Spring and summer are known for their sudden violent thunderstorms and local flooding. In addition, Florida averages temperatures in the mid to upper 90s for half of the year. Central Florida is knows as "The Lightning Capital of the World" which wrecks havoc with electrical, computerized, and time systems. On top of all of these variables, Florida is in a prime tropical storm and hurricane zone."

The hurricanes of 2004 hit hard in Winter Springs. Charley came first, with the eye of the hurricane right over Central Winds Park. Charley featured sustained winds of 120 miles per hour and gusts ranging from 135 to 140 miles per hour. The scoreboards came down and the light fixtures were damaged. The exteriors of the buildings sustained significant damage. A brick wall came down in the dumpster area. Clay from the ball fields washed onto walkways and into the turf.

"Hurricane winds keep changing directions," says Pula. "That's what caused the greatest damage. Trees were twisted and pulled completely from the ground."

Armed with chain saws, Kimball and crew were joined by Greene and Pula and every available department member to attack the damage. They learned the meaning of hangers (a limb ready to fall) and leaners (a tree leaning a certain percentage from the root base). And they dealt with debris, branches, treetops, and entire trees pulled from the ground with root masses of 14 feet and greater on top of the turf. Buildings were checked for structural damage. Electrical power was out throughout the city. The concession stand, run by generators, became a food station for the masses of workers from the police and fire departments, the parks and recreation staff, and the public.

"Public safety was our primary concern," says Greene. "People sought Central Winds Park as a place of refuge. With massive damage and power out at their own homes, our staff was on the job committed to opening community parks as a place to seek respite in recreation. While other communities were using their athletic fields as open space to pile debris, the City of Winter Springs opted to preserve that resource to serve the community."

Then Frances came and lingered. For two days the force of this hurricane pelted the city with winds and pounding rain. Hangers that hadn't yet been cleared fell; leaners toppled; trees undamaged by Charley were uprooted. Power, finally restored, was gone again. And the crews, still fighting the aftermath of the first storm, attacked the debris even harder.

Unthinkable, but very real, Jeanne came next. Once again the winds and rains attacked. Greene says, "With the already saturated conditions, this storm posed threats of residential flooding. The City offered the location in front of our park as a site for filling sandbags. The initial plan was to dump the sand, drop off the bags, and let people fill what they needed. By 7:00 am, with the first 3000 bags dropped off and the sand yet to appear, Tina was already facing a lineup of cars and lots of concerned and anxious people. We rallied the staff and, once the sand appeared, started filling bags for organized pickup. Between 7:30 AM and 6:00 PM, we'd handed out 12,000 sand bags."

Hurricane Ivan, though initially threatening, took an altered route, sparing the city. The cleanup work continued. Tired, facing the damages and outages at home, the staff was on the job. Plagued by heat and swarms of mosquitoes, they systematically tackled the cleanup. Their first concern was removal of debris that might endanger park visitors. They then moved additional debris away from public zones. This debris was stacked and hauled away to a dedicated mulching site. In addition, they tackled the regular workload and general operations to keep the park open and the fields in playable conditions.

Pula and Greene focused on the mounds of paperwork, the precise tracking and reporting of cleanup efforts necessary for the financial reimbursement to help offset the incredible outlay of resources. With three separate hurricanes, the details as related to each must be recorded down to the GPS position of the fallen trees, the record of precisely how each cleanup worker's time was spent, the engine cc and horsepower as well as the type of each piece of equipment used, what it was used for, and for what period, and even the cubic yardage of the debris.

In the end, over 90 trees were lost in Central Winds Park, with a total of 200 trees lost throughout the park system. That doesn't include the leaners, or the 300 or so trees with significant hangers. Just clearing the debris from the fields and other grass areas throughout the parks so the turf could be mowed was a massive task.

"Our incredible staff pulled together throughout it all," says Pula. "It was through their commitment and dedication that we were able to keep the park open and safe in spite of the humbling experience of the forces of the storms. Central Winds Park is truly a place for the community as a whole to come together. Through the top-notch sports programs and events at Central Winds Park, the City of Winter Springs is able to stay a close-knit community.

Suz Trusty from Trusty & Associates is a member of our Editorial Advisory Board. She can be reached at suz@trusty.bz.

Ohio State Turfgrass Research Field Day update

BY **PAMELA J. SHERRATT, DR. JOHN R. STREET, & DEB HOLDREN**

Here is a recap of presentations made before hundreds of turf managers last summer in Columbus. Please note these research results are, in many cases, preliminary results that have not been peer-reviewed and published yet:

Establishment Rate, Wear Tolerance & Recuperative Potential of Athletic Field Grasses. The aim of this study was to evaluate traditional and non-traditional athletic field grasses on a native soil and subjected to medium-high maintenance (irrigated, fertilized, aerated, and mowed). The plots were subjected to simulated traffic/wear (25 games in the fall of 2003 simulated a Midwestern high school varsity football field). Germination and establishment rate varied among treatments. First to establish (in order): Festuloliums; perennial ryegrass; tall fescue; bluegrasses. Quality, wear tolerance, spring green-up and recuperative potential are ranked 1-9, with 1 representing poorest and 9 representing best. Percent rhizome activity was assessed spring 2004 by taking a known sample from a plot and isolating plants that had rhizomes. The study is being repeated in 2004. Preliminary results can be seen in Table 1.

Table 1: Characteristics of Traditional and Non-Traditional Cool Season Grasses for Athletic Turf

Cultivar (s)	*Quality 15 WAS†*	*Traffic tolerance*	*Spring green-up*	*Rec. potential*	*Percent rhizomes*
Labarinth tall fescue	7.1	3.0	4.3	6.1	10.0
Grande II tall fescue	8.6	5.8	5.6	7.5	11.0
Thermal Blue bluegrass hybrid	7.6	6.1	4.6	7.1	29.6
Orfeo Kentucky bluegrass	7.1	4.6	4.6	6.0	28.3
Aberelf + SR4420 (50:50) Perennial ryegrass blend	9.0	6.3	6.6	7.8	-‡
Spring Green Festulolium*	5.0	3.6	4.6	5.3	-
Barfest Festulolium*	5.0	3.0	5.3	5.3	-
Showcase Kentucky bluegrass + SR5100/SRX5961 fine fescues	7.1	4.3	4.3	6.1	28.3
Nexus Perennial ryegrass	8.6	5.8	6.3	8.3	-
Rendition tall fescue	8.3	5.6	6.0	7.6	6.0
Titan Ltd., Kittyhawk 2000+ Rendition (3-way tall fescue blend)	8.3	4.3	5.0	7.1	13.0
Winter Active Fescue (WAF)	9.0	5.0	5.3	7.1	12.3
Grande II tall fescue + Rugby II Kentucky bluegrass (80:20 mix)	9.0	6.0	6.3	7.3	23.0
Rugby II Kentucky bluegrass + Renaissance perennial ryegrass (80:20 mix)	8.8	6.1	5.6	7.5	6.0
Barlennium perennial ryegrass	9.0	6.5	6.6	8.1	-
Bariris Kentucky bluegrass	7.6	7.6	5.3	7.8	33.0
LSD (0.05)	0.5	1.6	1.9	1.0	9.5

† 15 WAS denotes fifteen weeks after seeding
‡ Data not collected from Perennial ryegrass or Festulolium cultivars
*Festuloliums are not considered "turf" grasses at this time, they are used as forage grasses.

New Insecticides for Turfgrass Management. Dr. David "Bug Doc" Shetlar says over the next year, there will likely be one to two new neonicotinoid (same category as Merit = imidacloprid) insecticides registered for turf use. Syngenta is still working on registering thiamethoxam (=Meridian) for turf after getting Flagship registered for nursery and greenhouse ornamentals. A new company, Arvesta, has Clothianidin, which they are registering, as Arena. These new compounds appear to have slightly broader spectra of activity (Arena kills caterpillars quite well) or they work faster (Meridian and Arena control ants in 3-4 weeks compared to Merit that takes 6-8 weeks). You can also expect some combination products this next season, mainly mixes of neonicotinoids with pyrethroids, which improve rapid knockdown of surface insects.

Bermudagrass Management for the Cool-Season Zone. Bermudagrass use in the Midwest has been limited mainly due to poor low temperatures hardiness, delayed spring green-up and early loss of color in the fall. Discoloration is reported to typically occur at soil temperatures below 50 degrees F and persists until soil temperatures rise above this level in the spring. One aim of this study was to look at how covers can be used to improve winter survival and spring green-up. The two seeded cultivars were Yukon & Riviera. Their performance was similarly affected by the covers. See Table 2 for preliminary results.

Foliar Feeding & Dollar Spot Incidence. Initial research has shown a positive relationship between foliar feeding and turf performance/disease incidence. Foliar feeding in preliminary OSU research appears to significantly reduce the severity of dollar spot when compared to less frequent but equivalent monthly nitrogen rates of granular fertilizers.

In this study, there are four sources of nitrogen (both granular & foliar) and four rates (0.175 lb. & 0.25 lb. N/M weekly and 0.35 lb., and 0.50 lb. N/M biweekly). In addition, the study includes fungicide treatments, full rate and half rate Daconil Ultrex at 30-day intervals and a non-fungicide treatment. The fertilizer treatments were initiated on May 7, 2004 and fungicide treatments were initiated on May 11, 2004. Turfgrass quality ratings are being taken every 2 weeks and dollar spot ratings are being taken during major outbreaks.

Results to date: On September 14 (89 days without fungicide) the 0.25 lb. N weekly rate liquid treatments exhibited no dollar spot present.

Influence of Sand & Rubber Infill Mixtures on

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www.oners.ims.ca/2917-150

Sports Turf Managers Association

Table 2: Percent Bermudagrass Green Cover Affected by Cover Treatments

	% Bermudagrass Cover			
Date	*NO COVER*	*STRAW*	*GEOTEXTILE*	*EVERGREEN*
April 10	0	5	30	50
April 20	30	50	60	75
May 1	50	80	80	80
May 20	50	95	95	95
June 11	80	100	100	100

† 15 WAS denotes fifteen weeks after seeding
‡ Data not collected from Perennial ryegrass or Festulolium cultivars
*Festuloliums are not considered "turf" grasses at this time, they are used as forage grasses.

Table 3: Fungicides vs. red thread, rust

	% plot blighted by red thread **				% plot blighted by rust **
Treatment, formulation, and rate per 1000 sq ft	**May 12**	**May 21**	**May 29**	**June 6**	**July 11**
Untreated	5.0	8.3	15	13.3	16.7
Medallion 50WP 0.25 oz	5.3	1.0	5.0	3.0	43.3
Medallion 50WP 0.33 oz	6.7	3.0	1.7	2.0	33.3
Medallion 50WP 0.5 oz	4.0	2.3	1.0	0.7	26.7
Cuprofix MZ 30 42DF 6 oz	3.3	0.3	0.0	0.0	16.7
Bayleton 50DF 0.5 oz*	3.3	2.3	0.7	0.0	3.0
Heritage 50 P 0.2 oz*	3.3	0.0	0.0	0.0	13.3
Bayleton 50DF 1 oz*	6.0	1.0	0.3	0.0	4.7
Endorse 2.5WP 4 oz	3.7	0.0	0.0	0.0	7.3
LSD0.05	2.5	2.5	4.2	3.4	19.2

* A single application was made on 8 May.
** Ratings are visual inspections of plots to determine % plot area blighted by red thread (0 = no disease and 100 = entire plot diseased).

Surface Hardness & Temperature. Currently there is only one hardness standard for synthetic turf systems. ASTM requires that average Gmax (hardness) be less than 200. Companies installing high sand to rubber ratios typically guarantee that Gmax values will not exceed about 175. Companies installing 100 percent rubber infill systems usually warranty that Gmax won't exceed 135. Low sand to rubber ratios are warranted at about 150. Synthetic turf system research at major universities is attempting to determine what is a safe Gmax threshold value.

In addition to surface hardness evaluation, this study is assessing the effect that irrigation can have on controlling surface temperatures. On natural turf, the turf canopy temperature seems to mimic the ambient air temperature. Thus, if air temperature is 85F, then the turf canopy is also 85F. If natural turf is lightly irrigated (syringed), the canopy temperature decreases by about 10F for 30-60 minutes, whereby it returned to the original temperature. On artificial turf (infill), the canopy temperatures were in the range of 110-120 degrees F when ambient air temperature was 85F. When syringed, the infill canopy temperature decreased by 30F for 30-60 minutes, whereby it returned to the original temperature.

Bentgrass Removal in Kentucky Bluegrass Turf. Dr. T. Karl Danneberger & Robert Kerr say the product being used in the experiment is an experimental herbicide (Mesotrione) from Syngenta. The project was to see if the Mesotrione could remove creeping bentgrass from Kentucky bluegrass turf without affecting the Kentucky bluegrass. Treatments were applied July & August 2004. Some of the applications were made sequentially, which proved to be the most successful way of controlling the bentgrass. At the time of the field day, the results suggest that there was approximately 50-70 percent decline in the bentgrass.

Fungicides for the Curative Control of Red Thread in Perennial Ryegrass. This test, conducted by Joe Rimelspach, Dr. Mike Boehm, and Todd Hicks, was on perennial ryegrass mowed at 3.5-in. with clippings returned and no irrigation. No fertilizer was applied before the study. The soil was silt loam, pH 7.3. Treatment applications were made on May 8, May 22, and June 6. Red thread developed in early May in the area from natural inoculums. Treatments were initiated during the early stage of the disease. Significant disease reduction was observed in 13 days by all treatments. Bayleton, Heritage, Endorse, and Cuprofix all showed exceptional red thread control throughout the study. Medallion gave significant red thread control compared to the untreated plots. Rust developed in July and plots were rated 35 days after the last application of treatments. One of the lower rates of Medallion had a significant increase in the amount of rust affecting the turf.

TSll Alternative Species Establishment. TSll is a sand stabilizer material system consisting of polypropylene fibers and natural grass. Previous research has shown that turf species that have limited biomass (e.g. thatch) accumulation but do have aggressive establishment potential are candidates for this kind of system (in Ohio Stadium, the TSll is seeded with 100 percent perennial ryegrass for this reason). The aim of this study is to evaluate establishment rate and performance of several "new" alternative grasses on TSll.

Grasses are: turf-type annual ryegrass (Panterra), transitional ryegrass (TransEze), improved tall fescue (Grande ll), Kentucky bluegrass x Texas bluegrass hybrid (Thermal Blue), Bermudagrass (Riviera), and tufted hair grass (Barcampsia). The rate of seed establishment ranked as: annual ryegrass; transitional ryegrass; tall fescue; bluegrass hybrid; Bermudagrass; >tufted hair grass. In particular, the annual ryegrass germinated in 4 days, had achieved 60 percent cover in 7 days and was 3 inches tall by 10 days. **ST**

Pamela Sherratt is sports turf extension specialist at Ohio State; Dr. Street is associate professor, College of Food, Ag, and Environmental Science, Ohio State; and Deb Holdren is a Horticulture & Crop Science research associate. Sherratt also is a member of our Editorial Advisory Board.

Dr. Charles Mancino demonstrates the F355-01 "Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials" on an infill system.

ROYALS USE COLUMBIA SEEDS

Columbia Seeds LLC, is the official seed supplier to the Kansas City Royals. Their newly renovated field was completed this spring in time for opening day. Trevor Vance, Head Superintendent, is "pleased with the arrangement and the ability to utilize high quality seed from a young and innovative company." Products used on the park will be ClubHouse Perennial Ryegrass Blend, Armada Tall Fescue Blend, Riviera Bermudagrass and an elite Kentucky Bluegrass Blend.

Columbia Seeds LLC/888-681-7333
For information, circle 093 or
see http://www.oners.ims.ca/2917-093

POST-EMERGENCE HERBICIDE

Monument 75WG is a selective post-emergence herbicide for the control of certain weeds in commercial warm-season turf markets. A sulfonylurea herbicide, Monument 75WG provides control of a broad range of weeds including all major categories of sedge species, green kyllinga, oxalis, and various other grass and broadleaf species in Bermudagrass and Zoysiagrass.

Syngenta Professional Products
800-334-9481
For information, circle 089 or
see http://www.oners.ims.ca/2917-089

DIRECT-INJECT FOR TREES

The Wedgle Direct-Inject Tree Treatment System injects ArborSystems chemicals directly into a tree's cambial zone without drilling, so you can treat trees in the most tree-friendly way possible. Treat almost any tree in five minutes or less. ArborSystems offers Direct-Inject Insecticides, Fungicides, PGRs, and Nutrients.

ArborSystems/800-698-4641
For information, circle 092 or
see http://www.oners.ims.ca/2917-092

MARTIN JOINS QUANTUM TURF

Quantum Turf Technologies, a division of Moltan Company, has named Jeff Martin National Sales and Marketing Manager. Martin has more than 15 years of experience in the sportsturf industry at many levels, including the last 6 1/2 years in the sales, marketing, manufacturing, and distribution of professional groundskeeping products. Quantum Turf manufactures Red Diamond conditioners.

Quantum Turf Technologies/800-264-5826
For information, circle 126 or
see http://www.oners.ims.ca/2917-126

WINTER FERTILIZER

Healthy, beautiful grounds and turf reflect the pride of your organization, even during the cold winter months when plant carbohydrate reserves are under extreme stress. Opti-Gro is a pacesetter in the fertilizer industry through development of the most advanced turf care products and materials, says the company.

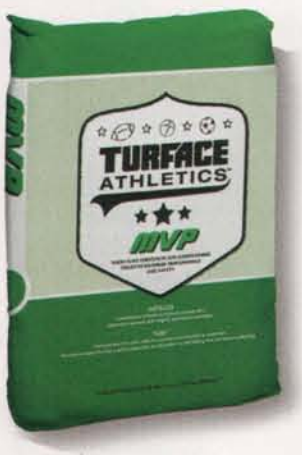
Opti-Gro
For information, circle 073 or
see http://www.oners.ims.ca/2917-073

TALL FESCUE

NEW PRODUCT!

Smith Seed Services has opened www.TitanLimited.com, a website dedicated to its new tall fescue with self-repairing rhizomes. The website explains the value of rhizomes, the variety's breeding history, and its many other characteristics that make it an ideal variety for athletic fields. Titan Ltd. tall fescue was specifically bred for rhizome growth, improved brown patch resistance, heat tolerance, and drought resistance.

Smith Seed Services/888-550-2930
For information, circle 074 or
see http://www.oners.ims.ca/2917-074



TURFACE MVP

Turface MVP helps football and soccer fields stand up to wear and tear to provide solid, safe footing throughout the season. Leading NFL groundskeepers have found TURFACE MVP is ideal for native soil fields because it absorbs excess water to prevent muddy, torn-up turf; conditions the soil to resist compaction in wet and dry weather; and adds permanent water and air-holding space to prevent turf damage and aid in turf recovery even under intense athletic traffic.

PROFILE Products LLC/800-207-6457
For information, circle 075 or
see http://www.oners.ims.ca/2917-075

AMENDMENT AND SOIL TESTING

Verify that the sand, mix, or amendment you are buying is the right one, with testing from Turf Diagnostics & Design. The company also performs rootzone mix design and testing during construction. Because they are not affiliated with any suppliers, test data and recommendations are totally unbiased, and the company does not sell any products.

Turf Diagnostics & Design/913-780-6725
For information, circle 076 or
see http://www.oners.ims.ca/2917-076

SEED PROTECTION MULCH MAT

North American Green's new product comes with 180-sq. ft. of DS150, a UV accelerated, Double Net Straw Blanket, 36 four-inch BioSTAKEs and installation instructions. The perfect size for smaller projects: landscaping changes, cable or drainpipe installations, around pools, sidewalks, as well as drainage areas. The Guardian Seed Protection Mulch Mat rolls out and is easily trimmed to conform to any landscape design; holds soil, seed and fertilizer in place; and won't clump, wash or blow away like loose straw.

North American Green/800-772-2040
For information, circle 079 or see http://www.oners.ims.ca/2917-079

ECO-LITE

Eco-lite has the highest nutrient holding capacity of all physical amendments. It is ideal for newly constructed sports fields. Eco-lite holds as much water as other amendments, but it also holds potassium and ammonium nitrogen. Eco-lite is the cleanest and hardest zeolite mineral, and will not break down in the soil.

EarthWorks Natural Organic Products/610-250-9560
For information, circle 078 or see http://www.oners.ims.ca/2917-078

FUTURE OF GROWING GRASS

Anyone who uses a HydroSeeder should realize that what you put down on the soil is just as important as how you put it down. Finn Corp. has developed the Finn Additive System, designed for use in HydroSeeders for quicker seed germination and turf development. The system consists of a variety of tackifiers, fiber products, fertilizer, soil amendments, water retention agents, and dye.

These products can save anywhere from $5,000 to $10,000 depending on the acreage because they can avoid the use of sod and require less labor-intensive application.

Finn Corp./513-874-2818
For information, circle 077 or see http://www.oners.ims.ca/2917-077

TURF COLOR METER

Spectrum Technologies won an engineering award for its Turf Color Meter (TCM 500). The unit provides an objective, accurate measurement of turf color, strengthening the validity of turf quality measurement. Three modes of measurement are available, including the traditional 0-9.9 "green index."

Spectrum Technologies/800-248-8873
For information, circle 080 or
see http://www.oners.ims.ca/2917-080

FIELD MARKING PAINT

Pioneer's Quik Stripe is fortified with Halogen 2000 optical brighteners to make lines pop off the field during night games and hold up during competition and severe weather. Comes ready to use in aerosol can designed not to clog and empty completely.

Pioneer Manufacturing/800-877-1500
For information, circle 081 or
see http://www.oners.ims.ca/2917-081

PENDULUM AQUACAP

Pendulum AquaCap encapsulates a new water-based formulation of BASF pendimethalin (pre-emergent active ingredient) to

consistently control crabgrass, as well as more than 40 grassy and broadleaf weeds. A BASF-patented technology surrounds pendimethalin with an ultra-thin capsule, and this combination of encapsulation technology and the new

water-based formulation results in virtually no odor, reduced staining potential and improved handling and storage stability.

BASF/919-547-2829
For information, circle 087 or
see http://www.oners.ims.ca/2917-087

STA-LO

Sta-Lo is a plant growth regulator that aids in increasing plant durability while reducing labor costs. Sta-Lo inhibits vertical growth and seed head formation of most warm season and cool season grasses for up to 8 weeks, thus allowing for potential root and lateral growth while improving stress tolerance.

Opti-Gro
For information, circle 083 or
see http://www.oners.ims.ca/2917-083

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Bayer Environmental Science today announces the launch of www.nofireants.com. The website provides information on all aspects of fire ant control, including fire ant biology and identification, research and trial data for TopChoice.

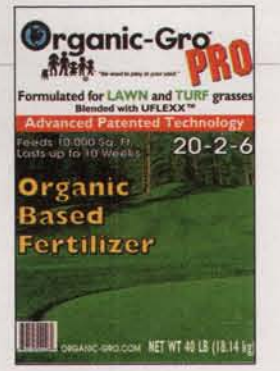
Fire ants infest more than 325 million acres across the southern U.S. and injure more than 20 million people each year with their stings.

Bayer Environmental Science/201-307-9700
For information, circle 082 or
see http://www.oners.ims.ca/2917-082

PARK, PLAYING FIELD, OR PORT-O-POTTY?

FlightControl PLUS from SePRO Corporation is a sprayable liquid goose repellent that will send geese packing, along with the two pounds per day of droppings they produce! When turf managers and park superintendents use FlightControl PLUS, treated turf looks different to geese in the ultraviolet light spectrum. Geese who feed on treated turf experience a temporary case of indigestion and in a few days become conditioned to avoid feeding in areas where they recognize the ultraviolet absorption of FlightControl PLUS.

SePRO Corp./ 317-580-8282
For information, circle 085 or
see http://www.oners.ims.ca/2917-085



FERTILIZER

Organic-Gro PRO 20-2-6 with UFLEXX works by supplying nutrients to turf while restoring proper microbial and earthworm activity for more colorful, healthier and stronger fairways and greens. Available in two formulations: SGN90 for greens and SGN150 for fairways and rough. It comes in 50 lb. bags, with 40 bags to a pallet and is also available in 1-ton bulk sack.

Organic-Gro/866-815-4839
For information, circle 088 or
see http://www.oners.ims.ca/2917-088

GREG NORMAN TURF COMPANY

NTEP TRIALS LIKE SHARK'S TURF

Aussie Green, a new hybrid Bermudagrass from Greg Norman Turf, had good results in preliminary data from latest NTEP trials. The grass finished first in testing grounds as climatically diverse as Texas, Virginia, Georgia, Kentucky, and South Carolina, showing temperature tolerance as well as aggressive growth, sod strength, and turf density.

Greg Norman Turf Company
561-743-8818
For information, circle 086 or
see http://www.oners.ims.ca/2917-086

VIGAROOT

VigaROOT is used in spray application programs to reduce stress and stimulate root growth through enhanced water and nutrient uptake and correct micronutrient deficiencies. It is a dry soluble combination of chelated iron chelated manganese, chelated zinc, natural humic substance, seaweed extract, yucca, and a proprietary blend of natural sugars, vitamins, amino acids, and beneficial bacteria.

Becker Underwood, Inc/800-232-5907
For information, circle 084 or
see http://www.oners.ims.ca/2917-084

Managing a Successful Irrigation Installation

BY **LUKE FRANK**

Your performance as a sportsturf manager is based on sustaining performance turf through the efficient use of whatever environmental, human, and fiscal resources available to you. Of critical importance are decisions around turf species, water resources, nutrients and pesticides, skilled full-time and seasonal crews, equipment selection, management and maintenance and more.

How can you ensure the long-term efficient use of such resources? The irrigation system represents a majority part of your facility's critical infrastructure upon which a successful venture will be built. Design and installation decisions should not be made lightly. Irrigation performance has decades-long impact on how much power and water are consumed, how much nutrient and pesticide load will be required, where your crews will be distributed across the site, and the cultural practices demanded of turf and plant material.

Installation impacts performance

It is at long last widely understood that irrigation is an engineered science, requiring considerable expertise to fully benefit from technological advances. The design, installation, and management of an irrigation system are complex processes that demand sound knowledge of available products, system hydraulics, horticulture, soil and water chemistry, and even construction.

A quality irrigation system installation relies on understanding the individual components and how they work together to achieve your irrigation objective. Armed with this knowledge, a competent installation contractor will better understand what changes can be made in the field when interpreting a design from paper, and provide support after the installation.

It is critical that an installation contractor fully understands this fundamental tenet of system integration and how it will affect the following performance characteristics and site conditions:

Construction codes. Specific installation requirements regarding the depth at which valves and piping must be installed, minimum backflow prevention requirements, easements, construction document fulfillment, utility locates, system wiring and more.

Water sources and quality. The location, quality and reliability of the resource must be understood. For example, will reclaimed or surface water be used or stored? Soil properties. Percolation properties through the soil profile, as well as how soil characteristics affect trenching, backfilling, tamping and thrust blocking applications to preserve system performance and designed durability.

Plant material. The incorporation of turfgrass, trees and seasonal color in a facility design and how the varying watering needs of each can be addressed through system zoning, accurate water placement and progressive scheduling.

Sound hydraulics. A complete understanding of flow and pressure conditions that determine how pipe sizing and routing will be compatible with the watering window. Such inputs include static and dynamic pressure, water velocity through the piping (which should be held under five feet per second), hoop stresses and water hammer at the fittings, pressure at the emission devices, hydrozoning, etc.

Controller operation and performance. The use of software and scheduling features, like weather and soil sensor inputs, multiple runtimes, irrigation pulsing, syringing, system override, troubleshooting, field satellite, communications (hardwire, trunked radio, remote control, etc).

Sensor and monitoring equipment. Placement and functions of equipment that provide real-time soil moisture-level information, flow rates and weather inputs (wind direction and velocity, temperature, humidity and precipitation).

Sprinkler heads and other emission devices. Knowledge of zone pressure, pressure at the head, valve-in-head control, throw distances, arcs, trajectories, nozzling and so forth. Also an understanding of system drainage, turf and irrigation exposures (to equipment, users, sun and wind), topography, and more.

Water system protection. Backflow preventer selection and placement for preventing backpressure and backsiphoning on sites with extreme elevation and relief, reclaimed water, fertigation and so forth.

The three primary components of a high-performance irrigation system are design, installation and management. None of these components masterfully performed individually will ensure that you are reaching your watering target efficiently. A superlative irrigation design can be reduced to hydraulic theory if the installation and management components are shoddy. Powerful installation principles can be strictly adhered to but ineffective if the design is flawed and management is haphazard. And of course, many of us perform miracles with an inherited irrigation system that was designed on a napkin and installed by apathetic, transient labor.

Ensuring a high-performance irrigation installation rests first upon having a high-performance design - followed by project coordination and supervision of the installation, and then system management training. Ideally, the project will best be served if all three of these functions are performed by a single, qualified, indepen-