

Development of Golf Course Fairway Renovation Strategies to Transition to More Sustainable Cool-Season Turfgrasses

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Fairway conversion to newly developed stress tolerant turfgrasses provide golf courses an opportunity to reduce inputs over their largest maintained acreages. However, a challenge for many superintendents is identifying the best practices to rapidly and effectively renovate fairways with minimizing disruption to play and annual bluegrass (ABG) infestation. A series of studies are being conducted to provide best management practices for fairway renovation that address these concerns.

Current glyphosate label recommendations specify waiting 7-d before initiating mechanical practices that may interfere with herbicide translocation. A study was conducted in 2014 and 2015 to determine how soon after glyphosate application seedbed preparation practices could be initiated to shorten the duration of fairway renovations without reducing herbicide efficacy. Glyphosate was applied to a mature creeping bentgrass (CBG) fairway turf 7-, 5-, 3-, 1-, or 0-days before seedbed preparation practices were initiated. Seedbed preparation treatments included vertical mowing (1 inch depth, 2 directions), core cultivation (0.5 inch tines, 1.5 x 2 inch spacing, 2 inch depth), vertical mowing + core cultivation, or none. Glyphosate provided complete CBG control regardless of application timing or seedbed preparation method. No CBG recovery was observed after 40 days. Results from this study demonstrate that aggressive seedbed preparation and seeding practices may commence within one day of glyphosate application with no reduction in herbicide efficacy. The outcome of this research is a potential savings of one week for courses closed due to fairway renovation.

A larger three factor study was initiated during early-September 2014 and 2015 on golf course fairways in Connecticut. This study was designed to assess optimal eradication strategies of existing turfgrass, seedbed preparation methods, and seeder types to establish CBG and minimize ABG contamination. The main plot was seedbed preparation (none, verticut, or core cultivation), sub-plot was seeder type (no seed, drop, spike, or slit seeder), and sub-sub plot was non-selective herbicide (glyphosate only vs glyphosate + dazomet). Creeping bentgrass (007, 13M, Barracuda blend) was seeded at 1 lb. 1000 ft⁻² except in the no seed plots. All treatments were completed within 5 days of herbicide application.

Bentgrass cover was similar among the three seeder types wherever seed was applied during both years. Preparing the seedbed by core cultivating or verticutting increased bentgrass cover in 2014, but had no effect in 2015. Dazomet + glyphosate more than doubled (2.4-fold) bentgrass cover compared to glyphosate only, in all seeded plots during 2015 (Figure 1).

A seedbed preparation and seeder type interaction influenced ABG contamination in both years; although specific differences were variable between years. When no CBG seed was applied, verticutting increased ABG contamination 79-81% compared to core cultivation during both years (Table 1). Core cultivation and non-cultivated plots had similar ABG contamination when CBG seed was not applied during both years. Applying CBG seed, regardless of method, frequently reduced ABG contamination. Core cultivation followed by slit seeding or drop spreader were among the treatments which resulted in the least ABG contamination each year (Table 1). Dazomet + glyphosate reduced ABG contamination

70% compared to glyphosate only, regardless of seedbed preparation or seeder type in 2015, but had no effect on ABG in 2014.

Additional studies are planned comparing our optimized renovation strategies during summer, and fall timings as well as evaluation of post-renovation chemical control of ABG. Separately, we will seek to determine the minimum time play should be excluded from newly established CBG fairways to minimize disruption to play and turf damage. These studies should provide best management practices to rapidly and effectively transition existing fairways to new, more sustainable creeping bentgrass varieties.

Bullet Point Summary:

- Core cultivating or verticutting before seeding occasionally improved bentgrass establishment. However, verticutting before seeding increased ABG contamination.
- Seeder type (i.e., slit, spike, or drop) had little effect on efficacy of bentgrass establishment over the two years of this study.
- Applying bentgrass seed, frequently reduced ABG contamination regardless of method. However, core cultivating with slit or drop seeding were typically among the treatments with highest CBG and least ABG cover over both years.
- Dazomet greatly improved CBG cover and reduced ABG cover, however result was only observed in 2015.

Table 1. Percent annual bluegrass infestation affected by interaction of seedbed preparation and seeder type on golf course fairways in Wethersfield, CT and Baltic, CT during Autumn 2014 and 2015, respectively.

Seeder Type	Seedbed Preparation					
	20 Oct 2014 (6 weeks after seeding)			2 Nov 2015 (7 weeks after seeding)		
	None	Verticut	Core Cultivate	None	Verticut	Core Cultivate
	----- % annual bluegrass -----					
No Seed	19.9 a [†] B [‡]	62.2 aA	34.8 aB	58.9 aAB	75.3 aA	41.7 aB
Drop	29.8 aAB	48.4 abA	6.7 bB	46.7 abA	32.1 bA	30.3 aA
Spike	36.9 aA	18.5 cA	18.6 abA	29.3 bA	24.9 bA	32.1 aA
Slit	36.6 aA	26.2 bcAB	8.8 bB	43.1 abA	26.5 bA	25.0 aA

[†] Means within columns followed by the same lowercase letter are not significantly different based on Fisher's LSD test.

[‡] Means within rows, and evaluation date, followed by the same uppercase letter are not significantly different based on Fisher's LSD test.

Figure Captions (See separate attachments for figures)

Figure 1. Percent creeping bentgrass establishment affected by interaction of seeder type and herbicide on a golf course fairway in Baltic, CT during Autumn 2015. Plots shown below were core cultivated

Figure 2. Verticutting the top inch of existing fairways prior to re-seeding increases annual bluegrass contamination.

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Fairways represent the largest acreage of intensively managed turf on golf courses. However, turfgrass species or cultivars with poor environmental stress and disease tolerance often make up the majority of existing fairway populations. This often necessitates increased irrigation and pesticide inputs to avoid turf failures. Conversion to newly developed turfgrass varieties provide golf courses an opportunity to reduce inputs over their largest maintained acreages. However, the challenge for many superintendents is identifying the best practices to rapidly and effectively renovate fairways with minimizing disruption to play and annual bluegrass infestation. A series of studies are being conducted to provide best management practices for fairway renovation that address these concerns.

Use of non-selective herbicides to eliminate the existing turf stand have been previously shown to be essential to establish new creeping bentgrass varieties. Current glyphosate label recommendations specify waiting 7-d before initiating mechanical practices that may interfere with herbicide translocation. Our initial study was conducted in 2014 and 2015 to determine how soon after glyphosate application seedbed preparation practices could be initiated to shorten the duration of fairway renovations without reducing herbicide efficacy. Glyphosate was applied to a mature creeping bentgrass fairway turf 7-, 5-, 3-, 1-, or 0-days at 3.0 lbs a.i. acre⁻¹ before seedbed preparation practices were initiated. Seedbed preparation treatments included vertical mowing (1 inch depth, 2 directions), core cultivation (0.5 inch tines, 1.5 x 2 inch spacing, 2 inch depth), vertical mowing + core cultivation, or none. Herbicide efficacy was assessed as percent cover using digital image analysis. Glyphosate provided complete creeping bentgrass control regardless of application timing or seedbed preparation method. No bentgrass recovery was observed after 40 days. Results from this study demonstrate that aggressive seedbed preparation and seeding practices may commence within one day of glyphosate application with no reduction in herbicide efficacy. The outcome of this research is a potential savings of one week for courses closed due to fairway renovation.

A larger three factor study was conducted during 2014 and 2015 at Wethersfield Country Club and Mohegan Sun Golf Club, respectively. This study was designed to assess optimal eradication strategies of existing turfgrass, seedbed preparation methods, and seeder types to establish creeping bentgrass and minimize annual bluegrass contamination. The main plot was seedbed preparation (none, verticut, or core cultivation), sub-plot was seeder type (no seed, drop, spike, or slit seeder), and sub-sub plot was non-selective herbicide (glyphosate only vs glyphosate + dazomet). Creeping bentgrass (007, 13M, Barracuda blend) was seeded at 1 lb. 1000 ft⁻² except in the no seed plots. All treatments were completed within 5 days of the initiation of the study during early September.

Bentgrass cover was similar among the three seeder types where seed was applied in both years. Preparing the seedbed by core cultivating or verticutting increased bentgrass cover in 2014, but had no effect in 2015. Dazomet + glyphosate more than doubled (2.4-fold) bentgrass cover compared to glyphosate only, in all seeded plots during 2015 (Figure 1).

A seedbed prep x seeder type interaction influenced ABG contamination in both years; although effects were variable between years. When no bent seed was applied, verticutting increased ABG contamination 79-81% compared to core cultivation during both years (Table 1). Core cultivation had similar ABG contamination as non-cultivated plots when no bent seed was applied during both years (Table 1). Applying bent seed, regardless of method, frequently reduced ABG contamination. Core cultivation followed by slit seeding and drop spreader were among the treatments which resulted in the least ABG contamination during both years (Table 1). Dazomet + glyphosate reduced ABG contamination 70% compared to glyphosate only, regardless of seedbed preparation or seeder type in 2015, but had no effect on ABG in 2014.