RESEARCH

A new product for fairway renovation

A granular soil fumigant may be the answer for superintendents looking at renovation projects.

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Renovation of perennial ryegrass (*Lolium perenne* L.) and annual bluegrass (*Poa annua* L.) fairways is increasing in popularity in the northern United States. Problems with disease, winterkill and summer stress have convinced some superintendents to explore converting fairways to improved cultivars of creeping bentgrass (*Agrostis stolonifera* L.).

The most common means of fairway renovation in northern states involves using a glyphosate product (such as Roundup PRO) to kill existing turf and then seeding with the desired turfgrass. Although this method has been successful in many cases, large seed banks of annual bluegrass in the soil can significantly contaminate newly established turf.

In the past, soil fumigation has been used to kill existing turf and prevent annual bluegrass contamination in the new stand. However, fumigation is not typically used in the northern United States because of its high cost and the inconvenience of covering large areas with plastic tarps. The most reliable and commonly used soil fumigant, methyl bromide, will soon be banned for agricultural and turfgrass uses in the United States because some scientists believe that methyl bromide contributes to depletion of the ozone layer in the stratosphere.

An alternative to methyl bromide

Recently, some superintendents and researchers have experimented with a granular soil fumigant called Basamid Granular (BASF Corp.) as an alternative to methyl bromide for golf turf renovation. 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 soilborne organisms, including weed seeds (4,6). Currently, not much is known about the effectiveness of surface applications of dazomet on the germination of annual bluegrass seed, the main target of golf turf fumigation in the northern United States.

The research

In 1999, we began a study at Penn State to evaluate dazomet as a fairway renovation fumigant. We began by determining the optimal rate of surface-applied dazomet required for complete control (kill) of existing turf and reduction of annual bluegrass seedling emergence. We also determined how covering dazomet-treated areas with a plastic sheet affected annual bluegrass seedling emergence. Although plastic sheeting is not required with dazomet, covering treated soils with plastic has improved preemergence control of certain weed species compared to treated soils that were not covered (3). Finally, we examined safe, effective creeping bentgrass seeding intervals following surface applications of dazomet.

KEY points

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- **Fairway renovation** is increasingly popular, but in the northern United States eliminating the risk of annual bluegrass contamination in new turf has been difficult.
- **A granular soil fumigant** (Basamid Granular) that does not require the use of plastic tarps is available to superintendents.
- **This study** found that Basamid applied at 350 pounds/acre completely killed existing turf and controlled annual bluegrass seedling emergence.
- **Superintendents** should be aware of difficulties with Basamid application and of the danger to aquatic life caused by runoff from Basamid-treated areas.

Control of existing turf

Materials and methods

The test area used for this study was a mixed stand of perennial ryegrass and annual bluegrass maintained under fairway conditions. Dazomet was applied to the turf surface at 347, 260 and 173 pounds per acre (=Basamid at 350, 263 and 175 pounds/acre, respectively) and, in accordance with label instructions, watered-in with 0.5 inch of irrigation water on July 12, 2000, and July 13, 2001. Control ratings were taken at various intervals following treatment applications.

Results and discussion

Dazomet applied at a rate of 347 pounds per acre (=Basamid at 350 pounds/acre) was the only treatment in this study that caused complete control (kill) of the existing perennial ryegrass/annual bluegrass turf. Complete control was apparent between five and nine days after dazomet application. Based on the results of this test, dazomet rates equal to or lower than 260 pounds per acre (=Basamid at 263 pounds/acre) will not completely kill established turf.

Control of annual bluegrass seedling emergence

Materials and methods

The seedling emergence study was designed to determine the effects of dazomet rate and plastic covering on annual bluegrass seedling emergence. The test area consisted of perennial ryegrass and annual bluegrass maintained under fairway conditions. The soil was a silt loam heavily infested with annual bluegrass seed. Treatments included dazomet applied at 347, 303, 260 and 173 pounds per acre and covered with clear plastic sheets (4.0 mil thick) or not covered. Untreated control plots, both covered and

not covered, were included for comparison.

Because the "Control of existing turf" study (above) showed that dazomet rates of fewer than 347 pounds per acre (=Basamid rates of fewer than 350 pounds per acre) will not provide complete, uniform kill of existing turf, Roundup PRO was applied to the test area (3.0 quarts per acre) before the application of dazomet treatments. This approach killed all existing turf. This step was important because live tillers would interfere with annual bluegrass seedling assessments.

Following turf death, the test area was core-cultivated and scarified using a vertical mower. Dazomet applications were made on Aug. 11, 2000, and Aug. 8, 2001, and followed immediately by irrigation at 0.5 inch. Plastic sheets were placed on plots in the covered treatment within one hour of irrigation. After the initial irrigation, plots were watered daily for several days to create a "water seal" (in adherence to label instructions) to minimize loss of MITC to the atmosphere (7). Plastic sheets were removed seven days after treatment. Approximately 30 days after dazomet application, we counted individual annual bluegrass seedlings that had germinated in the test plots.

Results and discussion

Dazomet treatments covered with plastic sheets provided greater than 98% control of annual bluegrass seedling emergence at all rates used in this study. Dazomet applied at 347 pounds per acre (the highest rate specified on the product label for control of germinating weed seed) and left uncovered provided 97% control of annual bluegrass in 2000 and 92% control in 2001. Although this study demonstrated improved control of annual bluegrass seedling emergence when dazomet-treated turf was covered with plastic, the difference between the two treatments probably does not justify the extra cost and labor necessary for covering entire fairways.

According to our observations, research results seem to mirror results obtained by superintendents in large-scale applications on golf course fairways. When applied properly, dazomet provides very good, but not complete, control of annual bluegrass seedling emergence in golf course fairways.

Photos courtesy of Bradley Park

A control plot from the annual bluegrass seedling emergence control study shows numerous annual bluegrass seedlings 30 days after the study began.

Safe seeding intervals

Materials and methods

The test area used for the safe seeding-interval study was chosen because it had a very low population of annual bluegrass seed, and germinating annual bluegrass seed could interfere with assessments of creeping bentgrass establishment. Site preparation was similar to that for the study on annual bluegrass seedling emergence. Dazomet was applied to half of the plots at 347 pounds per acre (=Basamid at 350 pounds/acre) and immediately watered-in with 0.5 inch of irrigation water on Sept. 18, 1999, and Sept. 12, 2000. The remaining plots were treated with glyphosate for comparison with the dazomet-treated plots.

Penneagle creeping bentgrass was seeded in plots treated with dazomet and in plots treated with glyphosate (controls) at 3, 6, 9,

ANNUAL BLUEGRASS CONTROL

		Annual bluegrass seedlings/24 square feet*†			
	Rate	2000		2001	
Treatment	(pounds/acre)	No plastic	Plastic	No plastic	Plastic
Basamid	350	137 c	2 b	303 c	23 b
Basamid	306	133 c	4 b	308 c	37 b
Basamid	263	366 b	7 b	341 c	35 b
Basamid	175	760 b	7 b	803 b	43 b
Control	—	3,914 a	3,407 a	3,930 a	3,853 a

*†Values followed by the same letter are not significantly different from each other ($P = 0.05$).
"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.

Mean annual bluegrass seedlings (observed counts) from fairway turf treated with different rates of Basamid covered with plastic or not covered.

12 and 15 days after dazomet was applied in 1999 and 0, 1, 3, 6 and 9 days after dazomet was applied in 2000. The zero-day seeding interval in 2000 involved seeding creeping bentgrass immediately following the watering-in of dazomet on the day of application (Sept. 12, 2000).

For all seeding-interval treatments, visual estimates of the percentage of ground cover were made 22 days after each seeding date to determine whether dazomet had affected creeping bentgrass establishment. In April 2000 (following the 1999 study) and in April 2001 (following the 2000 study), each plot was mowed with a reel mower and clippings were removed as a measure of creeping bentgrass yield.

Results and discussion

Current label instructions do not provide details on safe seeding intervals following surface applications of dazomet but suggest a period of 12 to 17 days between surface applications and seeding. Results of the 1999 and 2000 seeding-interval experiments revealed that creeping bentgrass can be seeded three days after a surface application of dazomet with no detrimental effects to the newly seeded turf.

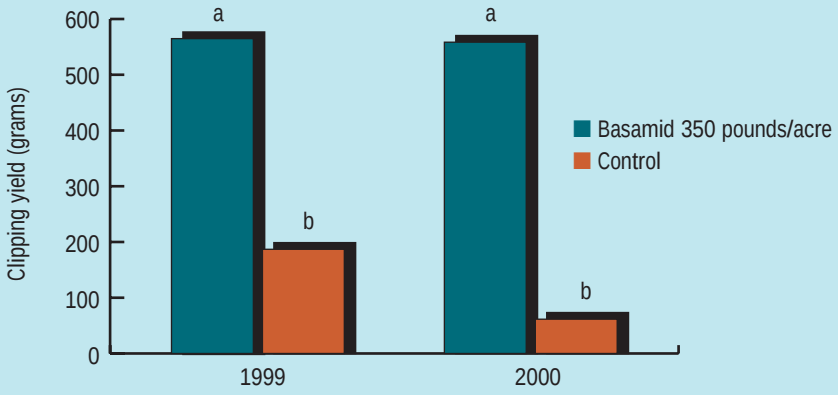
Clipping yield results from the seeding interval study indicated that a large surge of creeping bentgrass growth occurred following dazomet applications in 1999 and 2000. Increases in plant growth have been noted in other studies involving dazomet (1,2,5).

This plot, treated with Basamid at 350 pounds per acre and then covered with plastic, is shown 30 days after treatment.

Seeding creeping bentgrass three days after applying dazomet to a fairway is not practical in most situations because our research showed that at least five days are required for dazomet to provide complete control (kill) of existing turf. We advise superintendents to wait for complete turfgrass kill before seeding turfgrasses.

Keep in mind that dazomet activity can vary with differences in soil texture, moisture and temperature (7). Thus, it appears likely that results obtained in this study will differ somewhat among the highly variable soil conditions that occur on golf courses in the northern United States. We suggest that superintendents experiment with dazomet at their own courses to refine application methods and seeding intervals before large-scale use.

CREEPING BENTGRASS CLIPPING YIELDS



Clipping yields were significantly greater for plots treated with Basamid compared to control plots, all of which were seeded with creeping bentgrass three days after Basamid was applied.

Application summary

Based on the research results obtained at Penn State, for control of annual bluegrass seedling emergence in the northern United States, Basamid should be applied to fairway turf at 350 pounds per acre in early to mid-August using a well-constructed drop spreader and immediately watered-in with 0.5 inch of irrigation water. Irrigation must be monitored so runoff does not occur.

Treated areas can be covered with plastic to enhance fumigant efficacy. If the treated area is not covered, a post-application irrigation schedule should be followed according to label instructions.

Before seeding, allow time for complete turfgrass kill (turf areas may need to be re-treated if skips occur). To test whether the treated areas are ready for seeding, the Basamid label suggests planting lettuce or cress seeds in both fumigant-treated soil and untreated soil at no less than five days after treatment. If germination of the lettuce or cress is comparable in the treated and untreated soils, then it is safe to seed new turfgrass.

Application challenges and concerns

The granular formulation of Basamid permits applications as part of an in-house fumigation project (individual state laws may differ as to whether or not dazomet can be applied without a fumigation license). However, the extremely fine particle size of this product means that drop spreaders must be used for applications. Unless the drop spreader is well constructed, granules will leak out of every small hole in the hopper. Particles also will occasionally bridge over the outlet holes in the bottom of the hopper.

Weather conditions play a significant role in deciding when to make a dazomet application. Product drift and resulting skips can occur when applications are made during windy (or even in mildly breezy) conditions. Dazomet cannot be applied when dew is on the turf or immediately following rain, because granules will stick to tractor and spreader tires. It may be difficult to find a suitable time to apply dazomet because by the time turf dries from dew, the wind often picks up and prevents application.

When rainfall (or irrigation) exceeds infiltration, runoff from the dazomet-treated turf or soil can kill turf surrounding the treated fairway or contaminate surface water, killing aquatic organisms. Therefore, dazomet should be applied only when there is no threat of rain.

The runoff threat can be reduced by watering-in dazomet with 0.5 inch of water immediately after application. Watering must be done incrementally to ensure infiltration and prevent runoff. Runoff represents a serious risk when dazomet is used for fairway renovation, and more research is needed to help understand how this risk can be reduced.

Runoff from Basamid-treated turf or soil can kill turf surrounding treated fairways.

Acknowledgments

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Because of its granular formulation and extremely fine particle size, Basamid must be applied with a drop spreader that is well constructed and does not allow granules to leak from the hopper.

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