Growing In Seashore Paspalum with Multiple Challenges

A systems approach to maintaining this useful turfgrass.

BY RONNY R. DUNCAN and R. N. CARROW

Editor's Note: This article provides a summary of the presentation made by Tim Hiers, CGCS, Superintendent at Old Collier Golf Club, Naples, Florida.

All golf course grow-ins have a myriad of normal challenges, but sometimes Mother Nature deals a series of additional conditions that bring out the best in people. Such was the case at the Old Collier Golf Club (TOCGC) in Naples, Florida. Beginning with the initial decision in late 1999 to grass the golf course with seashore paspalum, numerous challenges emerged:

- The need to utilize irrigation water from the Cocahatchee River. This water resource ranges from 300 ppm salt during the summer rainy period, to Gulf of Mexico salinity (34,500 ppm salt) during the dry winter period.
- A record drought during the winter grow-in period (October-December 2000 + January/February/April/May 2001 = seven-month period with less than two inches of rain).
- Phase two watering restrictions from all surface water resources imposed by the South Florida water management authority.
- Record cold temperatures (number of days setting new record lows) during the winter of 2000/2001.
- Reduced light quality and quantity from short winter days and declining sun angle, which affects all turfgrasses.

• Restricted use of pesticides to meet labeled restrictions and to meet the guidelines required by Audubon International in its Signature Gold Program, since only a few fungicides, insecticides, and herbicides are specifically designated for paspalum or warm-season grass use.
• Grassing wasn't complete until early October; ideally, grassing should be finished by July or early August when anticipating a January opening date.
• The grassing source (the only viable source available at that time) was contaminated with significant amounts of bermudagrass. *In all fairness to the supplier, this course would not have been grassed without this source of sprigs and sod.*

Turf management under these conditions requires special qualities — resourcefulness and correct decisions. This Audubon International Gold Signature Cooperative Sanctuary golf course also incorporated environmental stewardship and water conservation strategies even with these challenging conditions.

THE KEY PLAYERS

Tim Hiers, golf course manager at TOCGC, surrounded himself with an excellent, dedicated staff. Todd Draffen (assistant superintendent), Mike Cella (first assistant superintendent), Mike Koopman (equipment manager), Joel Howard (natural resource manager), plus Ricardo Uriarte (foreman) and Dean Watkins (CGCS who came to offer his services between international jobs and to gain experience with seashore paspalum) were instrumental in meeting and overcoming the challenges. Special thanks to Steve Swanhart from Hawaii, whose extensive paspalum experience was invaluable to the operation. The staff members were allowed to perform their jobs and did so with dedication and extraordinary attention to detail. The successful result was opening for play at the end of September 2001.

THE SALT CHALLENGE

What obstacles stood in the way of the successful venture? Perhaps the greatest challenge was high total salt level, which induced nutrient imbalances (resulting in loss of nutrients as salts were leached), decreased water uptake and plant growth, suppressed cytokinin-enhanced shoot/root activity (slowing root development and recovery), and suppressed cytokinin-gibberellin-enhanced stolon and shoot growth (plant growth regulator effect). To overcome these challenges:

• Monthly adjustments were made in the fertility program based on water, soil, and tissue testing (including wet lab analysis). Targets included tissue N:K ratios of 1:2.5-3.0, extra magnesium to foster chlorophyll development, and consistent application of manganese to maintain enzyme activity for maximum growth.
• Fertigation with soluble nitrate sources, application of wetting agents, and foliarly applied (prescription fertilization) micronutrients were used to enhance turf performance under highly saline conditions.
• Regularly scheduled aeration was not practical because of the bermudagrass contamination issue and fear of spreading this cultivar. Only one deep-tine aeration was performed during the grow-in. Under normal circumstances, deep aeration (11-12 inches or 275-300 mm) is needed to help displace excess Na and to promote leaching of Na and excess salts.
• Careful irrigation water conservation strategies were essential to simultaneously manage the salts and supply water to the growing turfgrass, while complying with the phase II water restrictions imposed on Southwest Florida.
• Occasional verticutting (but less than desired because of bermudagrass contamination)/light grooming/heavy to light topdressing to firm up and smooth out the putting surfaces, primarily when salt levels were low, in order to achieve recovery and tighten up the turf canopy. Two primary factors had to be considered when making the decision to verticut: bermudagrass contamination that could be spread by verticutting and salt load in the irrigation water that could accumulate at cut surfaces of the turf plant and cause desiccation/salinity injury to the exposed cells.
• Occasional use of cytokinins and gibberillic acids to escalate root and shoot/stolon growth, respectively, when the turf growth was suppressed by salt (generally >5,000 ppm salt-laden irrigation water). *Note: Gibberillin applications should be applied infrequently and with caution. Use only when shoot growth has shut down during the grow-in mode. Hormonal adjustments need to be done delicately to maintain the proper balance in the plant, and small trial areas should be established before application to large areas.*
• Spot treatment and micromanagement of highly salt-challenged small areas on the golf course. Managing high salt loads is much easier with a sandy soil profile that facilitates salt

(Opposite page) The greatest challenge at Old Collier Golf Club was establishing and maintaining a grass that could tolerate high salt levels.

In areas of high salinity such as Old Collier Golf Club (Florida), management has to be oriented to an entire system approach to achieve the desired end product.

management, mainly because you can move salts down below the root system more effectively with high percolation rates and good drainage. Fines migrate to low spots, especially around drains and areas with sequestered salts. These areas required additional aerification to keep the salts moving and to prevent growth slowdown.

OTHER CHALLENGES

- High salt flux areas, such as berms, mounds, west- and south-exposed slopes (in the Northern Hemisphere), where moisture management is challenged by high salts rising back up through the soil profile by capillary action, are often predisposed to pathogens, such as Helminthosporium (*Bipolaris*), and require topical/systemic fungicide and potassium applications for effective and environmentally safe control. The manager must know exactly where the salts are being deposited, and moisture management in these "hot" zones must be adjusted frequently. On the positive side, salt load in the irrigation water can be used as a growth regulator during the rapid summer turf growth season and for both pre- and post-emergence weed control.
- These high salt flux areas are also sensitive to upward movement of overwintering insects, such as white grubs. When salts move up through the profile, the insects are brought to the surface, where birds, raccoons, opossums, armadillos, and other animals rip up the turf to feed on them, and insecticide applications are required in the middle of winter when grubs normally are not a problem. Generally, some winter irrigation should be practiced to maintain net downward movement of salts, especially during dry winters when evapotranspiration may be high. Ironically, pumping high-salinity water and following water conservation principles may be a positive IPM strategy to force grubs to the surface during selected seasons to minimize potential future insect feeding injury.
- Several days that exceeded record low temperatures (with the lowest temperature at 28°F or -2°C) challenged the heat load in the turfgrass-soil interface and slowed down growth. Milorganite® was applied on specific areas to absorb heat during the sunny winter days because of its dark color. Turf areas were also dyed dark green to absorb heat, and greens were topdressed with green sand. Ten new record lows were set during the grow-in period.
- Silt and other fines, as well as salt-adapted aquatic species that came through a 200-micron self-flushing sand filter at the intake from the river, impaired the irrigation system's ability to perform efficiently This required constant monitoring and manual cleaning of the intake twice yearly, especially during the winter dry season when the Gulf of Mexico backs up to the intake. Barnacles were a concern at the river intake pipe, and they threatened the irrigation system itself. Although barnacles have not yet penetrated the filter at the intake point, this mollusk requires constant monitoring, and the intake must be cleaned periodically to insure maximum intake volume. The silt problem originates from upstream construction and movement down a 40-mile linear watershed, which contributes to the fines being continually dispersed on the course.
- Grassing was completed early in October 2000 at a time when the high-salinity water from the river had to be used, slowing growth and prolonging the grow-in phase. The September/October planting of the last greens necessitated the use of grow-lights (seven 1,500-watt metafluide lamps per green) run by generators at night to facilitate the grow-in. Some of the greens were protected with a porous polymer cover that allowed water and air to penetrate but also retained heat and helped facilitate grow-in during the winter months.
- Nighttime application of 34,000 ppm salty water dictated that mowing the next morning had to be done very carefully, since salt residue covered leaf surfaces. Freshly mowed grass would then accumulate salt particles on the newly cut tips, causing desiccation or leaf tip burn.
- The prolonged drought increased the salt problems beyond the performance capabilities of the irrigation heads and pump stations. Research and development from the irrigation companies helped to develop new components that would withstand extremely high salty irrigation water. All pilot valves and solenoids were replaced on the golf course. For example, during March and April 2001, ET averaged 0.28 to 0.34 inch daily, while only 0.50 inch irrigation could be applied weekly due to water restrictions. Irrigation efficiency was critical to the success of the overall management program using high-salinity water.

An additional challenge occurred when small sections of soil on a few fairways would not support adequate turf growth. One initial hypothesis

was high salt content in the soil; however, low electrical conductivity readings suggested that salt was not likely the limiting factor on these areas. Extra slow-release and soluble fertilizers were micro-applied, but the grass did not respond. Finally, a more complete soil chemical analysis was run, and the results indicated that these problem soil areas were composed of sands that would not hold water, and what little moisture that was held on the surface was not available to the turf root system. Nutrients were not available for uptake by the roots and, subsequently, the turf root system could not establish properly. The areas were eventually excavated down eight inches and the problem sands were removed. A sand:peat mix not exceeding an 85:15 ratio (exceeding that ratio can lead to buildup of excess salts over time) was used. Zeolite was added to improve CEC. Extra P and K were added to enhance the root system. Gypsum was applied and the areas were resodded.

THE CULTIVARS

"Salam" seashore paspalum from Southern Turf was grassed on the fairways and roughs, while "SeaIsle 2000," an experimental cultivar from the University of Georgia, was planted on the greens and tees. Certified SeaIsle 1, a fairway-type cultivar from the University of Georgia, was sodded on some excessively salt-challenged and high-evapotranspiration areas on the fairways. An additional challenge was bermudagrass contamination in the Salam planting material, which is difficult to eliminate with herbicides. Most of the herbicides that remove bermudagrass also damage the paspalum, and this challenge will take time (possibly as long as 24 months) to resolve by managing the environment to the benefit of the paspalum over the bermuda. This involves using less nitrogen, applying more salt water at appropriate times, and maintaining aggressive growth behavior in the paspalum so that it eventually shades out the bermudagrass (salt will slow down the bermudagrass more than the paspalum).

A critical consideration for anyone grassing a golf course with seashore paspalum is to make absolutely sure that the planting stock is bermudagrass free; university-backed, certified paspalums must meet that criterion. Growers meeting that criterion can be found at www.seaisle1.com and through the state turfgrass certification agencies. Ask for blue-tag, certified sprigs or sod.

GREENS DENSITY

The next challenge was getting a smooth and firm putting surface on the SeaIsle 2000 greens. Regularly scheduled topdressing and rolling accomplished that feat. The effort was enhanced by occasional verticutting and core aeration when salinity levels were low. A change from the Toro 1000 to the Flex 21 mower minimized scalping in concert with weaning the greens off nitrogen almost to the point that dollar spot (*Sclerotinia homeocarpa*) started to show up. Once the greens were lean on the nitrogen side, growth slowed down and more uniform, smoother cuts were achieved. Acceptable green speeds were realized and ball roll trueness improved significantly. By late January 2002, the greens were being mowed at 0.113 using a walk-behind mower with a Wiehle roller. All greens were very consistent, firm, and fast, but receptive to good shots (ball actually biting and holding when struck properly). The greens were still young, but the management program will improve them as they age.

PEST ISSUES

All turfgrasses are challenged by insects and diseases, and seashore paspalum is no exception. All pesticide and fertilizer applications were applied with environmental stewardship and IPM procedures in mind. Challenges came from billbugs, armyworms, webworms, leaf blights, and patch diseases, mostly sporadic events that occur seasonally throughout the year.

WATER ISSUES

Having a consistent level of saline water is better than having a saline water source that constantly

changes. Water from the Cocahatchee River changes frequently in salinity levels both seasonally and with rainfall frequency. The salinity range has varied from 300 ppm salt during the rainy summer season to 34,500 ppm (Gulf of Mexico water) during the dry winter season, especially during the December through June time frame. With wide-ranging salt levels, management has to change accordingly to prevent salt accumulation near the root system. Irrigation scheduling, irrigation efficiency, and fertility program adjustments must be instituted to manage the grass effectively during a time when golf play is the highest.

Native plant species existing in the area around the lakes were selected for their salt tolerance.

Remember, salt management in the soil takes priority over turfgrass management. Having a sandy profile with high percolation rates is critical for proper salt management. Irrigation heads had to be monitored constantly to ensure that each sprinkler was operating properly. Additional heads were added after construction (bringing the total to 2,700 heads on 77 acres of irrigated turf area) to improve application uniformity.

Due to the wide variation in salinity levels from the river source, a permit was granted to drill a well into the non-potable 5,200 ppm salinity strata (in the lower Hawthorne aquifer) to supply water with a consistent salt level during the winter dry season. A second, separate pump system was constructed as a backup control system and to provide flexibility in implementing the water conservation standards for the course. The long-term goal is to operate pumps during off-peak times when demand is reduced and electricity costs are the most economical. Each pump system is capable of irrigating the entire course in 4.5-5 hours, which ensures effective salt and water management. This dual system also allows the use of high-salinity water for pre- and post-emergence weed control and the associated plant growth regulation from salt at selected times, followed by use of lower-salinity water for leaching and salt control.

Periodic granular gypsum applications and other calcium (Ca) supplements have been helpful in minimizing the buildup of excess sodium (Na). Calcium is instrumental in displacing Na, which can then bind with sulfates from the gypsum and be leached down below the turf root system.

What about salt accumulation? The golf course naturally recycles subsurface water back to the

Cocahatchee River by gravity flow, essentially at the same or lower level of salinity than initially came out of the river. Therefore, the course is neither concentrating the salts, nor is it building up salts that could lead to sterile growing conditions. They are simply applying the water to the natural grass filter on the golf course and recycling the unused water through subsurface gravity flow back to the river. Seven test wells are located on the course and salinity levels are monitored monthly, with reports going back to the Florida water management authority.

An example of the tough decisions that were made on the course included one on February 25, 2000, when the use of river water at 30,000+ ppm salt was stopped because of the high salt load, followed by the switch to limited use of the pond water twice weekly. This decision was made because of the severe drought from October 1999 through February 2000, the forecast for a very dry March through May 2000, the cold winter temperatures, and the fear of a buildup of salts in the soil profile/turf rootzone. This would have accompanying growth regulator effects, which could potentially delay grow-in even further.

With the challenge of heavy winter golf play occurring at the same time that river salinity levels were at their highest, the course began using the Hawthorne water source. The pump system for this source came on line in December 2001 and will be used primarily during the winter period when the river water exceeds 10,000 ppm salt. As a result, they will be recycling water back to the river with salinity levels that are lower than normally would be coming out of the golf course during the winter. The golf course can, thereby, meet the water restrictions imposed by the water authority, utilize water conservation strategies, and at the same time use water normally not acceptable for human, landscape, or agricultural consumption. Management programs will be adjusted seasonally to maximize turf performance with these water sources.

Regular soil testing, water monitoring, and tissue analyses are conducted on a monthly basis. "Wet lab" chemistry analysis of the tissue samples has been used in place of NIR (near infrared reflectance) to build a data bank on nutrient uptake of paspalum and develop sufficiency levels with high-salinity irrigation water. The wet lab ayalyses provide additional data on some nutrients that the NIR analysis does not.

TIM HIER'S COMMENTS ON THE GRASS

- Seashore paspalum is not a panacea, but in the hands of the right managers, it can provide an excellent to superior playing surface. The ball sets up on the canopy exceedingly well.
- The grass cannot be grown-in with high salt levels in the water (not more than 10,000 ppm). Salt loads in the 5,000–10,000 ppm range will be a challenge because of their growth regulator effect, but *mature turf* is very tolerant if the entire system is managed properly.
- Grow-in time is similar to bermudagrass under identical conditions (i.e., use of alternative water resources, soil profiles, and climatic changes for both grasses).
- If the grass is managed like bermudagrass, you will develop excess thatch with high nitrogen applications. Paspalum can potentially use 30-50% less N than bermudagrasses under the same challenges once the grass reaches maturity and the rhizosphere organic matter load stabilizes.
- The grass has a propensity for Ca, P, K, Mg, and Mn, and continuous spoon-feeding is important for good turf performance.
- Recuperative ability is similar to bermudagrass, but the recovery comes from rhizomes and not stolons.
- Insect resistance is potentially similar to bermudagrass, except mole crickets do not seem to prefer the thick density of the canopy.
- Seashore paspalum can and has produced championship playing conditions.

SUMMARY

Seashore paspalum is the first major warm-season turfgrass to become available to turf managers in 30 years, and this species can tolerate much poorer water quality than other grasses when the most salt-tolerant cultivars are used. Many of the initial uses of this grass will be on sites normally challenging to other grasses, usually with salinity involved.

The Old Collier Golf Club is a living example of how an effective *systems approach* can be environmentally compatible even with multiple challenges. The system encompasses the grass, soil chemical/physical/biological aspects, irrigation water, groundwater, surrounding wetlands, wildlife, and site-specific management. There were initial concerns that salts would build up to unmanageable levels on the golf course when high-salinity water was used consistently. That problem has not occurred. The normal topography carries the salts back to their original source — the Cocahatchee River — in a natural recycling design, neither increasing nor decreasing the salinity level during its exposure to the golf course. This excellent architectural plan fully encompassed environmental stewardship and water conservation principles. The landscape plants were integrated by the golf course architect, Jan Beljan

SEASHORE PASPALUM'S NOTICEABLE ATTRIBUTES COMPARED TO BERMUDAGRASS

- Better cold tolerance transitioning into the winter period.
- Poor water quality tolerance is excellent.
- Superior low light intensity tolerance (cloudy weather, not shade from trees or buildings).
- Potential for improved playability.
- Striping very similar to northern grasses.
- Needs less nitrogen.
- Does not need to be overseeded in South Florida.
- Looks like Kentucky bluegrass or perennial ryegrass.
- Does not form a "grain."

(design associate with Tom Fazio), into the course design based on innate salinity tolerance and exposure to salt-laden irrigation water or spray drift. The whole systems approach on this golf course is what has led to a successful venture.

The other positive aspect of dealing with all the challenges was that the company had the vision, resources, and patience to wait until the course was imminently playable, allowing the staff to deal methodically with adverse conditions while achieving a successful grow-in. The team had remained steadfast in its vision and did its research, knowing that waiting would lead to their expectations — opening one of the premier golf courses in the world.

THE KEY PLAYERS

With the right resources, staff, soil profile, equipment, and management program in place, seashore paspalum is capable of providing championship-level playing surfaces, even with numerous environmental and man-made challenges and with use of non-potable, highly saline water resources. Management has to be oriented to the entire *systems approach*, since salinity tends to exacerbate turf problems in response to environmental extremes.

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REFERENCES

Carrow, R. N., and R. R. Duncan. 1998. Salt-Affected Turfgrass Sites: Assessment and Management. Ann Arbor Press. Chelsea, Mich. (www.sleepingbearpress.com).

Carrow, R. N., D.V. Waddington, and P. E. Rieke. 2001. Turfgrass Soil Fertility and Chemical Problems: Assessment and Management. Ann Arbor Press. Chelsea, Mich.

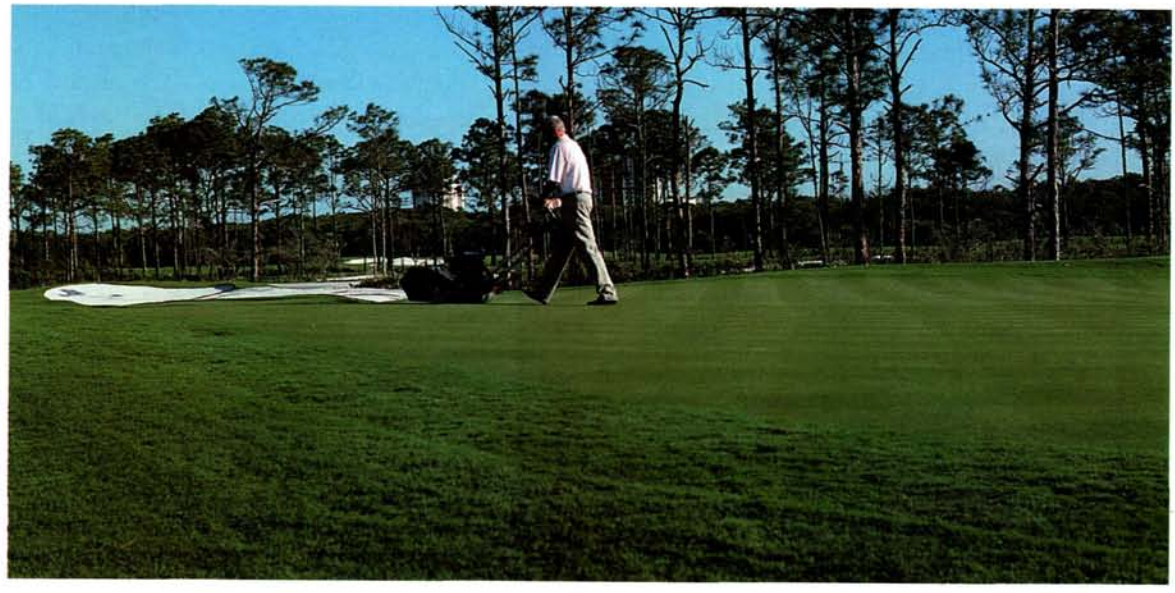
Duncan, R. R., and R. N. Carrow. 2000. Seashore Paspalum — The Environmental Turfgrass. Ann Arbor Press. Chelsea, Mich.

WEBSITES FOR ADDITIONAL INFORMATION

www.georgiaturf.com and click on "seashore paspalum"

www.seaisle1.com

DR. RON R. DUNCAN *(turfgrass genetics/breeding, stress physiology) and* DR. ROBERT N. CARROW *(turfgrass stress physiology and soil physical and chemical stresses) are research scientists in the Crop and Soil Science Department, University of Georgia, Georgia Experimental Station at Griffin. E-mail: rduncan@gaes.griffin.peachnet.edu.*



Greens were carefully maintained to achieve a smooth and firm putting surface.