Effect of Overseeding Rate on Spring Transition

The evidence shows that more is not better.

by D. M. KOPEC, J. GILBERT, K. MARCUM, M. PESSARAKLI, D. JENSEN

OVERSEEDING golf courses in southern Arizona is a must for maintaining year-long golf conditions over bermudagrass surfaces. Winter and spring play (November-April) can constitute 85% of golf play at resorts and even daily-fee courses, and most of this play is on overseeded bermudagrass.

Perennial ryegrass (*Lolium perenne*) is the most prevalent grass used for overseeding bermudagrass tees, fairways, roughs, and approaches. The advent of improved turf-type perennial ryegrass cultivars in the last 15 years has aggravated spring transition (exit of ryegrass and the regrowth of the bermudagrass base). Most of the perennial ryegrass germplasm is developed for worldwide use, where perennial ryegrass is selected as a permanent grass. Increased disease resistance, tolerance to frequent and close mowing, abundant tillering capacity, and increased heat tolerance make for better and stronger ryegrass turf. This is a major liability for spring transition, however.

Transition conditions may exhibit any of the following conditions:

1. Prolonged persistence of ryegrass into July and August.
2. Prolonged persistence followed by sudden loss of ryegrass cover.
3. Loss of ryegrass cover without adequate regrowth of bermudagrass from below.

Any (or all) of these conditions can result in poor surface conditions, coupled with shorter bermudagrass seasons, which is detrimental to the following year's transition as well.

In the 1970s and early 1980s, standard transition practices included water deprivation, verticutting and aeration of fairways, and overseeding at high seed rates. Unfortunate as it may be, the demand for year-round golf has preempted some of these accepted management practices. Research at that time showed that higher seeding rates would, in effect, cause a weaker ryegrass turf overall. Higher seed rates resulted in a lack of multi-tillered plants, whereby an abundance of single-tillered plants remain throughout the entire overseed season.

This research was an extension of similar work conducted on tall fescue for lawns, where high seeding rates maintained a finer leaf texture due to the anomaly of plant crowding effects and an overall high tiller density of plants with fewer tillers per crown. In time, the canopy reaches some equilibrium, at which time total tiller numbers decrease and leaf widths gradually expand.

It is not known how the canopy dynamics of modern cultivars of perennial ryegrass determine overall tiller performance, or the effects of canopy makeup on spring transition. Therefore, selection of a proper overseeding rate may be critical in terms of providing an edge for overseeding transition.

With this background in mind, a two-year study was devised to evaluate the effect of overseeding rate on turfgrass canopy dynamics, and to determine if seed rate and canopy dynamics were associated with spring transition.

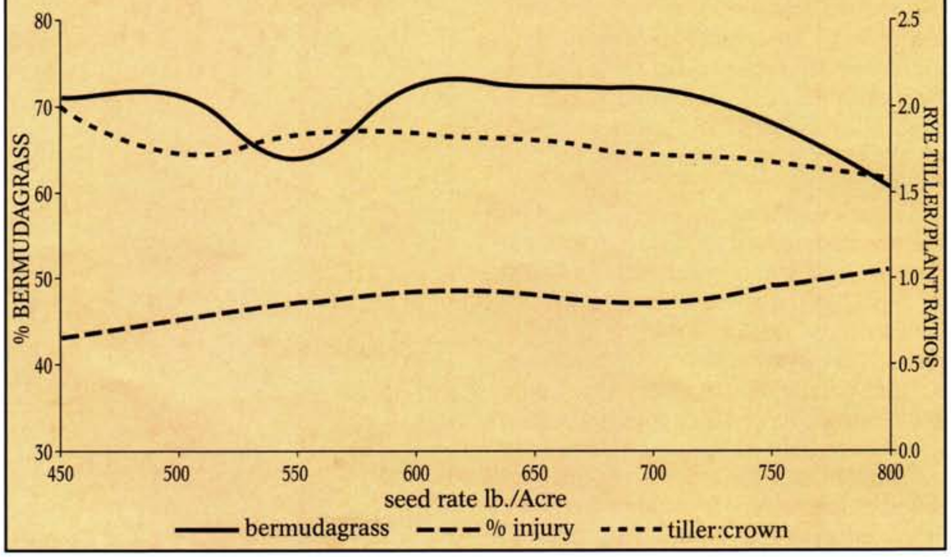
Perennial ryegrass ('Quickstart') was overseeded over an eight-year-old stand of Tifway 419 hybrid bermudagrass. Tifway was maintained under fairway conditions year long, being mowed three times weekly with a reel-type mower at 11/16". Thatch was controlled the second week in August by multiple verticutting and aeration with 5/8" hollow-core tines. Cores were ground in place, followed by topdressing.

Plots (15' × 15') were overseeded with 'Quickstart' observing pure-live seed (PLS) content at eight rates. Plots were then hand brushed with stiff push brooms in multiple directions, rolled in two directions, and irrigated (to avoid stress) at 75-80% of reference ET. Plots received 5/8-3/4 lb. N/M/month from October to August in each year.

The overseeding date was October 15 in 1998 and October 8 in 1999. Following grow-in and standard maintenance, turf plugs were harvested four times at six-week intervals, and canopy tiller number and plant composition were measured.

In June of each year (time of last harvest), heat tolerance tests and tiller evaluations were conducted to measure heat tolerance (via cell leakage content

Figure 1
Effects of Seeding Rate on Transition – Two-Year Average



measurements) for four of the seeding rates.

Results: Heat Tolerance Tests

The laboratory test for perennial ryegrass heat tolerance showed the following results. When averaged over both seasons:

1. As overseeding rates increased, heat injury increased as measured by cell leakage (Figure 1). Thus, as overseeding rates increased, plants were less heat tolerant. The 500 lb. rate was always more heat tolerant than the 800 lb. rate.
2. The response of multiple- or single-tillered ryegrass plants had no effect on heat tolerance. Single-tillered plants have just as much heat tolerance as multiple-tillered plants.
3. The response of heat tolerance among tiller classes was the same at each of the four seed rates tested. In other words, single-tillered plants were not different in cell leakage as seed rates increased. The same was true for multiple-tillered plants. They showed no difference in cell leakage from one seed rate to another.

Therefore, the take-home message is that *only* seed rates affected heat tolerance. As seeding rate increased, the turf was less heat tolerant.

Transition

The percent bermudagrass within the plots was determined by visual observations. Transition was affected by seed rate. The 450 lb. seed rate (lowest rate) was always different from the 800 lb. (highest rate) on all dates over the two-year period. The 600 and 700 lb. rates were always intermediate (Figure 2).

At rates greater than 700 lbs. pure live seed per acre, the percent bermudagrass falls off rapidly. This occurred over both years and was realized on each evaluation date (Figure 1). The 450 lb. rate always had the greatest amount of bermudagrass, while the 800 lb. rate always had the lowest amount. In year one (1999), ryegrass was still visible in plots during the first week of August. In year two (2000), some ryegrass was visible in patches up to and including the third week in July. No other treatments were included to enhance transition (altered irrigation, decreased mowing, verticutting, aerification) since it was necessary to allow the seed rate effects to carry out their natural progression so their effects could be measured.

Relationship Between Plant Heat Tolerance and Transition

As the seeding rate increased, heat tolerance decreased in the laboratory tests. In the field, the amount of bermudagrass usually *decreased* as the seed rate increased (Figure 2).

Results clearly demonstrated an inverse relationship between heat tolerance of ryegrass in mid-June and actual transition at that time or later. The accepted adage that was developed 25 years ago that overseeding at high seeding rates produces weaker plants may still be true. In these most recent tests, the heat injury method clearly showed that weaker plants resulted as overseed rates increased (Figure 2). But increased seed rates did not have the best transitions back to bermudagrass. In the last 25 years, there have been tremendous improvements in perennial ryegrass turf performance. The capability to produce and maintain a dense (high tiller capacity) turf under close and frequent mowing programs may change this old rule of thumb we have normally accepted in the past.

Plant Canopy Dynamics and Transition

'Quickstart' perennial ryegrass had changing responses with seed rate and sampling date for the total amount of

Figure 2
Heat Injury to Ryegrass and Percent Bermudagrass at Transition

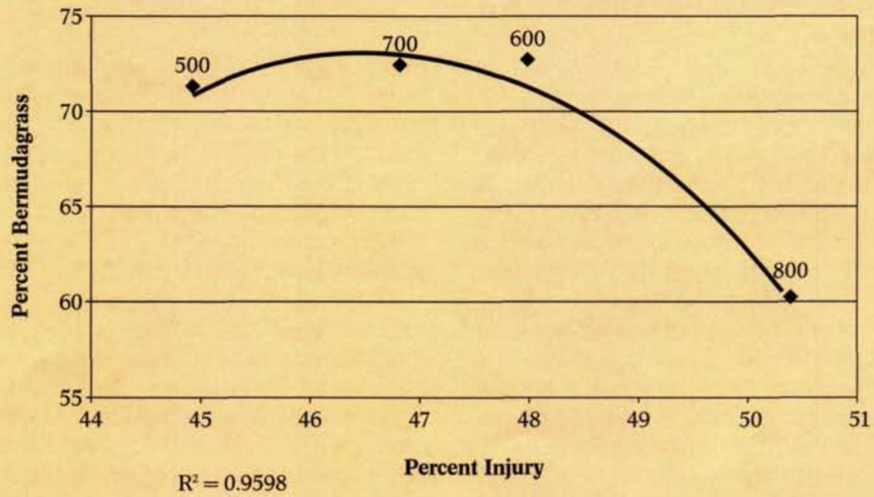
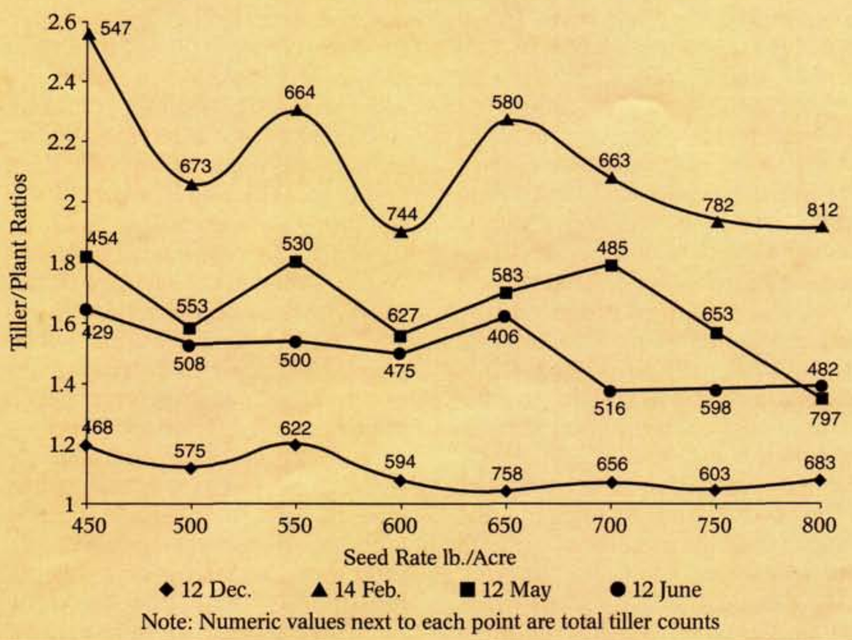


Figure 3
Tiller/Plant Ratios: Four Collection Dates – Year 2



Note: Numeric values next to each point are total tiller counts

Left: The canopy dynamics of modern perennial ryegrass cultivars and the effect on bermudagrass transition is not completely understood. The accepted adage for the past 25 years was that overseeding at high rates produced weaker perennial ryegrass plants, but this did not always equate to better bermudagrass in the summer. Right: Improvements in turf-type perennial ryegrass cultivars have aggravated spring transition back to bermudagrass. The result is a patchy appearance and poor surface quality during the summer, which negatively impacts bermudagrass growth.

tillers present and the degree of plants that had multiple tillers per plant. Overall tiller-to-plant ratios were calculated by dividing the number of all plants present by the total number of tillers. Seed rates with a low tiller/plant ratio have an overwhelming abundance of plants that are comprised of one tiller only. Seed rates that have a higher ratio of tillers/plants have an array of multiple-tillered plants present in the canopy. The larger the ratio, the greater the number of multiple-tillered plants present. Similar trends occurred over both years across all seeding rates, which can be explained in general terms as follows (Figure 3).

The earlier in the season after overseeding (two months), the greater the preponderance for single-tillered plants dominating each turf. Tiller/plant ratios ranged from 1.05 to 1.2 in December 2000, indicating that all seed rates have mostly single-tillered plants after overseeding (Figure 3).

By mid-February, the tiller/plant ratios increased dramatically, indicating that plants were developing multiple shoots from the base of separate plants (multiple-tillered plants). The lightest seed rate of 450 lbs. produced the highest number of plants with multiple tillers (tiller/plant ratio of 2.6), while the highest seed rate of 800 lbs. had the least number of plants with multiple tillers (tiller/plant ratio of 1.9). These results were as anticipated, given the premise of seed rate influencing the development of the bunch-type growth of cool-season grasses.

In early May, the tiller/plant ratios began to decrease, as did the total number of all shoots (regardless of origin). Tiller/plant ratios were highest for three seed rates, 450 lbs., 550 lbs., and 700 lbs. (Figure 3). Among all seed rates at this time, the 800 lb. seed rate had the greatest amount of total tillers (797), maintaining 99% of the number of tillers from February (812).

The 550 lb. rate proved to be a unique rate. This rate generally had intermediate to low tiller/plant ratios throughout the entire overseed seasons (Figure 3). This demonstrated that, for unexplained reasons, this particular rate maintained a level of single-tillered plants, which coincided with a relatively low amount of bermudagrass at transition (Figure 1). This seed rate was relatively stable in the amount of total tiller output from December to February and experienced lesser degrees of total percentage tiller loss into May and June (Figure 3).

At the last sampling in mid-June, tiller/plant ratios interacted differently as a function of seed rate. An alarming fact is that the 800 lb. rate lost 40% of the total tillers from May to June (797 to 482). This rapid loss of plants may be one explanation as to the decreased transition that occurs at the 800 lb. rate. Perhaps this is due to the release of plant chemicals that may suppress bermuda (allelopathy), increased competition from higher total shoot densities over time, or an accumulated mat. Also of interest is the result that the 650 lb. treatment had the *lowest* amount of total ryegrass tillers by mid-June, but also had a high tiller/plant ratio in June. Most likely, single-tillered plants were dying in the canopy, starting in mid-May or perhaps shortly before.

Conclusion

When all was said and done, some definite patterns and results were realized:

1. The accepted adage that increased overseeding rates of perennial ryegrass will cause weaker plants was generally true. Based on cell electrolyte leakage tests, plants that grew at higher seeding rates had decreased tolerance.

2. However, heat tolerance was not related to transition – bermudagrass amounts in plots did *not* increase as seed rates increased. In fact, the opposite generally occurred. The highest seed rate (800 lbs.) always had the least amount of bermudagrass present, while the lowest overseed rate (450 lbs.) had the largest amount of bermudagrass.

3. Overseeding rates of 450 to 500 lbs. and from 600 to 700 lbs. provided the best transition and acceptable turfgrass conditions.

4. Overseeding at 800 lbs. greatly reduced transition in this test.

5. All treatments, in time, returned to 100% bermudagrass, in the same ranked order based on the percentage reported for transition in June.

DR. DAVID KOPEC *is the extension turf specialist and* DR. KEN MARCUM *is assistant professor of turf science at the University of Arizona. Co-authors* J. GILBERT, M. PESSARAKLI, *and* D. JENSEN *are research faculty in turf at the University of Arizona.*