per acre [7 liters/hectare]) before the application of Basamid treatments. The Roundup PRO killed all established turf. This step was important because live turfgrass would have interfered with annual bluegrass seedling assessments. Following the death of the turf, the test area was core-cultivated and scarified using a vertical mower.

Treatments included Basamid applied at 350, 306, 263 and 175 pounds per acre (392.3, 343.0, 294.8 and 196.1 kilograms/hectare) and either covered with clear plastic sheets (4.0 mils thick) or not covered. Nontreated control plots (covered and not covered) were included for comparison. Treatments were applied on Aug. 5, 2000, and July 25, 2001, and, in accordance with

label instructions, immediately watered-in with about 0.5 inch (1.3 centimeters) of irrigation water.

Plots to be covered with plastic sheets were covered within one hour following irrigation. After the initial irrigation, non-covered plots were watered daily for several days to create a “water seal” (according to label instructions) to minimize loss of MITC to the atmosphere (3). Plastic sheets were removed seven days after Basamid was applied. Approximately 30 days after treatment, we counted individual annual bluegrass seedlings that germinated in the test plots.

Results and discussion

In plots treated with Basamid at rates of 350, 306 and 263 pounds per acre (392.3, 343.0 and 294.8 kilograms/hectare) and covered with plastic sheets, emergence of annual bluegrass seedlings was completely controlled during both years of the study (Table 1, Figure 1). Although we achieved complete

ANNUAL BLUEGRASS CONTROL						
Treatment	Rate		No. annual bluegrass seedlings/24 square feet (2.2 meters)			
	(pounds/acre)	(kilograms/hectare)	2000		2001	
			No plastic [†]	Plastic	No plastic	Plastic
Basamid	350	392.3	67	0	43	0
Basamid	306	343.0	101	0	96	0
Basamid	263	294.8	127	0	126	0
Basamid	175	196.1	620	0	216	22
Control	—	—	2,664	2,681	2,678	1,616

[†] “No plastic” indicates that field plots were not covered following Basamid application; “plastic” indicates that field plots were covered with plastic sheets for seven days following Basamid application.

Table 1. Mean annual bluegrass (*Poa annua*) seedlings from putting green turf treated with different rates of Basamid covered with plastic or not covered.

control of annual bluegrass seedling emergence at 263 pounds of Basamid per acre, the 350-pound-per-acre rate may be required to provide complete kill of established turf. To be certain that Basamid coverage is adequate for complete kill of established turf, we suggest treating putting greens with 350 pounds of Basamid per acre and covering with plastic sheets.

In plots that were treated with Basamid at the same rates but not covered with plastic sheets, control of annual bluegrass seedling emergence was greater than or equal to 95%, but it never reached 100%. The noncovered treatment at a rate of 175 pounds per acre (196.1 kilograms/hectare) was not very effective in controlling emergence of annual bluegrass seedlings.

Safe seeding intervals

Materials and methods

To kill the established turf and all annual bluegrass seed, the test area was fumigated with Basamid several weeks before treatments were applied because germinating annual bluegrass seed could interfere with assessments of creeping bentgrass establishment. Preliminary tests at this site indicated that creeping bentgrass seed germination was not inhibited when seeded four weeks or more following application of Basamid.

Following the death of the turf, the test area was core-cultivated and scarified using a vertical mower. The test area was divided into three replicate blocks, and each block contained 16 plots. Eight plots in each block were treated with Basamid at 350 pounds per acre (392.3 kilograms/hectare) on Aug. 24, 2001, and Aug. 22, 2002, and eight plots were not treated. Immediately following Basamid application, the test area was watered with 0.5 inch (1.3 centimeters) of irrigation water. Following irrigation, four of the eight plots treated with Basamid were covered with clear, plastic sheets (4 mils thick), and four were not covered. Four of the eight nontreated plots were covered with clear plastic sheets, and the other four were not.

Penn G-6 creeping bentgrass was seeded in plots treated with Basamid and in nontreated control plots at eight, 10, 13 and 16 days after treatment. For all seeding-interval treatments, visual estimates of the percentage of ground cover were made 22 days after each seeding date to determine



Figure 2. Because Basamid is formulated as a very fine, granular product, it must be applied with a drop spreader.

whether Basamid had affected creeping bentgrass establishment.

Results and discussion

Current label instructions do not provide details on safe seeding intervals following surface applications of Basamid, but they suggest a period of 12 to 17 days between surface applications and seeding. Results of the 2001 and 2002 seeding-interval experiments showed no significant differences in turf cover between control plots and treated plots when seeded eight, 10, 13 and 16 days after a surface application of Basamid.

In the treatments with the shortest seeding interval, treated plots were covered with plastic for seven days and seeded one day after the covers were removed (eight days after treatment). Although we did not observe seedling inhibition in these plots, we suggest waiting seven to 10 days after cover removal before seeding. We suggest a conservative approach because dazomet and MITC activity can vary with differences in soil texture, moisture and temperature (3). Thus, results may vary somewhat among the highly variable soil conditions that occur on putting greens in the northern United States. We suggest that superintendents experiment with Basamid at their own courses to refine application methods and seeding intervals before attempting a major project such as a putting green renovation.

Fumigation of putting greens at Maple Dale Country Club

In summer 2002, we met with Marlin Wian, superintendent of Maple Dale CC in Dover, Del., to discuss fumigating and regrassing two problem putting greens. These annual bluegrass greens were located in a wooded area with poor air circulation that suffered from anthracnose disease and other problems. Before our meeting, the Maple Dale CC green committee had approved a plan to remove a number of trees and resurface the greens with creeping bentgrass. Because Wian had to complete the project within a limited time frame, he decided to use Basamid to fumigate the greens.

In late August, the greens were prepared for fumigation. First, the greens were aerated, the cores removed and the surface topdressed with sand. Next, a sodcutter was used to cut a strip of sod around each green. The sod strips were used later to seal the plastic tarps used to cover the greens following Basamid application. Plastic tarps, conforming to the dimensions of the greens, were assembled before the application and placed in protected areas.

Basamid was applied to two putting greens on Aug. 26. Before application, dew was removed from the putting green surface by poling. The product must be applied to a dry turf surface to avoid tracking the fine granules via shoes and spreader wheels.

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When the surface of the putting green was dry, the Basamid was applied at 350 pounds per acre (392.3 kilograms/hectare) using a Gandy drop spreader (Figure 2). Following application, the product was watered in with 0.25-0.5 inch (0.64-1.3 centimeters) of water. The water was applied incrementally for 60 to 90 minutes to avoid ponding and runoff (Figure 3), which represents a serious risk because MITC is soluble in water and can move with water flow (4).

Following irrigation, the greens were covered with the pre-assembled plastic tarps and sealed with the previously cut sod strips (Figure 4). Tarps were used to keep the MITC gas in the soil and improve kill of annual bluegrass seeds. Tarps were left in place on greens for seven days and then removed. The greens were seeded on Sept. 5, three days after covers were removed from the treated greens, with a 50:50 blend of Penn A-4 and Penn A-1 creeping bentgrass at 1 pound seed per 1,000 square feet (48.8 kilograms/hectare). Although no detrimental effects on seedling development were



Figure 3. Basamid should be watered in with 0.25 to 0.5 inch (0.64-1.3 centimeters) of water applied incrementally for 60 to 90 minutes to avoid ponding and runoff.

observed, we cannot be certain that the three-day waiting period will yield positive results in every situation. A more cautious approach

would be to wait seven to 10 days after removing covers before seeding greens or trying to germinate seeds of sensitive plants,



Figure 4. Sod strips cut from the periphery of the green were used to seal the plastic tarps that covered the green following Basamid application.

such as lettuce, in the treated soil to determine whether any damaging residual MITC remains. If MITC concentrations are too high, the seedlings of the sensitive plants will be damaged.

Five weeks after seeding, the greens showed almost 100% creeping bentgrass ground cover. No annual bluegrass germination was visible during the fall grow-in period. The greens were opened the following spring and, by all accounts, the resurfacing was successful (Figure 5).

Summary

Results of studies at Penn State and Maple Dale CC indicate that Basamid can control emergence of annual bluegrass seedlings in putting greens when applied in late summer at 350 pounds per acre (392.3 kilograms/hectare), watered-in with 0.5 inch (1.3 centimeters) of irrigation water and covered with plastic tarps. It is important to monitor irrigation water carefully so that ponding and runoff do not occur. Our research showed no detrimental effects on creeping bentgrass establishment when Basamid-treated plots were seeded only one day after covers were removed (eight days after Basamid application). However, until more information is available on safe seeding intervals on different soil types and under different environmental conditions, we suggest waiting seven to 10 days after cover removal before seeding. As an added precaution, lettuce seeds or cress seeds can be planted in Basamid-treated soil (and nontreated soil) at various intervals after treatment. If lettuce seed germination is similar in treated and nontreated soil, then seeding of turfgrasses can begin.

The original objective of this study was to determine whether Basamid could be used as a suitable substitute for methyl bromide for putting green renovation, if methyl bromide were banned for turfgrass use. Although the initial results have been promising, we will be more confident when we see positive results from other superintendents using this approach for putting green renovations.

Additional comments and concerns

Granular formulation

The granular formulation of Basamid permits applications as part of an in-house fumigation project (provided that your state allows application without a fumigation license). However, the extremely fine particle size of this product means that drop spreaders must be



Figure 5. Using the fumigant Basamid resulted in a successful putting green renovation on a Delaware golf course.

used for applications. Unless the drop spreader is well constructed, granules will leak out of every small opening in the hopper. It may be helpful to place a piece of plastic under the spreader before filling. If leaks do occur, granules will fall onto the plastic, where they can be collected and returned to the container. Particles will occasionally bridge over the outlet holes in the bottom of the hopper during application. Bridging should not be a significant problem if it occurs only occasionally during the application and if the greens are covered with a plastic tarp. The MITC gas should circulate under the plastic and kill annual bluegrass seeds in areas that did not receive Basamid because of bridging over outlet holes.

Wind and rain

Weather conditions play a crucial role in deciding when to make a Basamid application. Particle drift and resulting skips can occur when applications are made during windy (or even in mildly breezy) conditions. As stated previously, the product cannot be applied when dew is on the turf or immediately following rain because granules will stick to spreader tires and shoes. In some locations, it may be difficult to find a suitable time for application because by the time the moisture on turf is gone, the wind often picks up and prevents application.

When rainfall (or irrigation) exceeds infiltration, runoff from Basamid-treated turf can kill turf surrounding the treated green or contaminate surface water, killing aquatic organisms. Therefore, Basamid

should be applied only when there is no immediate threat of rain.

The runoff threat can be reduced by watering-in Basamid with about 0.5 inch (1.3 centimeters) of water immediately after application. Watering must be done incrementally to ensure infiltration and prevent runoff. Runoff represents a risk when Basamid is used for putting green renovation, and more research is needed to help understand how to reduce this risk.

Acknowledgments

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