



# Establishment and Management of T-1 Creeping Bentgrass

Written by Doug Brede, Ph.D., breeder of T-1



## General Guidelines

Each and every golf course is unique. As breeder of T-1 creeping bentgrass, I developed the following guidelines to serve as a starting point in the management of this remarkable cultivar. These guidelines cover the basics as well as some advanced topics of cultivar management. Do not assume you need to incorporate every one of these recommendations, as T-1 is fairly flexible and accommodates a range of management styles. Sound agronomic judgments will always produce the best performing turf.

## Establishment

- Timing of seeding
  - Bentgrass seed germinates most readily when soil temperatures are warm (above 60°F/15°C).
  - If seeded in very warm conditions (above 80°F / 27°C air temp), bentgrass will germinate quickly but may need protection from damping-off fungi.
    - Seed can be coated with fungicide to provide protection before emergence.
    - In most cases an over-the-top application of fungicide after emergence will be sufficient.
    - Warm soil temperatures offer the best time to plant if *Poa annua* seed is present in the soil. *Poa annua* rarely germinates above 80°F / 27°C, hence giving the competitive edge toward bent establishment.
  - Bentgrass can be sown in the cooler months of the year but seed may require 30 days or more to emerge in cold weather. During this interval the surface is vulnerable to erosion.
    - Example: Seed planted in early August might produce a putting green that's ready for play by June of the next year. However, a green not planted until late September (in Northern areas) may require a full year until it's ready to open for play.
  - In semi-tropical areas, spring plantings may be problematic in trying to nurse immature seedlings through the summer. This feat can be accomplished but requires skill in irrigation and fungicides. Spring planting may also prolong the time until the grass is ready to play.
- Germination rate
  - T-1 exhibits exceptional seedling vigor. In the 2003 National Turfgrass Evaluation Program (NTEP) greens trial, T-1 was tied for #1 in seedling vigor. Data were averaged across nine university locations from Arizona to Quebec.
  - Superintendent observations:
    - *"Germination of T-1 was fast and consistent. It popped in 4 to 5 days."* – Jim Roney, superintendent, Sand Ridge CC, near Cleveland, OH
    - *"T-1 was fast to germinate and filled in aggressively. In no time at all, it was looking great and ready for action. In fact, we opened the tee for play in just 2½ months."* – Joe Lucas, superintendent, Saratoga National Golf Club
  - Because T-1 has a slower vertical growth rate than Pennncross or Seaside it may appear to produce less topgrowth during establishment. This is normal.
- Seeding rate
  - Optimal rate: 0.75 to 1.5 lbs. of seed per 1000 ft<sup>2</sup> (3.7-7.5 g/m<sup>2</sup>).

- Applying more than 1.5 lbs. seed per 1000 ft --
  - Does not make up for seeding errors
  - Nor does it allow for the green to open sooner for play. In fact, it may delay opening day because the overly dense plants are immature. Excessive seeding rates produce turf that is less stress tolerant and more susceptible to damping off.
- Establishment fertility
  - Corrective (basic) fertilizer
    - Do a lab soil test before seeding so that results are in hand prior to establishment day.
    - Correct deficiencies in P, K, Mg, and pH via fertilizer amendments as noted on the lab report.
    - Do not try to correct N, or Ca in most cases, or pH's above 8.5.
  - Starter fertilizer
    - Apply a balanced starter with a 1-1-1 ratio of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O (example: 10-10-10 or 16-16-16). Apply just before, at, or within 1 week after seeding.
    - Apply at 0.75 to 1.5 lbs. of actual nitrogen (N) per 1000 ft<sup>2</sup> (3.8 to 7.5 g N/m<sup>2</sup>). With a 16-16-16 product, this would equate to a rate of 200 to 400 lbs. of fertilizer product per acre. If a farm-grade fertilizer is used, apply only the lower rates to avoid burn.
    - Another alternative, if potassium levels are adequate, is to apply a 4-5-1 ratio starter. A product based on mono-ammonium phosphate offers fast nutrient availability with less salt effect.
    - Some superintendents prefer a starter with some slow-release N component. Try to avoid using a superphosphate-based P-source, as superphosphate dispenses phosphate slower than seedlings require.
    - Generally do not use liquid fertilizer as a starter treatment unless you have had success with this method in the past.
  - Fertilization from emergence to 4-6 weeks
    - Apply a 1-1-1 ratio fast-release fertilizer on an every-five-day cycle at 0.3 to 0.5 lbs. N/1000 ft<sup>2</sup> (1.5-2.5 g N/m<sup>2</sup>). Water immediately after applying.
    - Other acceptable alternatives:
      - 6-1-6 ratio fertilizer, with some slow-release nitrogen.
      - Fertigation (i.e., soluble fertilizer delivered through the irrigation system) applied at 0.3 to 0.5 lbs. N/1000 ft<sup>2</sup> (1.5-2.5 g N/m<sup>2</sup>) every 1 to 2 weeks.
      - Ammonium sulfate can be substituted during the cooler months as a nitrogen source. Ammonium sulfate also benefits disease control.
    - Seedlings grown on a sand-medium will usually require a foliar micronutrient application by 2 or 3 weeks after emergence.
  - Maintenance fertilizer
    - Maintenance fertilization varies depending on whether the growing medium is straight sand, USGA mix, or native soil. Sandier soils will require lighter and more frequent fertilizations and slightly heavier yearly rates.
    - Switch from a grow-in to a maintenance fertilizer regime at 4 to 6 weeks after emergence, or when the grass has reached nearly 100% ground coverage. It is important with T-1 to decrease the N fertility input as the stand completely covers the ground.
    - Rate

- Apply fertilizer as the grass requires it, not on a calendar schedule (see Maintenance section below).
- It is not unusual to end up applying 8-10 lbs. N/1000 ft<sup>2</sup> (40-50 g N /m<sup>2</sup>) over the course of the first growing season. That amount should drop by half in the second year and be even lower in the third.
  - Fertilizer choices
    - Polyon or similar slow-release fertilizer, such as GreensKote 18-3-18, applied at 500 lbs. product per acre.
    - Apply 1-1-1 ratio soluble fertilizer at 0.1 to 0.3 lbs. N/1000 ft<sup>2</sup> (1.5-2.5 g N/m<sup>2</sup>) as needed during the season for quick greening, especially if the stand seems sluggish or there are not enough clippings caught in the buckets.
    - Liquid fertilizer sources can be sprayed on the turf or fertigated at label rates.
- Mulch
  - A light application of wood fiber, clean straw, pellet or other organic mulch can be applied to the surface to:
    - Aid retention of moisture around the seedlings
    - Minimize washing of seed during storms
  - Some courses remove the straw at 3-4 weeks (raking) while others allow it to decompose.
  - The mulch can be omitted if an auto-irrigation system is used and timings of water are tightly controlled (see below).
  - Some people have had success with a geotextile blanket in lieu of an organic mulch. If you have used these successfully before, you can use them with T-1. Otherwise, I'd recommend sticking with organics.
- Mowing
  - The first mow should occur as soon as the surface is physically capable of supporting the weight of a mower, without damage. Never let the stand grow to 1 inch (25 mm) tall before mowing.
  - First mowing should be done when there is uniform turf coverage and the plants reach:
    - 0.25 to 0.38 inch (6 to 10 mm) for greens
    - 0.38 to 0.5 inch (10 to 12 mm) for tees
    - 0.6 to 0.75 inch (16 to 19 mm) for fairways
  - It's a good idea to run a walk-behind mower across the green with the reels off, once before mowing for the first time, to help solidify the surface.
  - Collect the clippings during the first mow and then alternate catching and not catching the clippings until surface coverage reaches 80%. This small amount of added biomass improves wear and reduces ball marking when the course first opens. Use a fiberglass whip as needed to prevent clippings from shading and damaging the surface.
  - Never use a riding or triplex mower for the first 4-6 weeks after establishment, until the greens are solid enough to support the weight without tearing. Many superintendents prefer to use only walk-behind mowing the first growing season on greens.
  - Lower the mowing height in small increments, every other mow. Ideally, you should reach the desired mowing height by 6 to 8 weeks after first mowing if not sooner.
  - The greens should be mowed the first season with smooth front rollers. Grooved rollers should not be used the first year, especially on the clean-up pass.

- Special care should be given depending on the sand particle shape: Round sands tend to shift during establishment causing holes and bare spots. Angular sands pack tighter but can be more abrasive to young plants until a thatch builds.
- Topdressing
  - Light weekly topdressing should be used to help cover the clippings and smooth any surface irregularities.
  - Washed masonry sand with particles from 0.25 to 0.5 mm can be used in place of a sand-organic topdressing during the establishment year, if desired.
- Irrigation
  - The irrigation system should be checked thoroughly before seeding day. It's a good idea to water the day before seeding to help firm the sand surface and bring the green to field capacity.
  - A green will normally require more irrigation the first week after seeding than thereafter.
  - During germination, it is best to irrigate on multiple 5 to 10 minute cycles, spaced out across the daylight hours. The time of run should be watched every day so that NO puddling or washing of seed occurs. If the system is flexible enough, 2 revolutions of the sprinklers every hour is ideal.
  - Early irrigating practices are key to success or failure of bentgrass establishment. The critical time for seedling viability is when seedlings are first emerging from the soil. At that point they are at their lowest energy state and even one missed day of irrigation (or rainfall) can mean a spotty stand.
  - At around 2 weeks after emergence, gradually switch from very frequent watering to once or twice daily watering.
  - By 4-6 weeks after emergence, the green should be on a normal maintenance irrigation schedule (see below).
- Core aeration and vertical mowing during the establishment year
  - Core aeration is generally unneeded during the establishment year. In fact, it can cause surface damage if handled roughly, until the sand surface stabilizes.
  - Vertical mowing (grooming) is desirable during the establishment year if you notice:
    - A lot of plants with larger-than-desired leaf widths, and/or
    - Stolons creeping across the surface into thinner areas.
- How to tell when a T-1 green is ready for opening
  - My rule of thumb is to cut a square of turf from the green and --
    - Examine it to see whether a mat (cushion) layer has adequately developed
    - Try pulling the square apart. It should be fairly resistant to tearing.

## Maintenance

- Fertilizer
  - Yearly nitrogen applications should total 1 to 4 pounds (5-20 g/m<sup>2</sup>), phosphorous 2 to 3 pounds (10-15 g/m<sup>2</sup>), and potassium 6 to 10 pounds/1000 ft<sup>2</sup> (30-50 g/m<sup>2</sup>). Higher rates in each range are used with more golf rounds and sandier soils. Likewise, courses with smaller-than-average greens may need to fertilize to compensate for more concentrated wear.
  - T-1 greens up earlier in the spring than most creeping bentgrass cultivars and thus may benefit from an earlier "wake-up" shot of fertilizer. In university trials averaged across 7 sites from Washington State to Virginia, Penncross greened up 86% as strongly as T-1, and Seaside only 65%.

- T-1 has a naturally dark color that is many shades darker green than all other bentgrass cultivars. And it does not lose its color as readily. Therefore, you are advised to watch the clipping collection buckets rather than relying on color to tell you when to fertilize. But being a dwarf bentgrass strain, T-1 produces less volume of clippings than some other bents. Keep this in mind if you're used to growing older bents like Penncross and Seaside and gauge your maintenance inputs accordingly.
- Micronutrients should be checked via tissue tests during the summer.
- A soil test should be done annually, each year in the same month.
- Mowing
  - Common mowing heights for T-1:
    - 0.100 to 0.150 inch (2.5 to 4 mm) for greens. One superintendent has successfully maintained T-1 at 0.080 inch, but that is not recommended.
    - 0.150 to 0.400 inch (4 to 10 mm) for tees
    - 0.250 to 0.500 inch (6 to 12 mm) for fairways
  - Although T-1 is a "Fore-giving" bentgrass, it is not recommended that you skimp on its mowing frequency. A consistent mowing schedule always provides a higher quality turf. Infrequent mowing results in the removal of excessive amounts of leaf tissue and puts the grass under stress. Removal of half of the leaf tissue at a single mowing can result in stunted growth and a stemmy surface.
  - For greens, mowing 6-7 times weekly is recommended. Mowing less often can be done if reductions in surface quality are acceptable.
  - For fairways or tees, mowing 2 to 3 times weekly during the growing season is best.
  - Changing mowing patterns each day helps eliminate grain and reduce wear and compaction. When triplex greens mowers are used, the final "clean-up" cut around the perimeter of the green should be mowed on alternate days. Some superintendents make this perimeter cut with a walking greens mower to reduce wear and compaction.
  - If fast greens are desired for tournament play, mowing heights can be lowered for a short period. However, other practices such as brushing and verticutting are recommended instead to increase speed of greens. Research has shown that the primary factors influencing putting green speed are: Double mowing (mowing twice per day) and rolling.
- Vertical mowing, grooming, brushing
  - T-1 generally will require less vertical mowing than "horizontal" varieties like Penncross. Once or twice a month should be adequate in most cases.
  - Groomers may reduce the need to verticut as often. Groomers may be used 1-4 times per week depending the growth and maturity.
  - Some superintendents use a deep verticut (Graden) in the spring to remove thatch and dead material. My preference for thatch control is core aeration and topdressing.
  - Brushing is another useful maintenance tool. Brushing early in the spring and once a month depending on weather and growth, will increase plant density. Brushes on mowers will do an acceptable job but are not as thorough as a heavier brushing or brooming.
- Aerification, topdressing
  - Most golf courses aerate two to three times a year – once in the spring, early summer and fall. Aerification frequency of T-1 is similar to other bentgrasses.
  - Because of its lateral vigor, T-1 heals readily after aerification. Therefore, a range of tine sizes can be used from the ¼" solid to 5/8" hollow core. Solid tine, star tines, and Hydro-jet injection also work.

- A divot-recovery trial at Oklahoma State University confirmed the healing rate of T-1. Divots taken June 15<sup>th</sup> on tee-height T-1 healed 80% by 4 weeks versus 44% for Seaside and 58% for Princeville.
- Superintendent observation: *“We had cottage guests at the course who took quite a few wedge shots off our bent test plots, leaving big divots all across the plots. Four weeks later, I was showing a visitor around. The divots were still apparent on most plots but were gone on the T-1 plots. I mean, we could still feel the depressions in the T-1 plots but the divots were filled solid.”*  
– Jim Roney, superintendent, Sand Ridge CC, 0.100 inch mowing
- Topdressing styles vary from golf course to golf course. Topdressing is important to smooth the greens from foot traffic and ball marks. T-1 accommodates light weekly applications or heavier monthly applications.
- The main purpose of topdressing is to dilute thatch. An even blending of topdressing and thatch is the fastest way to stem thatch buildup.
- If thatch thickness is increasing, your options for remedy are --
  - Apply less nitrogen per year
  - Apply topdressing more frequently
  - Aerify more often
- It is important to incorporate the topdressing into the plant canopy. Topdressing can be worked into the stand by dragging or brushing, or with the application of water. Remaining small stones and large sand particles should be brushed off the green.
- T-1 has a shoot density that is 2-3 times greater than older bents. Thus it is important to open up the stand before topdressing by use of groomers, verticutting, grooving, slicing, aerification, or spiking. It may also be helpful to specify topdressing sand with fewer large particles (>0.5 mm).
- Irrigation
  - Weather conditions and greens construction have major influences on watering. Watering rates vary from 0.05 to 0.3 inches (1.3-7.6 mm) per day depending on temperature, wind, humidity and sunlight. During cooler months, rates are less than 0.1 inch (2.5 mm) of water per day and weekly irrigation may be adequate.
  - It is best to irrigate “as needed” rather than on a tightly fixed schedule.
  - Watering every other day or every second day is preferable over daily irrigation. Research from Texas A&M has shown that watering greens every-other day or twice weekly produced a higher quality surface than turf watered daily (weekly water rates being equal).
- Plant growth regulators (PGR's)
  - T-1 responds well to Primo MAXX (trinexapac-ethyl), Proxy (ethephon), and Trimmit (paclobutrazol). In fact, T-1 gets even darker and more dense with PGR treatment.
  - Recovery rate from ball-mark damage can be enhanced by the application of PGR. Studies at Penn State University have shown that growth regulators and bio-stimulants can accelerate ball mark recovery without the need to increase nitrogen fertility, which can reduce green speed.
- *Poa annua* (annual bluegrass) control
  - T-1 was bred for improved competitiveness against *Poa annua*. At Jacklin Seed, we test every bent strain in our breeding program against *Poa annua*. If it can't hold up against *Poa*, we pitch it. All of the plants that went into T-1 excelled at keeping *Poa* at bay. In fact, they made visible gains against *Poa* every year
  - T-1's *Poa annua* resistance was confirmed in a fairway-height wear trial at the University of Wisconsin O.J. Noer Center. T-1 maintained less than 7% *Poa* invasion under heavy

simulated-cart wear. Penncross had twice as much *Poa annua*, Seaside three times as much, and colonial bentgrass four times.

- Paclobutrazol (Trimmit) is a particularly useful tool for enhancing the superior *Poa* competitiveness of T-1. T-1 responds well to the higher label rates of paclobutrazol on 4 to 6 week intervals throughout early summer. Ethofumisate (Prograss) and bispyribac-sodium (Velocity) are also safe on T-1 at label rates and timings.
- Interseeding T-1 into an existing turf
  - Interseeding is the introduction of a new grass into existing turf. One of the most challenging surfaces for interseeding is an existing putting green during play. Interseeding in the past was of little value for most golf courses because cultivars were not vigorous enough to compete under these extreme growing conditions. Initial testing has shown that T-1 is in a league by itself in interseeding capability. A separate protocol sheet is being assembled to explain interseeding tips and techniques in detail. The following is a brief description of two techniques for incorporating T-1 seed into existing turf:
    - Seed 1 to 3 times annually, each time in a different direction
      - Use 2-4 lbs. T-1 seed per 1000 ft<sup>2</sup> (10-20 g/m<sup>2</sup>) per application. Research at Jacklin Seed has shown that establishment rate (i.e., surface area covered by T-1) effectively doubles when seeding rates increase from 1 to 2 lbs. and from 2 to 4 lbs.
      - T-1 interseeds best during months when soil temperatures are warmer.
      - Vertical mow, aerify, or slit seed to open the stand and allow the seed to reach the soil. Then broadcast seed, topdress, and drag or rake.
      - Superintendent observation: At Hakone CC in Japan, superintendent Mariko was one of the first to test T-1. He interseeded his Dominant + *Poa* greens 3 times over 3 years. He asked local university scientists to sample his green and found a T-1 percentage of 87%.
      - Superintendent observation: At Grand National Golf Course in Hinckley, MN, superintendent Steve Benson slit seeded T-1 in two directions with a Gradin slit seeder. He had visible germination in 10 days and fill-in during the first month.
    - An alternative method is to interseed at low rates every 2 weeks throughout the growing season, whenever the stand is groomed, spiked, or topdressed.
      - This technique regularly introduces bentgrass seed to the green and is useful for countering the *Poa annua* “seed bank” in turf soils.
      - Superintendent observation: Mark Kuhns at Baltusrol Golf Club uses this technique. He applies 0.1 to 0.25 lbs. of seed every 2 weeks via a Scotts drop spreader with the spreader gate *closed* (the spreader leaks bent seed at the proper rate when closed!)
      - A Gandy tip-spiker can also be used to seed. The hopper can be throttled down to low seed application rates.

*Information in this fact sheet is provided as a general guideline. It is intended as a starting point in developing a sound management program. T-1 creeping bentgrass is a patent-pending variety, covered under US patent 10/872,697. Unauthorized propagation is prohibited.*