(Art of Spraying continued)

4. Nozzle Flow Rate. The last number in the nozzle identification number indicates its flow rate at 40 PSI. The 8008 has a greater flow rate than either an 8005 or an 8003, and it is interesting to note that at pressure from 10 to 80 PSI the larger flow rate nozzle has fewer drops in the smaller VMD range. The droplet size is smaller when 100 degree nozzles are used over the same range of pressure. The better method of increasing spray volume rates is to change nozzle size, not to increase pressure. A method of reducing drift is to lower the pressure at the nozzle. Nozzles sold to reduce drift usually operate at a lower pressure due to designs that have lower pressure at the exit opening. Standard nozzle operating pressure is 40 PSI; below that the angle of coverage can be reduced and above that a higher percentage of driftable drops result. Pressure from 35 to 40 PSI at the nozzle is desired with fan type nozzles for most effective spraying.

5. Delivery Volume or Dilution Rate. A surface area of 1,000 square feet covered to a depth of 12 inches requires 7,480 gallons of water. Sixty-two point three (62.3) gallons of water will cover that same 1,000 sq. ft. to a depth of 0.1 inch, while 6.2 gallons will only produce a layer of water 0.01 inch deep and 0.62 gallons results in a very thin water layer, 0.001 inch. How thin is a layer of water 0.001 inch? Take a 1-inch piece of paper and cut in in half ten times. What is left is 1/1024 inch. When spraying one gallon of water per 1,000 sq. ft. a layer is produced 0.0016 inch thick; at two gallons per sq. ft. the layer is 0.0032 inches thick. This assumes all of the volume is spread evenly and none is lost. Sprayer technology and operator skill are seldom so exact.

6. Disease Control/Delivery Volume. It was shown that the length of effective disease control with Bayleton was dependent on the delivery volume. Significantly less disease control was reported at 23 and even at 37 days after treatment if delivery volume was reduced from 2 to 1 gallon of water. Optimum dilution ranges are 1 to 2 gallon for many products. Some new fungicide labels provide dilution guidelines.

7. Post Spray Water. Maximum disease control was obtained from contact and some systemic fungicides when they were applied to dry turf and allowed to dry before rain or irrigation was applied. The period of time from initial wetting from spray application until dry on the leaf appears to be important for uptake and disease control. While the mechanism is not understood, the basic effectiveness of a fungicide is reported to be established by the initial water amount when applied; therefore application to dry turf is desired and the turf should not be rewet until the product has dried. Watering systemic fungicides after the leaf is dry may not reduce effectiveness, nor will it improve product performance. Contact fungicides do suffer a significant drop in disease control if watered before they dry. Products with sticking agent(s) remain effective if the spray has dried on the leaves before wetting.

The application of fungicides for turf winter disease management last fall began a study to evaluate three dilution rates: 2, 1 and ½ gal. per 1,000 sq. ft., two rates of a combination, tank mix fungicide program and three noz-

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(Art of Spraying continued)
zle types. The results are not yet completely in, but initial readings at Duluth suggest some differences relataed to all variables. One year does not make a good test and future results are needed. I'll be preparing a first year summary after the next set of notes are taken at Duluth.

I'd suggest that you very carefully consider the dilution rates used for fungicide application, as low dilution rates of products appear to perform poorly in research reports and in the first trial for winter disease control. It is possible, not proven, that low dilution rates are part of the problem in allowing for rapid development of fungicide resistance. Clearly the repeated use of fungicides with the same mode of action and application of such products at lower than label rates are important and significant factors in resistance development. Application of fungicides at the tested/recommended dilution rates may result in better disease control and fewer reports of resistance or produdt failure concerns. Nozzle type, size and pressure are significant factors affecting fungicide performance.

The sprayer output should be tested following procedures given in operation manuals or in spray nozzle catalogs. Your goal is to measure the delivery of product per unit area of turf. This is a function of nozzle size, number, pressure and speed of the sprayer. How well does your sprayer perform? **Credit: Hole Notes 6/95**

Bentgrasses
Past, Present & Future
by Skip Lynch, National Technical Representative
Seed Research of Oregon

Not long ago, the golf course superintendent had very few choices of creeping bentgrasses for new green construction or overseeding of existing putting greens. Since 1987, the choices seem to have grown exponentially. Because of the introduction of so many new bentgrasses, knowing which bents do what, where and for whom is getting to be a full time job in itself.

So, how is a superintendent to keep up with the barrage of new varieties entering the bentgrass market?

So, how is a superintendent to keep up with the barrage of new varieties entering the bentgrass market? Study, study, study. Perhaps the next few paragraphs will provide you with a brief guide to the bentgrass market's past, present and possible future.

THE PAST

As golf was emerging on the North American continent, the only "bentgrass" seed for greens available to the

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market was the "South German Bentgrass". This was little more than a collection of Agrostis sp. seed from southern Germany that was cleaned and resold. The purchaser of this seed was likely to get a wide range of plant materials from creeping to colonials, highlands to redtops, to velvet bentgrasses.

The first improvements to bentgrass putting greens took off in two directions, vegetative selections and improved seeded varieties. After 1920, several vegetative varieties became available to the market. Among these were Toronto, Cohansey, Washington and Pennpar. Although these varieties were fairly uniform, regional adaptation and lack of genetic diversity limited their long term success. The first improved, seeded variety of creeping bentgrass in the U.S. was 'Seaside' in 1923. This was significant to the market sources. Also, an improved seeded variety was significant because the seed could be shipped and stored more easily than vegetatively propagated varieties. By modern standards, little or no advancement in disease resistances, color uniformity, or wear tolerance was bred into this variety.

The next (and undoubtedly) significant development in the U.S. creeping bentgrass market came with the release of 'Penncross' in 1954 from Penn State University. Penncross was something of a hybrid of the two production philosophies. In order to maintain the uniformity of the variety, three genetically different plant materials were vegetatively planted in the production field, grown to seed, and harvested.

This production process brought to the market a relatively uniform variety. Penncross would only segregate into 3 different colors, textures and growth habits. It was coarse, aggressive, and susceptible to nearly every disease of putting green turf. However, Penncross's adaptability, persistence, popularity and impact on the market allowed it to become the industry standard until the late 1980's.

The Penn State breeding program, realizing that Penncross tended to be too thatchy for fairway use, bred and released 'Penneagle' primarily for fairway use in 1978. This was significant because it marked the first time that a variety had been developed for a specific use. Although Penneagle has been used on putting surfaces, it is best suited to fairway use.

THE PRESENT

At the end of the 1960's several University breeding programs were working hard to improve creeping bentgrasses in North America. Researchers were making improvements in disease resistance, darker color, finer texture, reduced thatch accumulation and greater traffic tolerance.

In 1986, the floodgates opened to several new varieties. Among the most significant entries to the market were 'SR 1020,' 'Providence' ('SR 1090'), and 'Pennlinks'. Each was developed for a specific purpose, and have led the way for further generations of bentgrass variety development.

SR1020 — Developed by Dr. William Kneebone at the University of Arizona, SR 1020 was nearly 20 years in the making. Dr. Kneebone collected and evaluated bentgrass

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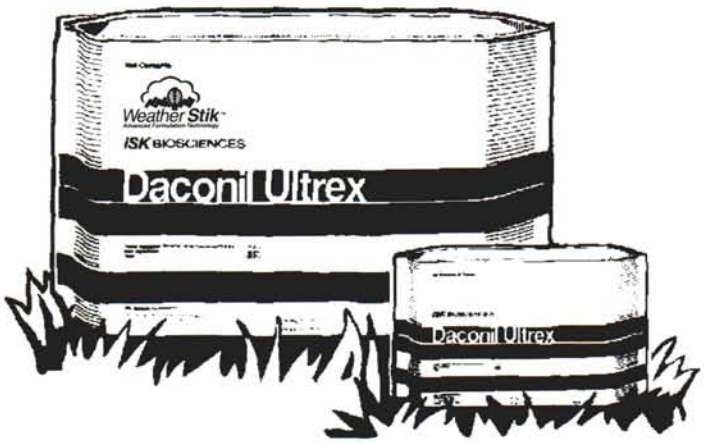

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(Bentgrasses continued)
germplasm from across the southern tier of the U.S. looking for a putting green variety that would be extremely heat, drought and wear tolerant. SR 1020 was bred to be very fine textured and upright to reduce the need for mechanical grooming and increased putting speeds at higher mowing heights. Furthermore, Dr. Kneebone's breeding and evaluation process produced an extremely uniform 5-cyclone synthetic variety. By the selection of five very dark green and texturally similar clones, SR 1020 has almost no segregation, unlike its seeded predecessors.

Although it was released in 1986 as the first creeping bentgrass developed specifically for the southern U.S. over the past eight years, SR 1020 has proven that its range of adaptation is not so limited. SR 1020 has been a top performer in the far south from Georgia to Texas to Arizona to California. It has also been very successfully managed well north of the Mason-Dixon line, and continues to perform well throughout the Midwest and Great Plains states.

Providence (SR 1019) — Providence creeping bentgrass was developed at the University of Rhode Island by Dr. Richard Skogley. Like Dr. Kneebone with the University of Arizona breeding program, Dr. Skogley spent nearly 20 years collecting bentgrasses from old South German greens throughout the Northeast. The result of Dr. Skogley's hard work and patience has been one of the market's most uniform dark green and upright varieties to date. Because of its extensive evaluation under a wide variety of disease pressures, Providence has shown extremely good resistance to all major turfgrass diseases. In addition, Providence's fine texture and upright growth makes it a very fast putting surface that is very resistant to spiking.

Over the last three years, the 5-cyclone synthetic Providence has been the #1 creeping bentgrass in all three NTEP bentgrass trials (Modified Green, Native Soil Green and Fairway/Tee).

Pennlinks — Just as Penneagle had been dveloped to replace Penncross for fairway use, so too was Pennlinks developed to surpass Pencross's performance on greens. Pennlinks was developed by Dr. Joe Duich at Penn State University, and released in 1986. Pennlinks has produced very good putting surfaces under a wide variety of growing conditions. Although it is more upright and uniform than Penncross, Pennlinks is not quite as fine textured, upright, dark green and uniform as other varieties available on the market.

Putter — Developed at Washington State University by Drs. Stan Braun and Roy Goss, Putter is a 2-clone synthetic developed primarily for Take-All Patch resistance. Putter is one of the darker varieties on the market with a fairly fine leaf texture. Putter had done well at putting green height, and has shown good heat tolerance in transitional climates.

Cobra — Cobra was developed at the New Jersey Agricultural Experiment Station by D. Ralph Engle. It is a 7-clone synthetic with a very good leaf spot resistance and a less thatchy growth habit. The latter has made Cobra a good fairway grass. Cobra has been highly rated in California and Texas NTEP sites.

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(Bentgrasses continued)

Crenshaw (Syn 3-88) — Developed by Dr. Milt Engelke of Texas A&M and Dr. Virginia Lehman of Lofts Seed Company, Crenshaw is a 6-clone synthetic developed out of many of the same materials that brought SR 1020 to the market (in fact 3 of 6 clones are believed to be in common with SR 1020).

Developed in the 1980's on heat benches at the Texas Agricultural Station in Dallas, Crenshaw was bred to have excellent heat and drought resistance. It is fairly finely textured, aggressive and dark green. Crenshaw seems to perform best in climates with prolonged heat and drought seasons.

Crenshaw was not entered into the 1989 NTEP National Bentgrass Test. Until the results from the 1994 plantings are published, there is no NTEP data for either Crenshaw or its sister, Cato.

Cato — Like its sister, Crenshaw, Cato was developed by Drs. Engelke and Lehman at the Texas Agriculture Experimental Station in Dallas. Cato produces a fairly fine textured, dark green turf, while exhibiting more Dollar Spot resistance than Crenshaw.

Southshore — Dr. Reed Funk at Rutgers University and Dr. Richard Hurley of Lofts Seed Company developed Southshore after collecting hundreds of plant materials from the Mid-Atlantic states. Southshore's 200 plus clones exhibit a medium green, medium textured growth with Brown Patch resistance. Although test plots of Southshore have been planted alongside the NTEP bentgrass trials at Rutgers, Southshore was not entered in the 1989 NTEP National Bentgrass Test.

The Future — No longer does the golf course superintendent need to settle for just one choice of bentgrass. It appears that there will be many more new varieties released over the next several years. Many of these varieties will need to be looked at very carefully to determine their range of adaptation, disease tolerance, management requirements, and their durability under play.

Not all of these new varieties have been entered into the NTEP's. Great caution should be taken when reviewing non-NTEP research data.

Not all of these new varieties have been entered into the NTEP's. Great caution should be taken when reviewing non-NTEP research data. With more and more varieties appearing in the marketplace each year, first-hand knowledge may be the best way to select your next creeping bentgrass.

The challenges facing the seed industry are similar to those facing the superintendent. We are working to provide creeping bentgrasses that require less mechanical management, fewer irrigation, pesticide and fertilizer inputs, while providing excellent playing surfaces. Our work has only just begun.

Credit - "The Reporter", 8/95

The Life of Mr. G. Penncross

by Anna Joelsson Softing
Chalmers Golf Club, Sweden

(Ed. Note: Anna Joelsson Softing, head greenkeeper at Chalmers G.C., Sweden, with a little story about the life of a creeping bentgrass seed.)

It all began when I, a little seed, was born. I was a "test-tube" seed and was made in a huge clean and hi-tech laboratory in Pennsylvania, USA. They gave me the name Greg Penncross and I got four stars (out of five) in the quality seed ranking list.

Flown over the Atlantic Ocean

My childhood was traumatic, just the fact that you are totally unaware of your origin can be confusing to a little seed. My upbringing was also demanding due to the fact that everyone wanted me to mature without delay so that they could keep the generous government and company contributions. At an early age I was considered mature enough to move away from my surrogate family which was growing on the turf. Without any warning came a big machine, which smelt horrible from diesel, and ran over my family turf. All over the neighborhood seeds were being separated from their families. Between hard and cold metal rollers I and millions of my seedfriends were thrown into a huge sack without mercy. After that they put us on a big white Concorde, (disappointingly economy class), and we were flown to a little country called Sweden and an ever smaller peasant village called Landvetter and taken to a big and famous club called Chalmers GC. We had just arrived when we were thrown into a dark and humid room with other species of grass seeds.

But just because I had a rough start in life, doesn't mean I'm racist. Hell no, they are also seeds although they aren't as green and pretty as me.

The life on a golf green ain't easy

In this little room time passed slowly and I was kept alive only with the little food storage I had under my seed shell. But suddenly one gloomy afternoon someone came and carried us out into the open, put us on a jumpy and small vehicle and drove away with "full speed ahead". You had to hold on tightly! The storage packing was torn open with haste and I saw the light of day again.

The golf balls that rolled over my backside also gave a thrilling feeling

Pale white working hands picked me up and raised me to the blue and white sky so impatiently that I almost fell off and the owner of the pale hands said to me: "Be a good sport, grow, get strong and make a family." She fed me well so that I would enjoy my life here. But the life on a golf green is not easy. My feet are always cold and the air is always filled with huge and horrible golf balls which can exterminate whole families if you've run out of luck. And still, this isn't the whole story — daily, heavy and overweight people step right on me with shoes full of spikes big as Indian totempoles.

Other terrible things

Every morning Anna (one of the older families on the golf green told me her name) comes along with her big Ransomes greensmower and cuts my top off. You also have to cope with steel blades which cut down beside you, you better watch your feet! And if that isn't enough they throw sand right on you and bury you so deep that you sometimes have trouble breathing. After that they usually drag a steel net over my shoulders to even the sand or as I say just for the fun of it, the wicked people!

Cheering and swearing

But life wasn't all pain and misery — daily these golfers checked me over and with admiration in their voices said: "Look at him, girls, he's so good looking and green, much more handsome than the guy that was here last year." The golf balls that rolled over my backside also gave a thrilling feeling, and then I heard cheering and occasionally a bad word.

The most beautiful grass in the world

In this environment I grew big and strong and time passed on. It became even colder and inhospitable. Anna gave me less and less to eat, the golf balls and the nailshoes stopped showing up and my top was cut less frequently, stopping completely in late October. And suddenly the weather changed and it got really unbelievably cold and it started to snow and this continued for what seemed

My feet are always cold and the air is always filled with huge and horrible golf balls

forever. Anna came and checked on me occasionally but she never brought any food. Now I had come to the stage in both mind and life that I just didn't care anymore. And one day after heavy rain the temperature dropped and the water froze to ice. I began having trouble breathing, and felt more and more weak for every hour that passed. When I had come to the point where I had given up, I felt the pressure over my chest easing. The ice began to melt and the temperature rose. Anna came with some refreshments and one day she came with a sack that I recognized. New seeds were spread out and right beside my right side a blond and well developed little seed landed. She was called Emerald Pennlink.

It's spring once again — the golfers return, life is great — and the rest I'll leave to your imagination.

Credit: Greenkeeper International, official publication of the British & International Greenkeeper Assoc.