# *Poa annua reptans* and the Development of DW-184

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*Poa annua* is arguably the dominant grass on golf courses in Wisconsin. Some superintendents spend years and thousands of dollars combating the grass. Other superintendents have decided to play by the old adage, "If you can't beat 'em, join 'em" and have adjusted their management practices to favor *P. annua*. The greens at Trout Lake are an excellent example of this attitude: properly managed, *P. annua* can produce a remarkably uniform putting surface.

*P. annua* is stereotyped by a shallow root system, consistently abundant seed heads, and a light green color. The shallow root system predisposes the grass to drought stress, which is indeed one of the tools superintendents use to discourage the grass. The seed heads wreak havoc with play and are easy to spot. The light green color of patches of *P. annua* in a bentgrass green or even Kentucky bluegrass fairway disrupt the appearance of the turf. But as new research is showing, these attributes do not typify all *P. annua* populations. To understand *P. annua*, we have to explore its origin, its tremendous diversity, and its potential for use as a golf course turf.

**Where did *P. annua* come from?** *P. annua* is a relatively recent species of grass, probably formed in Europe between one of the ice ages during the Quaternary Period. The wide variation of biotypes indicate it is still rapidly evolving. Some researchers have theorized *P. annua* was a product of hybridization between *P. supina* (Supina bluegrass), a stoloniferous perennial native to the mountains of central Europe, and *P. infirma*, a bunch-type annual which is native to the Mediterranean region (Damency and Gasquez, 1997; Tutin, 1957). Evidence suggests otherwise, however, as hybridizations between the two species yield plants which appear to be *P. annua* but do not produce viable seed (Damency and Gasquez, 1997; Pietsch,

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1989). Pietsch (1989) showed that crosses between P. supina and *P. trivialis* (rough bluegrass) yielded plants morphologically similar to *P. annua* which did produce viable seed. All the *P. annua* plants from the hybridization were tetraploid, with 28 chromosomes (2n=28), a result of the crossing between the two diploid parents, each of which had 14 chromosomes (2n=14).

**The Diversity of *Poa annua*.** Superintendents and scientists have been aware of the wide range of *P. annua* types for decades. Some plants are small, others large. Many are bunch type, although stoloniferous plants are not uncommon. Some plants are self-fertile while others have sterile male flower parts and must be cross-pollinated by another plant. Color and even rooting vary widely. Life cycles range from annual to biennial to perennial (Johnson et al., 1993). First described over a century ago based on erect, bunch type plants with an annual life cycle, taxonomists now largely agree on the existence of at least two separate types (biotypes): *P. annua* var. *annua* and *P. annua* var. *reptans*. *P. annua* var. *annua* are typically bunch type grasses which produce large quantities of seed during the spring and summer before they die. Most *P. annua* var. annua plants are tetraploid , reflecting their purported origin from the hybridization of two diploid species. *P. annua* var. reptans, however, has a prostrate, stoloniferous growth habit, a perennial life cycle, and is typically diploid with 14 chromosomes (2n=14). Many *P. annua* var. reptans plants are fine textured with a dark green color and are often overlooked by turf managers who associate only light green color with *P. annua*.

**Management and ecology**. Management practices influence the type of *P. annua* in turf areas. The annual biotypes are more common in areas which are mowed relatively high, lower nutrient fertility, and irrigated irregularly, such as roughs and fairways (Till-Bottraud et al., 1990). In ecological terms the annual types are known as *r* strategists: they have short life cycles and produce large quantities of seed in order to persist as a species. A single annual bluegrass plant has been documented to produce 350 seeds during a growing season, with "seed banks" in the soil capable of possessing over two million *P. annua* seeds per square foot! (Lush, 1988). These strategies allow *P. annua* var. annua to grow and produce seed during spring and summer, die off during unfavorable winter conditions, and develop another generation from seed in the soil when conditions are favorable. (In the northern U.S., *P. annua* often behaves as a summer annual while in the South it is more of a winter annual). The huge seed banks give *P. annua* var. annua a competitive advantage over perennial turfgrasses which produce very little seed under mowed conditions. The seed, some of which is viable within 1-2 days following pollination and can remain viable for up to 15 years, can readily germinate any time the soil is exposed by divots, diseases, or other damage. Mosquitoes, rabbits, and crabgrass are other examples of *r* strategists. On the other hand, the perennial types of *P. annua* are typical of *k* strategists. *K* strategists typically have long life cycles, produce fewer progeny, survive through both ideal and stress conditions, and, in the case

of turfgrasses, often capable of reproducing vegetatively through stolons or rhizomes. Humans, elephants, and creeping bentgrass are examples of *k* strategists. *P. annua* var. *reptans* is confined mostly to greens and similarly close-cut, intensively managed areas. White (1993) reported up to 24% of the *P. annua* on greens were diploids (2n=14) and were fine textured with dense, dark green foliage. No diploid types were found in roughs or fairways, and other studies have yielded similar results. The low height of cut, high fertility and irrigation, and pesticides provided selection pressures which favored *P. annua* var. *reptans*.

**Elimination of *Poa annua* is unlikely.** Most superintendents disdain *P. annua* due to its propensity to die out from summer drought and/or heat stress and anthracnose or from winter cold/freezing stress and snow molds. Getting rid of it is unlikely. Most commonly minimal irrigation, lower fertility, overseeding, seedhead removal, and/or plant growth regulators are used in attempts to reduce or eliminate *P. annua* from greens and fairways. Such efforts may not be worthwhile. The USGA acknowledges only two or three successful conversion programs from *P. annua* to creeping bentgrass. A three year study in fairway conditions found that yearly overseeding with 'Penncross' creeping bentgrass resulted in no more than an 8% increase in creeping bentgrass. Mefluidide, a plant growth regulator used to control *P. annua* seedhead production, actually increased *P. annua* populations. The most successful management practices involved removing clippings during each mowing (which removed the seedheads), overseeding, and not using mefluidide: this combination still only reduced the *P. annua* population by 28% (Gaussoin and Branham, 1989). Recently a fair amount of attention has been given to the idea of using a bacterium, *Xanthomonas campestris* pv. *poannua*, as a biocontrol to kill annual bluegrass. In growth chamber tests up to 92% control was obtained. In the field, though, applications had to be made three times weekly to gain 40% control, and the *P. annua* recovered within two to five weeks once applications were stopped (Zhou and Neal, 1995). Nonetheless, the research continues, as recent tests on *P. annua* in bermuda turfs have shown much better control when the bacteria were applied to freshly mowed turf (Johnson et al., 1996).

**Breeding programs.** The USGA has supported breeding projects since the 1980s with the goal of producing perennial types of *P. annua* for use as golf course turfs, primarily for greens. The longest running program has been that of Dr. Don White at the University of Minnesota. Dr. White and his assistants have evaluated thousands of *P. annua* plants for their capacity to bear seed, resist environmental stresses, and produce high quality turf at heights of ½" and lower. *P. annua* plants from many states, and a few from overseas, were evaluated for color, disease and insect resistance, environmental stress tolerance, persistence and quality under putting green conditions (White, 1993). Many crosses were made between likely candidates, and several exceptional lines were developed, particularly from *P. annua* var. *reptans* biotypes. Dr. David Huff at the Pennsylvania State University has recently developed a complementary breeding pro-

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gram. Since PSU is in a different climate than UM, selection pressures during outdoor trials will likely yield different results than the ones encountered in Minnesota. Dr. Huff is evaluating over 1600 types of perennial *P. annua* biotypes for putting greens. Assessing cold and heat tolerance, management requirements, and disease and insect resistance, his goal is to develop super aggressive varieties (Huff, 1997).

The Wisconsin Golf Turf of the Future? Last year I was invited to visit a new golf course being built in God's country near Hayward, WI. Although the course will likely not be finished due to the loss of the financier, one of the intentions was to plant naturalized grasses in an effort to cut pesticide and fertilizer requirements. When I suggested *P. annua* be planted since it would come to dominate the course anyway, the consulting superintendent (from Virginia) scoffed at the idea and was convinced he could keep *P. annua* out through non-chemical means. Since I couldn't tell him where to get a sufficient supply of reliable seed anyway I decided not to push the issue.

Late in 1997 the first cultivar of *P. annua* was released. A type of *P. annua* var. *reptans*, it was at first marketed as P. *reptans*. Since only an international committee of taxonomists can approve new species names, the new advertisements refer to it correctly as *P. annua reptans*. The cultivar name is 'DW-184', formerly 'MN-184'. The DW stands for, of course, Don White, who developed the cultivar out of his breeding program at the University of Minnesota. 'DW-184' is a perennial, stoloniferous type grass and is targeted for greens. Although it has performed poorly in tests at PSU, it has grown quite well in Minnesota test plots. Marketed through Peterson Seed Co. (Savage, MN), it is supposed to be capable of being maintained at mowing heights of 0.125 inches. The greatest drawbacks at this time are its high price (approximately $40 per pound) and a lack of knowledge of management requirements. We can expect the seed price to come down over time as supply and demand equilibrate and seed production is optimized. Management schemes will be developed as more people use the grass and as testing is performed at more sites. The seed comes coated with a variety of materials, including fertilizer and a fungicide to prevent damping-off; the blue colorant indicates the seed has been "treated". This is likely only the first of more varieties to come. At one time, and perhaps still now, plans had been laid to release at least two more cultivars from Dr. White's program. We can likely expect Dr. Huff's program to produce cultivars adapted to a different set of environmental conditions, and maybe even to our conditions as he and Dr. Mike Casler of UW-Agronomy discuss plans to test promising lines in Wisconsin.

If you want to get an early peek at the potential of *P. annua* var. *reptans* for golf course putting greens, stop by the O.J. Noer Facility next spring, or better yet, at field day in August. 'DW-184', supplied by Peterson Seed Co., was planted on a USGA-specified sand root zone this autumn. The seed was planted in a test designed to determine management requirements for the A and G series bentgrasses in Wisconsin, particularly topdressing and aerifying. The research project is generously sponsored by the Wisconsin Golf Course Superintendents Association, so it truly is your research, and should provide beneficial recommendations to superintendents throughout the state.

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