Interseeding: A New Approach

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Since its release almost 50 years ago, Penncross creeping bentgrass (Agrostis palustris) has been the dominant cultivar planted on golf course putting greens.

As popularity for the game of golf has increased, so have the demands placed on golf course superintendents to provide superior putting surfaces. These demands prompted the use of Penncross in areas where creeping bentgrass is marginally adapted. The environmental stresses present in these areas often lead to a severe decline in turf quality of Penncross.

Over the last decade, many new cultivars of creeping bentgrass have been released which are more tolerant of environmental stresses than Penncross. Many of these grasses exhibit improved heat tolerance, higher shoot density, finer texture, more vigorous root and shoot growth, and can tolerate lower mowing heights. With the improvements in turf quality that can be achieved, many golf course superintendents are interested in converting to one of the improved cultivars of creeping bentgrass.

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Conversion of greens by means of a complete renovation is costly and leads to a significant loss of play while the new greens establish. Therefore, many superintendents resort to interseeding, which is a process in which the desirable cultivar is seeded into the existing cultivar.

Figure 1. Drop spreader for mechanical distribution and surface application of seed.

The goal is that, over time, the newly planted creeping bentgrass will become the dominant variety on the green. Achieving this can be very difficult, because young germinating seedlings are not competitive against the established grass for sunlight, nutrients and moisture. Also, current methods that are effective at moving the seed through the existing turfgrass canopy to achieve seed to soil contact are disruptive to the turf surface. This leads to a decrease in putting quality that may result in less play causing a loss in revenue.

How interseeding works

Current interseeding practices include broadcast seeding (Figure 1), verticutting prior to broadcast seeding and the use of "jobsaver" tines prior to broadcast seeding.

Topdressing is typically applied in conjunction with these methods. Primo (trinexepac-ethyl) may be used as well to further

Figure 2. Seed captured from the fan nozzles of the Envirojet.

suppress the competitive advantage of the established cultivar. Bowman (1998) reports that by using a combination of jobsaver tines plus Primo, 21% of a Penncross putting surface was converted to Penn A-4.

Jobsaver tines alone led to a conversion of 16% while simply broadcasting seed resulted in a conversion of almost 14%. Clearly, the methods that are disruptive to the turf surface are more effective because the seed is moved through the turfgrass canopy onto the soil surface.

Therefore the question remains, is it possible to efficiently convert a Penncross green to a new cultivar without being disruptive to the turf surface? Rossi (1999) states, "There is no known easy, nondisruptive way to establish new cultivars on old greens."

The objective was to determine if use of an Envirojet using high-pressure injection (HPI) might allow for a nondisruptive means of placing seed beneath the turfgrass canopy.

The Envirojet is a sub-surface injection machine that may be used for aerification or injection of fertilizers and pesticides. It allows for adjustment of injection depth and distance between injection periods. This is accomplished through the use of different accumulators. The large accumulator (62 in3) injects to a depth of five inches. and distances between injections vary from five to 9.5 inches depending on the speed of travel.

The smallest accumulator (6 in3) injects to a depth of approximately one inch. Distances between injections vary from one to two inches depending on the speed of travel.

The objectives for this project were to determine:

- **Will creeping bentgrass seed pass through the pump and nozzles? (physical size)**
- **Will the seed remain viable after injection? (mechanical damage to seed)**
- **Will surface disruption of putting surfaces occur, reducing playability?**
- **Will seed germinate on a green and how deep are the seed injected?**

Note that the focus was to determine if this method is a feasible method of interseeding, not to compare it to other methods of interseeding.

The 6 in3 accumulator was used along with fan nozzles to provide uniform placement of seed. The Envirojet was calibrated to apply 20 gallons of water per 1000 square feet. One pound of Crenshaw creeping bentgrass was added to the tank per 20 gallons of water. Two passes were made over an area to provide a seeding rate of two pounds per 1000 square feet.

Project results

We answered the questions raised as objectives for the project as follows:

Will seed pass through the plumbing of the Envirojet?

The Envirojet ran stationary for a few seconds with a geotextile fabric placed under the nozzles to capture emitted seed. Figure 2 shows the amount of seed that was able to pass through the machine.

Will the seed remain viable?

A major concern was the degree of damage, if any caused to the injected seed. The geotextile fabric used to capture the seed was placed on a misting bench in a greenhouse to determine percent germination. Samples taken from the geotextile fabric gave an

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average germination rate of 61% (Figure 3). Under normal conditions creeping bentgrass should germinate at a minimum rate of 85%. Therefore, it appears some seed was damaged during injection. However, we feel that a germination rate of 61% was acceptable and justifies the use of a high seeding rate.

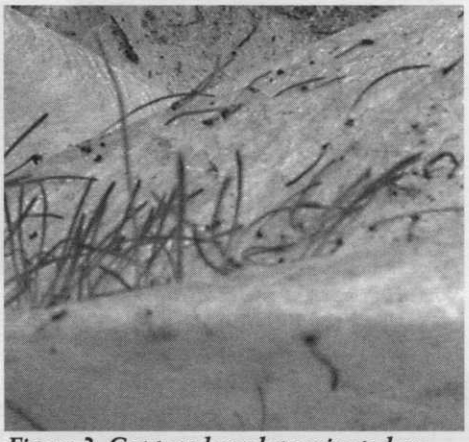

Figure 3. Captured seed germinated on cheese cloth to check mechanical damage of viable seed.

WILL SURFACE DISRUPTION OF PUTTING SURFACES OCCUR?

The high-pressure injection of water using the fan nozzles does not lead to any soil displacement. Seed is projected through the turf canopy into the thatch/soil interface with minimal surface disruption. The existing thatch and mat layers act as a stabilizer as well as holding moisture levels near the seed at a more optimum level for germination with only a modest increase in irrigation. On a bare soil surface significant soil displacement will occur and therefore, this is not recommended for new plantings.

Therefore, the question remains: is it possible to efficiently convert a Penncross green to a new cultivar without being disruptive to the turf surface?

Figure 4. Side view of Envirojet inserting seed into weak and damaged turf.

Figure 4 shows the resulting pattern following injection. The watermarks disappear as the turf surface dries. The injection process had only a minimal impact on turf quality or playability.

WILL SEED GERMINATE ON A PUTTING GREEN AND WHAT IS THE DEPTH OF SEED PLACEMENT?

Initially seed was injected into a green with a thin stand of creeping bentgrass to determine if germinating seedlings could be located. We saw the presence of germinated seedlings in thin areas on the green.

Seed was then injected into an area of a creeping bentgrass green that had previously been killed. This allowed for an easy assessment of germination and subsequent plant densities. Figures 5a and 5b show the excellent germination rates and plant densities achieved using the Envirojet.

Depth of seed placement was determined by excavating soil from areas where seed was injected and placing that soil in petri dishes for germination. Soil was excavated at $^1/_8$-in. increments to a depth of $^3/_4$-in. No seed germinated in petri dishes containing soil from depths lower than $^1/_8$-in.

Figure 5a. Germinating seedling one week following HPI seeding.

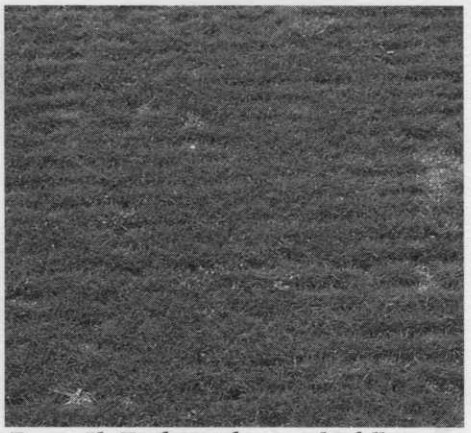

Figure 5b. Turf area four weeks following planting with HPI.

This indicates that no seed was injected deeper than $^1/_8$-in. This is an ideal depth for creeping bentgrass germination.

Conclusions

- Seed can easily pass through the Envirojet. Use of a wetting agent did not increase the amount of seed being injected.
- The majority of the seed remains viable after injection.
- Seed is effectively placed beneath the turfgrass canopy but not injected to a depth that would prevent germination.
- The Envirojet is not disruptive to the turf surface.
- Playability of the green is not reduced.
- More research is required to determine the percent conversion from the established cultivar to the one being injected. However, preliminary data indicate the Envirojet provides a non-disruptive effective means of interseeding.

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