The Andersons Contec® Fertilizers Meet Your Needs – Inside and Out!

Contec® is The Andersons homogeneous, small-particle, controlled-release fertilizer technology. Contec® controlled-release fertilizers have been created specifically to deliver performance in a wide range of soil, pH, turf types and climatic conditions.

The reasons for Contec® working under these varied conditions are:

- Within each Contec® product is several degrees of solubility to choose based on the percentage of methylene ureas. The Contec® methylene ureas contain shorter chain MDU and DMTU within the WSN portions. What this provides to the turf manager is more efficient nitrogen use by the plant, a low salt index and greater safety to the turf.

- Smaller particle sizing (average SGN of 80 to 90 for greens formulations and 140 to 150 for fairways) provides greater flexibility on nitrogen rates from spoon feeding to full-rate applications. The turf manager can customize his application rates based on the residual he desires.

- Average Uniformity Index of more than 50 to assure even distribution of nutrients across the spreader pattern. (A Uniformity Index of 35 is considered acceptable.)

Additional benefits to Contec® fertilizers:

- Homogenous composition for maximum uniformity even at low rates. What this means is that the analysis on the bag is present in each and every particle on the turf.

- More free-flowing particles per square inch. Contec® provides approximately 35 particles per square inch compared to 18 particles per square inch for standard greens fertilizers.

- Reduced tracking and mower pick-up. This is especially important with many of today's new turf types.

- Significantly lower potential for leaching

- Greatly reduced possibility of volatilization

The Andersons formulate eight Contec® products, all using potassium sulfate, designed to address varying climactic, nutritional and application situations.

From North, South, East and West, and from dry conditions to soaking wet, you can count on The Andersons to have the right product for every need. Innovative technologies from The Andersons are a high priority as you will see in the years to come.

Article contributed by Steve Dearborn, Andersons Territory Manager.

Greens Formulations

- 9-18-18 w/18% Methylene Urea + 4% Ca and 2% Mg
- 13-2-26 w/100% Methylene Urea
- 17-3-17w.50% Methylene Urea + Fe and Mn
- 18-9-18 w/63% Methylene Urea + Fe and Mn
- 19-2-15 w/100% Methylene Urea & Minors
- 19-3-19 w/100% Methylene Urea.
- 20-0-10 w/75% Methylene Urea & 5% Mn

Fairway Formulation

- 22-3-11w/98% Methylene urea + Fe And Mn

Andersons™ GOLF PRODUCTS

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TABLE 1

Entry	1993-95 Quality	1993-95 Brown Patch	1997-00 Quality	1997-00 Brown Patch
Rembrandt			6.3	6.6
Plantation			6.2	6.3
Millenium			6.2	6.3
Dynasty			6.1	6.3
Shenandoah II			6.0	6.3
Masterpiece			6.0	6.3
Scorpio			6.0	6.3
Crossfire II	5.9	6.1	6.0	6.6
Coyote	5.9	5.9	6.0	6.1
Arid 3			5.9	6.4
Jaguar 3	6.0	6.9	5.9	6.7
Olympic Gold			5.9	6.6
Mustang II			5.9	6.4
Tarheel			5.9	6.6
Southern Choice	5.9	6.1	5.8	6.1
Durana			5.8	6.5
Wolfpack			5.8	6.5
Genesis	5.9	6.3	5.8	6.1
Empress	5.8	6.1	5.8	6.0
Renegade	5.8	6.2	5.7	6.2
Coronado	5.8	5.8	5.7	5.8
Tulsa	5.8	5.9	5.7	6.0
Shenandoah	5.6	6.3	5.7	6.2
Duster	5.8	5.8	5.7	5.9
Safari	5.7	6.4	5.7	5.7
Sunpro	5.7	5.4	5.7	5.7
Regiment	5.7	6.2	5.7	5.7
Falcon II	6.0	6.3	5.6	6.2
Finelawn Petite	5.9	6.2	5.6	6.0
Marksman	5.8	5.9	5.5	6.1
Shortstop II	5.7	5.8	5.5	5.2
Titan II	5.7	6.1	5.5	6.1
Leprechaun	5.6	6.1	5.5	5.9
Bonsai	5.5	5,1	5.3	5.6
Arid	5.3	6.2	5.0	6.3
KY-31 w/E	4.4	6.5	3.9	6.3
LSD*is 5%	0.1	0.5	0.1	0.6

*(LSD stands for Lowest Statistical Difference)

Top-ranked and varieties common to both trials shown. Overall means are shown but varietal performance varies by location, year and management. This data should only be used for comparison between the trials not for varietal recommendations in specific locations. Quality for 1997-2000 trial is from 28 locations and from 48 locations in 1993-1995. Brown patch '93-95 from 16 locations and 15 locations in '97-00. The comparison of tall fescue cultivar quality and brown patch were done on varieties rated in the 1992 and 1996 NTEP trials.

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fescues and the difficulties in finding resistance genes in many crops to this disease may explain the slow progress in identifying stable, consistent resistance.

Hexaploid species

Tall fescue is a hexaploid species, which means it has three distinct sets of chromosomes, one set similar to that in perennial ryegrass and the other two sets from another related species.

Andy Hamblin of the University of Illinois is currently working on identifying resistance genes for one strain of brown patch using crosses between a resistant X and a susceptible parent. Then the progeny are crossed to each other to create an F2 population. The F2 population was normally distributed with a population mean of 50.4 percent overall disease severity. The range of values within the population was 15 percent to 88 percent disease severity, so it segregated for resistance. From these current results, this population suggests additive inheritance and is likely controlled by several genes.

They will confirm this with work by comparing it with an F2 derived F3 population (Hamblin, 2002). In rice, using a similar population, Prinson (2002) identified 15 genes for Rhizoctonia resistance. Rouf Mian of The Noble Foundation (2002) has been working on developing genetic markers for tall fescues that may enable breeders to use comparative genomics between tall fescue and other grasses and cereals to find resistance genes.

In many species, it has proven difficult to find stable, effective genes for rhizoctonia resistance, so genetic modification by insertion of chitinase, glucanase and ribosome inhibitor protein genes have been attempted (Stricklen,1998, Feng and Li, 2002). Long-term stable resistance against the many forms of this disease will continue to be a focus of breeding programs.

Additional diseases that continue to need improved resistance to are pythium blight, helminthosporium net blotch, gray leaf spot and stem rust in seed production. Pythium blight can be especially devastating to young turf when warm, wet weather occurs and is more severe with high nitrogen and high seeding rates. Older turf can also be damaged under similar conditions. Helminthosporium net blotch can be damaging to young turf when cloudy, cooler weather occurs.

On mature turf, it rarely kills the turf but it

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can weaken it. It is particularly damaging when the turf is growing slowly from spring to fall, especially in mild winter areas. Some of the dwarf types, without winter-active growth, show the most damage from net blotch and it can be the most serious disease in areas of the Western United States.

Other diseases

Gray leaf spot can also devastate young stands of tall fescue in the Southeast. There appear to be more varieties with resistance to this disease than in perennial ryegrass, so this resistance may come from the other genomes. A. Hamblin (2002) is also studying resistance to this disease and trying to identify genes responsible for resistance. Stem rust continues to be a problem in seed production.

It is important to have varieties cycled for improvement in seed production so resistance can be improved with reductions in fungicide use for seed production.

One of the major problems of tall fescues for many uses has been its slow recovery from injury and the tendency to become clumpy or bunchy if not overseeded. Sod-forming grasses that produce rhizomes or stolons often maintain greater density and recover from injury more quickly than bunch-types grasses (Turgeon, 1985).

Traditionally, tall fescues have been considered bunch grasses but as early as 1958 Porter documented rhizomes in tall fescues. Jernsted and Bouton (1985) established that the most common rooted stems in tall fescue are morphologically and anatomically equivalent to rhizomes of Kentucky bluegrass. Development of turf-type tall fescues with the potential to produce rhizomes has received attention from some breeders both in the United States and overseas, and it was noted that certain varieties developed using varying selection pressures produced significant amounts of rhizomes. Grande, for example, shows about 65 percent rhizomes as spaced plants and sod growers note it seems to knit faster.

Alan Stewart of Pyne Gould Guinness in New Zealand developed a highly rhizomatous tall fescue from European material that has principally been used as winter-active forage in the United States. Barenbrug has released a variety also developed from European material called Labarinth for turf usage. The rhizomatous characteristic is only one criteria for selection of varieties and resistance to stresses and diseases commonly found in tall fescue use areas must also be evaluated. Seed Research of Oregon has continued to use rhizomatous material in its breeding program. SR 8600 has 55 percent rhizomatous plants, Crewcut II has 65 percent, and 100 percent of the parental plants of Grande II have rhizomes.

The breeding program at Advanta Seeds Pacific has seen an increase in the number of plants with rhizomes based on selections for survival when grown in a heavy clay acid soil subjected to drought and mowing pressure. Other breeders have been using this screening method and their populations may also see an increase in rhizomatous types. Care must also be taken that the tall fescue plant does not sacrifice turf density in favor of rhizome production. Identification of genes responsible for this important characteristic would make inclusion of it in new varieties easier.

One of the traditional advantages of using tall fescues has been drought and heat tolerance. For tall fescue to demonstrate these characteristics, there must be adequate soil moisture prior to the stress to enable the tall fescue to establish a deep root system, plus adequate soil depth for this root system.

Dwarf varieties

Some of the newer dwarf varieties have been observed to not have the stress tolerance of older material and reduced root systems have been observed in some varieties. Drought avoidance can also be influenced by mowing height, nitrogen rates, soil permeability and any previous stress.

Different techniques are being examined to retain and improve the drought avoidance (and possibly increase true drought resistance) in tall fescues. Huang and Gao (2000) studied root physiological characteristics in six cultivars of tall fescue as they underwent drought stress. Rebel Jr. had increased root mortality and reduced water uptake in both soil layers as the soil dried, while Kentucky-31 had the least root mortality.

Ronny Duncan, professor of plant breeding and biotechnology at the University of Georgia, grew tall fescues in acid, clay soils with cycles of drought and mowing stress to select material with reduced leaf firing and less water use during drought cycles (Duncan and Carrow, 2002). This has led to the development of varieties such as Southeast, Tulsa II and Greystone by Duncan and other breeders through cooperative work.

Further work on the mechanisms associated with improved drought avoidance and true drought resistance may enable reduced water use by tall fescue without a reduction in turf quality.

Winter-active growth is another characteristic that would enable tall fescue to be used more extensively. It would enable it to be used more in the Pacific Northwest, where slow winter growth allows *Poa annua* to invade. Many of the initial dwarf varieties were day-length-dependent dwarfs with reduced growth primarily during times of year when day length was shorter. In other environments, we still need improvements in cold tolerance, especially when the turf is young. Quicker establishment, especially when soil temperatures are lower, would improve the usefulness of the species.

Incorporation of improved endophytes into turf-type tall fescues continues to be important in many breeding programs. In some areas of the country, the endophytes have demonstrated less importance in tall fescue than they have in ryegrasses and fine fescues. The alkaloids produced by the endophytes help in resistance to stem and leaf feeding insects such as chinch bugs, billbugs and cutworms. In certain tall fescue/endophyte combinations, improved nematode resistance has been observed.

Additionally endophytes have been shown to improve stress resistance in many environments, with endophyte-containing plants growing more vigorously during heat and drought stress. In the most stressful environments where breeders collect germplasm, it's almost always infected. The presence of the endophyte in the straw from seed production fields can effect the ability to market this so some growers prefer varieties without endophytes.

Care must be taken that an endophyte-containing turf-type tall fescue is used to plant an area where the family horse may graze. Recently, endophytes that do not contain the alkaloids that cause animal problems but retain other benefits have been incorporated into forage tall fescues.

It may be beneficial in the future to use these types also in turf-type tall fescues. Identification of endophytes that provided resistance against root feeding insects would be a valuable contribution.

In all improvement projects, breeders must balance different goals and different markets. Seed production goals must be balanced against turf goals. Cycles of improvement in one environment for certain characteristics need to be followed by additional cycles in other environments. If you examine a map of where tall fescue is used as a turfgrass in the United States, it's one of the most extensive.

During cycles of heat and drought, the area tends to expand. Different regions and different management will require unique cultivars. It is important to utilize regional data from the National Turfgrass Evaluation Program to help in decision making or data from other local trials.

Brilman is director of research for Seed Research of Oregon.

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New Construction Method May Reduce Pollutant Runoff

By David M. Casnoff

Within the past 10 years, several pesticide, fertilizer and water restrictions have been placed on turfgrass managers. As a result, many in the industry are looking at alternative construction ideas to help superintendents meet those restrictions without placing an undue burden on them.

My company has devised the Pennfield system, a construction method based on the concepts of reduced water use, increased use of recycled natural resources and reduced pesticide inputs. The company has research in the works and hopes to report the full results soon — but the initial feedback has been potentially promising.

Actions in Maryland resulting from a scare over pesticide and chemical runoff into the Chesapeake Bay sparked my interest in developing such a system. I was also intrigued when Maryland Governor Paris Glendening had some pointed comments directed at the golf course and other turf industries, specifically in the area of environmentally sensitive use of fertilizers on large turfed areas such as golf courses. Understanding that superintendents were doing the best they could with current construction methods, I wondered whether there might be a better way. This was the impetus for study of the Pennfield System.

Strides being made

There is an effort in the irrigation industry to develop new technologies to reduce water use, and many companies have made great strides in this direction. With the onset of drought conditions showing up across much of the United States, this has become a major priority.

In some areas, drip irrigation systems can reduce water use by half. In fact, research done by Bernd Leinauer revealed water use on subsurface-irrigated research plots was shown to be 90 percent to 95 percent less than on sprinkler-irrigated plots.

These subsurface-irrigated plots also had root masses greater at lower depths than those irrigated with conventional sprinkler systems.

If these systems could be used on golf courses, they could make a great contribution to water savings. In addition, use of composted manures and watering systems that can introduce water below the surface and keep the soil surface and turf thatch layers less hydrated could help in the reduction of disease and reduce the use of pesticides. That's why my company decided to build on the existing success of subsurface irrigation systems in the creation of the our new system.

What is the the Pennfield system?

The Pennfield system is a field construction method that uses the concepts set up by the Purr-Wick System developed in 1966. It combines older and newer technology developed in recent years. The components of the system are:

- A pond liner to allow water to be collected from irrigation runs or ambient rainfall. The liner is a low-volume polyethylene product that is lightweight and durable.
- A subsurface irrigation and a subsurface aeration delivery systems (in this case provided by Precision Porous Pipe, a division of Colorite Plastics), including a regenerative blower used to force air through the soil profile.
- A flat pipe drainage system (donated by Advanced Drainage Systems) that is used not only to drain the soil but also as the main component in recycling water resources.
- A micro-injection unit to inject pesticides, fertilizers and soil amendments at precise rates, and a recycling pump unit to help recycle water from collection tanks back to the field or green (donated by Moyer & Sons).
- A soil mixture developed for the Pennfield System which contains 85 percent sand (USGA specifications), 12 percent Canadian sphagnum peat, and 3 percent aerobically composted turkey manure.
- A moisture monitoring and valve control system (provided by Adcon Telemetry) and the software to completely run the guts of the Pennfield system.
- A conventional part of the irrigation system that will be used to supplement the subsurface system during the most stressful times during the year if needed and to help in the cooling process through syringing and the watering-in process for

TABLE 1

Physical characteristics of each of three soil profile/air treatment combinations.

	Sustane with Forced Air	No Sustane with Forced Air	Sustane No Forced Air	Well-Drained Greens – Ideal values
Infiltration Rate (in/hr)	15.96	11.15	6.35	6 to 10
Subsurface Air Capacity (Non Capillary Porosity)	29.07%	26.58%	23.43%	~ 20%
Water Porosity (Capillary)	18.15%	16.53%	20.86%	15% to 20%
Bulk Density (g/cc)	1.31	1.40	1.37	1.40 to 1.50
Water Holding	13.82%	11.83%	15.22%	10% to 15%
Organic Content _ to 1 in.	0.85%	0.42%	0.72%	1.5 to 2.5%
Organic Content 1 to 2 in.	0.72%	0.66%	0.67%	1.0% to 2.0%
Organic Content 2 to 3 in.	0.62%	0.72%	0.77%	0.5to 2.0%
Organic Content 3 to 4 in.	0.75%	0.69%	0.79%	0.5% to 1.5%
Root Mass	_ in.	5/8 in.	_ in.	At least _ in.
Feeder Roots	Medium at 3 in.	Sparse at 3.5 in.	Sparse at 3 in.	At least 3.5 in. – medium density

DATA GENERATED BY THE INTERNATIONAL SPORTS TURF RESEARCH CENTER LOCATED IN OLATHE, KAN.

topically applied fertilizers, pesticides and other chemicals.

Future applications for the Pennfield system are golf greens and tee complexes and high-end sports fields. Parts of the system have been used successfully in park and recreation sports fields as well as high school practice fields.

Potential benefits

The potential benefits of the Pennfield system are being studied as part of a research project being established in collaboration with faculty at Pennsylvania State University. Mike Fidanza at Penn State's Berks Campus is the principal investigator on this project. The intent is to support undergraduate and graduate student education and faculty input, to develop research projects that will investigate environmentally sensitive methods of constructing, and maintaining turfgrass stands for golf courses.

Areas of research will include:

- potential water savings and more efficient use of water resources including gray water;
- reduction of fertilizer inputs;
- possible reduction of amounts and more efficient timing of pesticide applications; and
- reduction of human contact of pesticides with the use of microinjection systems used in conjunction with subsurface water delivery systems.

As the research progresses, other areas of interest will be identified and studied.

Methods and materials for greens

Construction of the Pennfield golf green starts in much the same way as a California green or a USGA green. An experienced excavator will create a subgrade that will mirror the grade of the surface. The depth of the subgrade will be 12 inches throughout the entire profile. Edges of the green should be tapered so as not to have an abrupt transition from the green to the approach.

The piping for the recycling system is installed. Pipes will be connected to collection tanks that gather water from irrigation runs and ambient rainfall.

Once the excavation is done, the low-volume polyethylene liner is installed. This type of liner is easy to work with since it is lightweight and durable. Holes can be cut into this material to accept pipes for irrigation, aeration and drainage. The holes are then sealed using a material specifically made for this process. The irrigation, aeration and drainage systems are constructed on top of the liner.

At this point the air blower is attached to the air delivery system. The air blower that is used is a 2.5 horsepower regenerative blower that has the maximum capacity to deliver

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The small diameter pipes combine the subsurface irrigation and air delivery components of the Pennfield system. The white, flat pipes provide drainage and help recycle water from rainfall and irrigation cycles.

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160 cubic feet of air per minute through the system.

The last pieces of equipment to be installed are the weather station and the water moisture monitoring equipment. These tools are used to help schedule irrigation runs as well as to measure environmental data to help develop the most effective scheduling of fungicides. The software will be used to develop disease models and irrigation schedules. It also controls the valves involved in the subsurface irrigation system, the forced air system and the recycling and micro-injection systems.

It is better to keep everything under one software program to keep things as simple as possible.

Preliminary results and future research opportunities

The first study performed on the green was turfgrass establishment rates for each of the three soil/aeration treatments. Before seeding the plot which contained 85 percent sand and 15 percent Canadian sphagnum peat, a 10-10-10 fertilizer was used to apply .75 pounds N-P-K. Fertilizer was worked into the top 2 inches of the soil profile. No fertilizer was used in the other two treatment areas that had Sustane 2-3-3 in the soil profile.

The green was seeded to five different varieties of creeping bentgrass varieties, including Crenshaw, Cato, Dominant, A4 and G1. The varieties were seeded May 16, 2001, at 1 pound per 1,000 square feet. An 18-24-12 starter fertilizer was used on the 85/15 section of the green at .25 pounds of nitrogen per 1,000 square feet, and was applied the day of seeding and every two weeks for the first 45 days. No supplemental fertilizer was put on other areas of the green that contained the Sustane 2-3-3 in the soil profile.

Several preliminary observations were made for the forced air treatments both for temperature and disease incidence. These two observations are presented as points of interest and will need to be studied in replicated trials to provide evidence that these observations are valid.

The first and most important observation in terms of its implication that the area treated with organic fertilizer did significantly better than the plot that did not, as measured in the number of tillers per plant.

The second major discovery was the major reduction in dollar spot incidence in Crenshaw creeping bentgrass when air is forced through the soil profile.

The results show that the dollar spot incidence is reduced significantly in the forced air treatments as compared to the treatment without forced air.

The plot with no Sustane and forced air through the profile has slightly more dollar spot lesions as compared to the plot with Sustane and forced air through the soil profile.

The other observation was the apparent increase in soil temperature of the soil profiles where air is being forced through them. In Fig. 10, snow is melted from the areas where air is forced through the soil profile. A sharp delineation is seen between plots with air and no air treatments.

Table 1 shows the physical characteristics of each of the three soil profile-air treatment combinations, six months after seeding. Once data has been collected over several years, some greater understanding of these initial observations will be realized. Nonetheless, these initial observations are still quite interesting.

As environmental restrictions continue to evolve throughout the country, we believe the potential benefits of this and other environmentally sensitive construction and maintenance methods will become apparent.

Casnoff is president of Casnoff-Austein-Casnoff Associates, a turfgrass consulting firm in Davidsonville, Md.

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