

Techniques for Conversion of Conventional Putting Greens to Roundup Ready® Creeping Bentgrass

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In 2002, a Roundup Ready® creeping bentgrass (RRCB) putting green and fairway conversion trial was established at Veenker Memorial Golf Course. In this trial, aerification and vertical mowing were used to create openings in the soil for seed placement. From the results of the 2002 trial, it was apparent that aerification and vertical mowing were not effective for converting putting greens to RRCB. The objective of this new putting green conversion trial is to research methods which allow putting greens to be converted to RRCB in a timely manner.

This trial is designed to determine the effects on conversion to RRCB when:

- Four mechanical methods are used,
- Three seeding rates are used with each mechanical method, or
- Three seeding dates with each mechanical method.

Materials and Methods

Site and Experimental Design

This trial is being conducted at the Iowa State Turfgrass Research Facility on a native soil putting green established to 'Penncross' creeping bentgrass. It is divided in two areas, one-area to investigate seeding rate within each mechanical treatment, and the other to investigate seeding date within each mechanical treatment. The trial is a split-plot design in which the whole plot is a mechanical treatment and the sub-plots represent seeding rates (Figure 1) or seeding dates (Figure 2).

Figure 1. Experimental design of seeding rate study

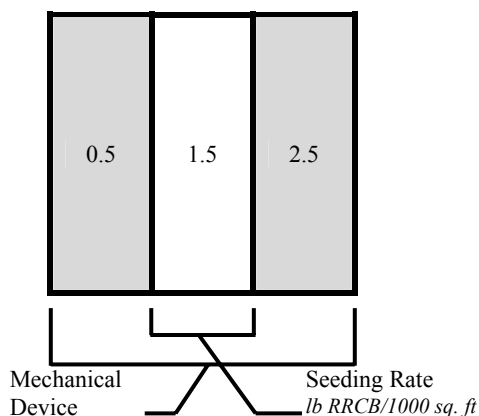
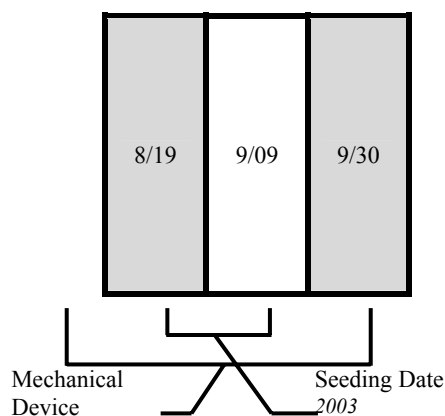


Figure 2. Experimental design of seeding date study



Treatments

- Bare Soil Seedbed
- Aerification / Vertical Mowing
 - 5/8 inch tines-2 directions
- Vertical Mowing using Toro triplex-2 directions
- TIP Green Spiker
 - Apply mechanical treatment, sow 1/2 of seed, apply mechanical treatment in opposite direction, sow remaining seed, apply mechanical treatment
- Terra Combi Spiker
 - Apply mechanical treatment, sow 1/2 of seed, apply mechanical treatment in opposite direction, sow remaining seed, apply mechanical treatment
- Graden Vertical Mower
- Vertical blades at one-inch spacing-2 directions

Procedure

Seeding Rate Study

On August 18, 2003, one day prior to seeding, all plots were treated with Roundup® at a rate of 1.5 quarts per acre. On August 19, all mechanical treatments were applied to the whole plot and seeding was sown at the rates of 0.5, 1.5 and 2.5 lb RRCB per 1000 square feet on the sub-plots. Each plot was topdressed with sand to smooth the surface and fill in any voids created by the mechanical treatment. A 19-25-5 starter fertilizer was applied at 1 lb N per 1000 square feet following topdressing. The entire

area was treated with Roundup® at 1 quart per acre 21 days after seeding. This was done to remove any creeping bentgrass that was not tolerant of Roundup as the seed used was 60% RRCB and 40% conventional creeping bentgrass.

Seeding Date Study

One day before the seeding dates of August 19, September 9, and September 30, Roundup® was applied at 1.5 quarts per acre to each plot. Each mechanical treatment was applied to individual sub-plots on the designated seeding dates. All plots were seeded at a rate of 1.5 lb RRCB per 1000 square feet and were topdressed with sand to fill in voids and smooth the surface. Following topdressing, a 19-25-5 starter fertilizer was applied at 1 lb N per 1000 square feet. Each plot was treated with Roundup 21 days after seeding at 1 quart per acre to remove any bentgrass that was not Roundup® tolerant.

Data Collection

Data collection began in the fall of 2003 and will continue through the summer of 2004. Percentage cover of RRCB and turfgrass quality (on a scale of 1-9, 9 = best, 6 = lowest acceptable, and 1 = worst turf quality) will be used to determine the success of each treatment. Also, the date when each plot is acceptable for play will be recorded in order to calculate “days from seeding to opening for play.”

Preliminary Results

Seeding Date Study

The earliest seeding date, August 19, achieved the greatest coverage on all dates data was collected except for April 21, 2004 (Table 1). There were no significant differences between the mechanical methods used in the conversion process (Table 2).

Seeding Rate Study

On September 3, 2003, the 2.5 lb rate had the greatest cover and the 1.5 lb rate was greater than the 0.5 lb rate. By September 22, the coverage of the 2.5 lb rate was no longer greater than the 1.5 rate, but the 0.5 lb rate had significantly less RRCB cover than both of the higher rates. This trend continued until April 21, 2004 (Table 3).

The Terra Combi Spiker and bare soil methods had greater RRCB cover than the aerification/vertical mowing treatment on September 3, 2003. On September 22, 2003, every method but the Graden had greater RRCB coverage than the aerification/vertical mowing treatment. Approximately two weeks later, only the Terra Combi Spiker and bare soil treatments had significantly more cover of RRCB than aerification/vertical mowing methods. On all other dates in which data was collected, there were no statistically significant differences between the methods used in the conversion process (Table 4).

Discussion

Mechanical Method

From the preliminary results, it appears that the conversion process is quickest when the mechanical method used creates many smaller soil openings for seed placement (i.e. Terri Combi Spiker, TIP spiker) rather than fewer, larger soil openings (i.e. aerification/vertical mowing).

Seeding Date

It is fairly apparent that the greatest RRCB coverage is achieved when seeding takes place earlier in the fall. An earlier seeding date does not guarantee a successful conversion to RRCB. However, it does make establishment less dependent on ideal weather conditions later in the fall.

Seeding Rate

The results of this study seem to indicate that there is no advantage to seeding at a rate of 2.5 lb when compared to 1.5 lb. RRCB per 1000 square feet. The rate of 0.5 lb appears to be inferior to the higher seeding rates.

Table 1. Percentage cover of RRCB averaged across the 5 mechanical methods for each seeding date.

Seeding Date	Percent RRCB Cover					
	22-Sep-03	07-Oct-03	28-Oct-03	13-Nov-03	06-Apr-04	21-Apr-04
19 Aug	91.3 a ^Z	94.3 a	97.9 a	99.0 a	98.6 a	99.2 a
09 Sept	22.0 b	48.1 b	78.6 b	82.9 b	87.9 b	92.7 a
30 Sept	---	---	47.7 c	44.0 c	37.3 c	58.0 b

Table 2. Percentage cover of RRCB averaged across the 3 seeding dates of August 19, September 9 and September, 30 for each mechanical method.

Mechanical Method	Percent RRCB Cover					
	22-Sep-03	07-Oct-03	28-Oct-03	13-Nov-03	06-Apr-04	21-Apr-04
Bare Soil	57.5 a	74.7 a	74.0 a	76.2 a	75.3 a	80.0 a
Aerification/Verticutting	50.8 a	61.7 a	67.6 a	68.1 a	70.7 a	81.1 a
Graden Vertical Mower	53.3 a	69.0 a	76.7 a	77.9 a	78.8 a	88.9 a
TIP Spiker	59.7 a	75.2 a	77.2 a	75.6 a	74.2 a	83.9 a
Terra Combi Spiker	61.8 a	75.5 a	78.1 a	78.7 a	74.1 a	82.7 a

Table 3. Percentage cover of RRCB averaged across all 5 mechanical methods for each seeding rate.

Seeding Rate <i>lb/1000 sq ft</i>	Percent RRCB Cover						
	3-Sep-03	22-Sep-03	07-Oct-03	28-Oct-03	13-Nov-03	06-Apr-04	21-Apr-04
0.5	39.3 a	83.0 a	88.5 a	97.1 a	96.4 a	96.7 a	97.8 a
1.5	73.3 b	96.5 b	97.8 b	99.2 b	99.4 b	99.3 b	99.9 b
2.5	87.1 c	97.5 b	98.9 b	99.9 b	100.0 b	99.6 b	100.0 b

Table 4. Percentage cover of RRCB averaged across the 3 seeding rates for each mechanical method.

Mechanical Method	Percent RRCB Cover						
	3-Sep-03	22-Sep-03	07-Oct-03	28-Oct-03	13-Nov-03	06-Apr-04	21-Apr-04
Bare Soil	79.2 a	97.1 a	98.3 a	98.8 a	98.4 a	98.2 a	99.6 a
Aerification/Verticutting	49.4 b	86.1 b	90.3 b	98.0 a	97.2 a	97.2 a	98.4 a
Graden Vertical Mower	62.8 ab	90.9 ab	94.2 ab	99.0 a	99.0 a	99.3 a	99.3 a
TIP Spiker	68.7ab	92.6 a	94.4 ab	98.0 a	98.8 a	98.2 a	99.0 a
Terra Combi Spiker	72.8 a	95.1 a	98.1 a	99.8 a	99.8 a	99.6 a	99.8 a

^Z Values within columns with the same letter are not significantly different at the Tukey's multiple comparison error rate of $P \leq 0.05$