Final Report

Effects of environmental modifications on the germination and development of perennial ryegrass seed in early spring

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Abstract: Commercial pesticide applicators use more pre-emergent herbicide on turfgrass in New York State than any other pesticide. One IPM goal is to find alternatives to chemical herbicides for lawns. This goal can be met by increasing turfgrass density, since a denser lawn will naturally crowd out weeds. Overseeding in the autumn has recently been demonstrated to improve turfgrass density, but similar efforts in spring have not been successful, due to lack of seed hydration and/or low soil temperatures. This research found that compost and geotextile treatments as well as the early seeding date greatly increased the speed of germination and cover development in perennial ryegrass, and that the number of times seed was applied had less impact.

Background and Justification: Turfgrasses cover 3.4 million acres in New York State (1). Each year, commercial turfgrass managers and homeowners apply pre-emergent herbicide to turfgrass to decrease infestations of annual weeds, including crabgrass. Among commercial pesticide applicators, pendimethalin, a pre-emergent herbicide for lawns, is the most highly used pesticide (by weight) in New York, with over 2 million pounds applied in 2004 (2). Homeowners do not report their usage, but the total amount of pre-emergent would be significantly higher if their contribution was known. Clearly, any IPM practice that reduces this tremendous herbicide use would be welcome.

Dr. Frank Rossi at Cornell University has demonstrated that high rates of perennial ryegrass seed, applied repetitively in autumn, can dramatically increase turfgrass density on sports fields (3). This concept has been demonstrated by David Chinery and other Cornell Cooperative Extension educators (including Amy Ivy in Clinton County and Rick Harper in Westchester County). As an adjunct to this concept, Chinery has repeated these studies in early spring for three growing seasons (unpublished data), with the idea that if turfgrass density can be increased dramatically in spring, the need for pre-emergent herbicide could be reduced. Instead of applying herbicide, professional turfgrass managers and homeowners could apply seed, with little to no impact on the greater environment. This would provide an IPM alternative strategy to herbicides for weed management.

While these spring-seeding studies have shown improved turfgrass density, results have been variable, most likely due to cool soil temperatures and possibly a lack of seed hydration. This project will attempt to address the problems of cool soils and lack of hydration by studying several cultural practices which may hasten germination. These include:

1. Use of dark colored compost. It is well documented that dark colored soil increases in temperature faster than light colored soil. Seed germination response to soil color, modified by compost, will be examined.
2. Use of geotextile. Geotextiles have been used for many years in the commercial vegetable industry to modify temperatures in the field. This project will investigate using this product in a turfgrass setting.
3. Use of a germination mat. This product is applied over the seedbed, is left in place as the seed germinates, and then decomposes.
4. Use of paper mulch. This product is applied over the seedbed, is left in place as the seed germinates, and then decomposes.
5. Single versus repeated applications. Seed will be applied either once or three times at one week intervals, with the idea that more seed might produce a denser turf more quickly.
6. Time of seeding. Frost seeding (applying seed in very late winter/very early spring, when there is still frost in the ground) has been noted to improve the germination of some agronomic grasses (4) by increasing seed hydration. Early seeding (early to mid March, as weather permits) and later seeding (early to mid April) will be examined.

Objectives:

1. To quantify the influence of compost, geotextile, mat, and mulch material on the rate of perennial ryegrass seed germination for two seeding dates
2. To quantify the influence of compost, geotextile, mat and mulch material on perennial ryegrass seedling density for two seeding dates
3. To evaluate this project and share it with various turfgrass audiences

Procedures:

1. A test site at Cornell University's Agronomy Research Farm in Valatie, NY, was used for this study.

2. The following ten treatments were constructed for each of two seeding dates:

B1	Seed applied once to bare soil
B3	Seed applied three times at one week intervals to bare soil
C1	Seed applied once with one application of compost (1/4" depth) on top
C3	Seed applied once with one application of compost (1/4") on top, then seed applied two more times at one week intervals
G1	Seed applied once then covered with geotextile
G3	Seed applied three times at one week intervals and kept covered with geotextile
GC1	Seed applied once and covered with ¼" compost and geotextile
GC3	Seed applied once and covered with ¼" compost and geotextile, then seed applied two more times at one week intervals
Mulch	Seed applied once and covered with mulch
Mat	Seed applied once and covered with mat

3. The compost used was Vafei Brand. The geotextile was Reemay Garden Blanket. The mulch was Vigoro Ultra Turf Seed Starting Mulch. The mat was Pennington Seed Starter Mat.

4. Each treatment was replicated three times. Each set of treatments was seeded at two times: Early (March 29, just after the snow had melted) and Late (April 23). Averages of the replicates are reported below.

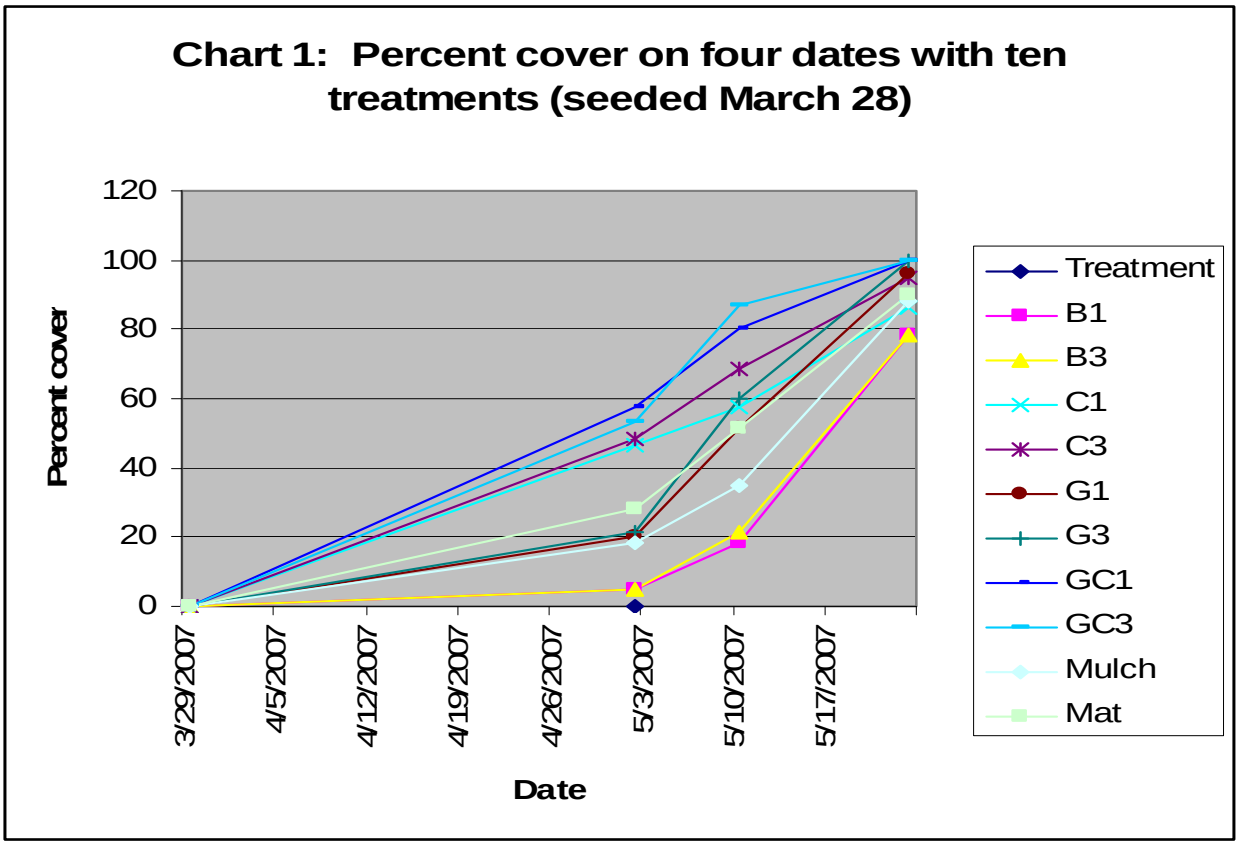
5. Germination rate and density will be evaluated through the project.

Results: The first set of plots were seeded on March 29. Observations on these plots were recorded three times, on May 2, May 10 and May 23. Data for these plots is in Table 1.

Table 1. Average percent cover on three dates for ten treatments (seeded March 29)

	2-May	10-May	23-May
Treatment	Percent cover		
B1	5.0	18.3	78.3
B3	5.0	21.7	78.3
C1	46.3	57.5	86.3
C3	48.3	68.3	94.7
G1	20.0	51.7	96.0
G3	21.7	60.0	99.7
GC1	57.5	80.0	99.6
GC3	58.3	86.7	99.7
Mulch	18.3	35.0	88.3
Mat	28.3	51.7	90.0

The fastest germination was seen in the plots with compost and the compost plus geotextile plots. These plots, along with the geotextile plots, also had the highest percent cover by May 23. The slowest germination was seen in the bare plots, which also has the lowest percent cover by May 23. All plots had 90% or greater cover by May 23, except for the bare, compost seeded once, and the mulch plots. The rate of germination and development of turf cover is shown graphically on Chart 1 below.



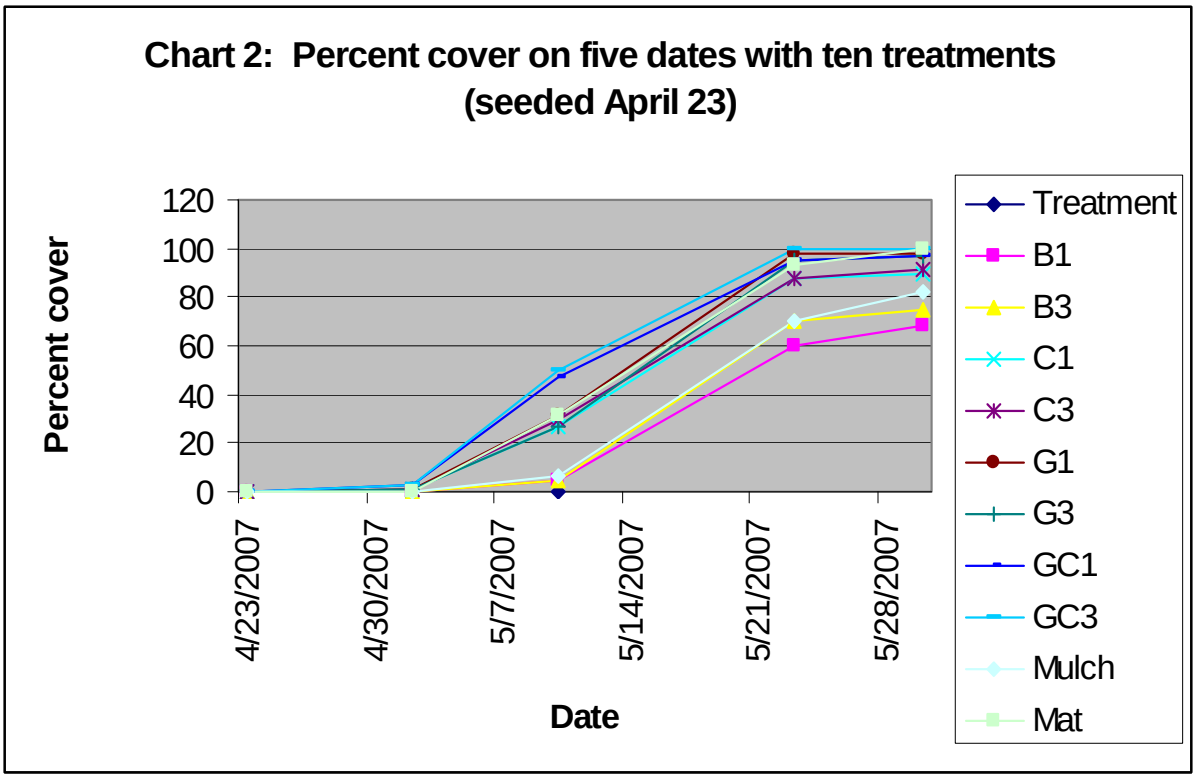
The treatments seeded three times had the same or greater cover for each of the three evaluation dates. On May 23, B3 was greater than B1 by 0.0%, C3 was greater than C1 by 8.4%, G3 was greater than G1 by 3.7%, and CG3 was greater than CG1 by 0.1%.

The second set of plots were seeded on April 23. Observations on these plots were recorded four times, on May 2, May 10, May 23 and May 30. Data for these plots is in Table 2.

Table 2: Average percent cover on four dates for ten treatments (seeded April 23)

	2-May	10-May	23-May	30-May
Treatment		Percent cover		
B1	0.0	4.3	60.0	68.3
B3	0.0	5.0	70.0	75.0
C1	0.5	26.7	87.3	90.0
C3	0.5	30.0	87.3	91.7
G1	1.0	31.7	97.7	98.3
G3	1.0	26.7	95.0	96.7
GC1	3.0	46.7	95.0	96.7
GC3	3.0	50.0	100.0	100.0
Mulch	0.0	6.7	70.0	81.7
Mat	0.0	31.7	93.3	100.0

The fastest germination was seen in the plots with geotextile and the compost plus geotextile plots. The mat, geotextile, and geotextile plus compost plots had the highest percent cover by May 30. The slowest germination was seen in the bare plots, the mat and the mulch. The bare plots had the lowest percent cover by May 30. All plots had 90% or greater cover by May 23, except for the bare and mulch plots. The rate of germination and development of turf cover is shown graphically on Chart 2 below.



The treatments seeded three times had the same or greater cover for each of the three evaluation dates, except for the geotextile plots, were the plots seeded once had a greater cover. On May 30, B3 was greater than B1 by 6.7%, C3 was greater than C1 by 1.7%, G1 was greater than G3 by 1.6%, and CG3 was greater than CG1 by 3.3%.

Conclusions:

Observations on the treatments: Applying the ¼ inch of compost was difficult and time consuming. The compost had to be screened to break up large clumps and create an even application. The geotextile was held down using landscape staples, was easy to use and could be re-used in future years. Both of these methods have an added benefit: they could also be used on a thin turf area that was overseeded, rather than the bare ground used in this study. This would be a very common situation on home lawns and on sports fields.

The mulch product was easy to apply but it only produced moderate results. The mat was also easy to use, was held down using landscape staples, and produced moderate results.

Some loss of seed was noted in the bare plots due to high winds, which also blew some compost off of the plots and created the need to stake the mat and geotextile down firmly.

Another factor in this study were extremely variable temperatures. On April 20 it was noted that growing degree days were running two weeks behind the average for that date and that there was no germination in the plots. But then on April 23 the temperature climbed to 87 F and germination was starting in the compost plots.

Number of seed applications: Applying seed three times compared with just once produced denser turf in all but two treatments: the bare treatments made on March 29 and the geotextile treatments of April 23. The gains in density at the final evaluation were small however, in the 0.1-8.4% range. The added time and expense of seeding plots three times may not be worth the slight increase in density.

Speed of establishment: The quickest turf cover (and the best cover to outcompete early germinating weeds) can be developed by planting as early as possible in the season and using compost, geotextile or a combination of the two. This research showed that a plot seeded on March 29 could have a 60 to 85% turf cover by May 10, versus a plot seeded on April 23, which would have only a 30-45% turf cover at that date. These methods hasten germination by creating the right microclimate at ground level for perennial ryegrass seed. This quick and dense germination should be adequate to compete with a good proportion of the crabgrass which might germinate and develop on a given site.

Seed planted on bare ground, and the paper mulch did not produce quick or dense turf cover. The mat treatment eventually produced a dense turf cover but did so rather slowly. These treatments would be less competitive with developing crabgrass and early germinating weeds.

Sharing these results: The results of this research were incorporated into the project leader's overseeding presentations for 2008. These presentations were given to groups at the Westchester Turf and Landscape Conference, a golf course superintendent's meeting at Cornell Cooperative Extension of Westchester County, and at the Sports Turf Manager's of New York Conference in Syracuse, among others. These results will also be part of a new overseeding brochure, currently under development, which will be shared with Extension educators statewide in 2009.

<u>Sources Cited</u>:

1. New York Turfgrass Survey, New York Agricultural Statistics Service, Albany, NY, 2003
2. Cornell University Cooperative Extension Pesticide Management Education Program website, http://pmep.cce.cornell.edu/
3. "Aggressive Sports Turf Overseeding," Dr. Frank Rossi, in "Cornell Field Day '03 Program Booklet," Cornell University, 2003
4. Personal communication with Tom Kilcer, Field Crops Extension Educator, Cornell Cooperative Extension of Rensselaer County

Overall view of the research plots on April 23, 2007. The white fabric is the geotextile, the dark plots are covered in compost, the green plots are covered with the mat, and the pale green plots are covered with mulch.

The following photos were taken on May 8, 2007 of the plots seeded on March 29.

Bare soil seeded once


Mulch treatment


Geotextile plus compost seeded three times