Velvet Bentgrass as a Potential Turfgrass?

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I started my study of Horticultural Science in Korea. When I was an undergraduate in the Department of Horticulture, I was interested in ornamental plants. For my Masters degree, I studied the regeneration of cyclamen and *Gypsophila paniculata* using tissue culture. During the course of my graduate work in Korea, I became interested in plant breeding and genetics using molecular techniques. When I joined Dr. Jung's lab, I knew little about turfgrass and its diseases. However, I have come to enjoy the study of turfgrass, especially velvet bentgrass species. In this article, I would like to tell you why velvet is an untapped gem of a turfgrass and briefly discuss my research project.

Velvet bentgrass, *Agrostis canina* (L.), is a cool-season, extremely fine-textured grass that creates the smoothest playing surface of all turfgrasses. Velvet bentgrass naturally occurs throughout all of Western Europe to Eastern Asia and in a portion of North America where there are temperate-oceanic climates such as those of New England and the Pacific Northwest. There are two kinds of subspecies, ssp. *canina* and ssp. *montana*. *A. canina* ssp. *montana* is now recognized as the species *A. vinealis*. When we say velvet bentgrass, we mean *A. canina* ssp. *canina* which is a typical diploid (by definition, an individual with two sets of a basic genome). On the other hand, *A. vinealis* is an autotetraploid, which doubles the diploid chromosome set. Triploid hybrids between these two species confirm that *A. vinealis* is an autotetraploid of *A. canina*. A longer, more pointed ligule and a shorter palea distinguishes it from other species of *Agrostis*. In every textbook and paper, velvet bentgrass is described as forming the most beautiful turf surface due to its fine texture and high shoot density. Also, according to an article from the Bulletin of the USGA Green Section written by Monteith, J.Jr. and K. Welton in 1932, ten professional golfers at Arlington Turf Gardens in Virginia recognized velvet bentgrass as the best putting surface.

Although people regard velvet bentgrass as the most visually striking turfgrass, most golf courses have chosen creeping bentgrass (*Agrostis palustris*) instead of velvet. Velvet bentgrass fell out of favor with turf managers nearly 50 years ago due to its higher maintenance inputs. There was a reason why people thought velvet bentgrass needed high maintenance. For an explanation, I will use the example of the velvet bentgrass cultivar "Kingstown" which was bred through an inbred selection from "Piper" and released by Drs. C.R. Skogley and J.A. DeFrance at the University of Rhode Island. It was a lighter green than many other bentgrasses and seemed to demand excessive fertilization and watering. Consequently, this management style resulted in heavy thatch, disease development, and *Poa annua* encroachment which led to the loss of velvet at many turf sites and the misconception of velvets as high maintenance turf. In addition, unreliable seed production reduced velvet bentgrass usage.

Velvet bentgrass does not do well in germplasm collections and preservations. However, the University of Rhode Island made an effort to collect germplasm and breed cultivars. After much work, Dr. Skogley released the variety "SR 7200" in cooperation with Seed Research of Oregon. "SR 7200" shows traits such as excellent disease resistance to dollar spot and drought-tolerance that are superior to all other bentgrasses as well as improved seed yields compared to previous velvets. Recently, Rutgers University has been working to develop velvet bentgrass. They are collecting the germplasm of velvet bentgrasses

from many old golf courses in New York, Connecticut, and New Jersey and have developed new experimental velvet bentgrass lines. They have been evaluating those experimental lines with reduced input requirements.

Sport Turf Research Institute in Bingley, England and Rutgers University compared the new velvet bentgrass materials to other bentgrasses. Their results are as follows:

1) Velvet bentgrasses are the most visually striking turfgrasses and velvet greens are the smoothest, truest, fastest putting surfaces of all bentgrasses.
2) Due to their extremely high numbers of shoots per unit area, velvet bentgrasses have the finest texture of all the turfgrasses. The density of velvet bentgrass is much greater than creeping bentgrasses and higher than equivalent stands of *Poa annua*.
3) There is much color diversity in the velvet bentgrasses ranging from very bright, lime green to darker shades of green. "SR 7200" shows a striking dark green color.
4) Velvet bentgrasses are tolerant to many stresses including drought and especially shady conditions. Also, velvet bentgrasses are highly tolerant to low temperature. It has been thought that high temperature has limited velvet. But there is significant evidence that indicates a much higher degree of high temperature tolerance than was previously thought.
5) Velvet bentgrasses are generally highly resistant to most turfgrass diseases. It is well known that "SR 7200" has excellent resistance to dollar spot and brown patch. There is some evidence that mature turf shows high resistance to *Pythium* sp. diseases.
6) Velvet bentgrasses are well-adapted to low nitrogen fertility programs. This trait helps prevent *Poa annua* infestation because *Poa annua* needs high levels of nitrogen fertilizers.
7) Although velvet bentgrasses are adapted to relatively low soil pH levels (5.0-5.5), they persist and perform well at slightly acidic levels of 6.0-6.5.
8) Velvet bentgrasses are much more accommodating of low mowing heights than what was once thought. Velvets perform very well at any heights from as low as 0.120" (3.00 mm) for tournament-grade velvet bentgrass greens to 0.560" (14.00 mm) for fairways.

It is apparent that velvet bentgrass has a decided advantage over other bentgrass species. However, there is no report on genetic variability among velvet cultivars, breeding lines, and clones in their susceptibility to pink snow mold (*Microdochium nivale*) which is a major disease of turfgrass and economically important turf disease in North America. Therefore, my research focuses on the genetic analysis of pink snow mold resistance in velvet bentgrass using DNA marker technology.

Pink snow mold is a common disease in later fall and early spring in areas where cool-season grasses are adapted. The environmentally sound way of controlling this disease is to develop resistant cultivars. However, little research on pink snow mold has been conducted in turfgrass. Almost no effort has been put into developing velvet cultivars resistant to pink snow mold. As the first step of my research, one hundred forty velvet clones from various sources (cultivars, breeding lines, and Plant Introductions) will be screened for their differential reactions to different pink snow mold isolates collected throughout Wisconsin. The velvet clones consist of 5 plants from each of 19 breeding lines from Seed Research of Oregon, 6 PIs (Plant Introduction) from the U.S. National Plant Germplasm System (NPGS), 2 commercial cultivars ("Vesper" and "Bavaria"), and a seed collection of Dr. Mike Casler, University of Wisconsin-Madison.

Once resistant and susceptible velvet clones for pink snow mold are selected as parents, they will be crossed with each other in order to develop a population segregating for pink snow mold resistance which will be utilized for genetic analysis of the resistance.

Velvet is of interest to breeders and geneticists because of its low maintenance turf, multitude of benefits, and diploid characteristics with which it is genetically easy to work. I hope my research will help stimulate genetic research on velvet bentgrass species and accelerate a breeding process of developing disease resistant cultivars or breeding lines with the help of molecular marker technology.