

May 23, 2013

**Windmill Ridge Golf Course
Monett, Missouri**

DATE OF VISIT: May 14th and 15th

PERSONS PRESENT:

Justin Beck, Golf Course Superintendent
Michael D. Vogt, CGCS, CGIA

Overview of Greens

Aerification remains to be beneficial to the health of the green turf at Windmill Ridge.



Photo 1 Deep tine aerification on #1 green

This aerification should be the last of the spring season; a supplemental “venting” process should be performed several times before the critical high temperatures of summer begin. “Venting”, is a process very similar to aerification, only using a thinner tine to open a channel for air and water to pass by the turf mat layer into the sand root-zone below. These channels are typically left open, (not filled with sand) to collapse inside the hole in a short period of time. “Venting”, being a smaller hole disturbs the green surface less, after a quick rolling playability is returned to near normal. If the greens can be vented several times before extreme summer weather sets-in this would be very beneficial.

Overview of Greens (continued)



Photo 2 Long bright white conducting roots penetrating deep into the root-zone

Together with the impressive long roots illustrated in Photo 2, I discovered a dense mat of roots in the top four inches of the green root-zone. With the turf plant at maximum efficiency and health a careful nutrition plan should be designed to strengthen the plant to ward off the effects of disease and summer temperature stress. Soil samples have been taken and sent to Logan Lab, as of this writing we are awaiting test results, after which, superintendent Beck will design a nutrition program that is suitable based on test results.

A golf course I am very familiar with has raised the height of cut on greens to .125 of an inch. The golf course is in the Golf Digest Top 100 Course List for 2012. They maintain a green speed of 10 – 11 feet measured on the Stimpmeter.

1. Mow once in the morning and once before dark;
2. Roll after each mowing;
3. 5 people hand watering each day during stress times with soil moisture meters;
4. Light topdressing every week, just enough to irrigate away after topdressing;
5. Light vertical mowing every other week, set level on bench.

The cost is prohibitive to most golf courses but the results are proven to produce fast, firm, smooth greens consistently.

Overview of Greens (continued)

Decimal Equivalents Used for Golf Course Greens Cutting Heights	1/64	→	0.01563	Danger-Zone for Greens Height
	3/64	→	0.04688	
	1/16	→	0.06250	
	5/64	→	0.07813	
	3/32	→	0.09375	Mow-Zone for Greens
	7/64	→	0.10938	
	1/8	→	0.12500	
	9/64	→	0.14063	
	5/32	→	0.15625	
	11/64	→	0.17188	
	3/16	→	0.18750	
	7/32	→	0.21875	
	1/4	→	0.25000	
	9/32	→	0.28125	
	5/16	→	0.31250	
	5/16	→	0.31250	
3/8	→	0.37500		
7/16	→	0.43750		

Table 1 Mowing height of cut for greens

In Table 1 mowing and rolling gives great results around the 1/8 or .125 inch mark. After rolling on the morning of May 15th, superintendent Beck and I measured green speeds on several greens; 8.5 feet was measured as average. After solid tine aerification and rolling the greens rolled smooth. It also should be noted that greens were not mowed for two days. My recommendation based on greens at Windmill Ridge and considering all inputs and available resources greens should be mowed \approx 1/8 inch, alternate mowing and rolling, with rolling occurring no more than three times per week.

Considering weather as of this writing a plant growth regulation (PGR) program of Trinexapac-ethyl (Primo Maxx™) should begin on June 3rd and be continued as needed for the summer months. Weather will have an effect on how often to apply Primo Maxx™. The higher the temperature and wetter the root-zone closer the application window should be, i.e.

- 80°F high temperatures = once every 14 days
- 90°F high temperatures = once every 10 days

The rates of application for Primo Maxx™ are well explained on the label; no more than 7 ounces per 1,000 ft² should be applied per year. No more than .125 ounce per 1,000 ft² in any one application.

Trimmit® 2SC (Paclobutrazol) should be discontinued until autumn.

Overview of Greens (continued)



Photo 3 Bent nursery / future practice green

Bent Grass Nursery / Future Practice Green

The spring seeding did not succeed. Summer seeding rarely produces favorable results. It is recommended that a late summer seeding take place (late August early September). If successful the green will be playable early next season.

Seeding Rate

- Seed bentgrass at a rate of 1.5 lb. per 1,000 ft² of putting surface;
- Seed in at least two directions to ensure uniform coverage across the entire green;
- Mix bentgrass seed with a lightweight carrier such as a natural organic fertilizer to facilitate a more uniform distribution of seed through a drop spreader.

Maximize Seed-to-Soil Contact

- Use the knobby tires of a motorized sand rake to press the seed into the soil;
- Most always the first seedlings to germinate are those at the bottom of the tire depressions;
- Immediately after seeding light rollers should be used to press the seed into the root-zone mix;
- The importance of adequate seed-to-soil contact cannot be overemphasized.

Overview of Greens (continued)

Disease Control

- Treating a new green for diseases is a challenge since most common golf course sprayers are too heavy and would cause wheel rutting across a putting surface during grow-in;
- Use granular fungicides on new greens and be sure that the materials chosen for disease suppression are safe to use on immature bentgrass.
- Be sure the person using the spreader is comfortable with the equipment and that the spreaders have been carefully calibrated.
- Another option is to have a walk-behind boom-type sprayer available for use during grow-in. This type of sprayer could also be used to apply light rates of soluble fertilizer to spoon feed the new greens. In fact, some superintendents prefer the walk –behind boom sprayer to the more common motorized sprayer for putting green management.

Irrigation

- Opinions vary greatly regarding the proper method of irrigating a new green. Too much irrigation is the tendency prior to seed germination;
- Light frequent irrigation is believed to be much more important after seed germinates;
- A seed probably will not germinate if the surrounding soil dries out, but a seedling will;
- The importance of dependable, uniform irrigation coverage is paramount during establishment, automatic irrigation system can always be supplemented with hand watering or roller-based sprinklers.
- Unfortunately, a sprinkler head that does not function properly may not be discovered soon enough to prevent seedling dieback, wind may disrupt the uniformity of irrigation coverage, even when the system is functioning properly;
- Moisture levels across the entire surface of a new green need to be checked many times a day during hot, dry weather;
- How one interprets light and frequent irrigation can have a significant influence on the rate of turf germination, growth and development;
- The weather dictates irrigation needs, since more frequent irrigation cycles are needed during a dry, windy day and less irrigation is needed during a humid, cloudy day;
- Irrigation times may need to be adjusted to accommodate changes in the weather patterns;
- Irrigation frequency can be reduced as the stand of turf matures;
- Consistently check the depth of the root system and adjust irrigation.
- Sand-based greens typically are overwatered during the grow-in because porous root-zones accept water readily;
- Heavy irrigation cycles will do little more than move soluble plant nutrients beyond the root zone and encourage disease activity.
- Immature bentgrass seedlings cannot tolerate much drought stress, but soaking greens several times a day is counterproductive.
- Should an extended dry period occur during grow-in, it may prove necessary to periodically water more deeply.
- The combination of frequent applications of fertilizers and frequent, light watering can result in a buildup of salts in the upper root-zone. These salts must be flushed by a 0.25- to 0.5 inch rain or a sufficient irrigation application.

Overview of Greens (continued)

Fertility

- Take an initial soil test for the root zone mix and use as a guide for how much fertilizer to add to the upper inch or two of the green just prior to seeding;
- Once the turf begins to grow, a good rule of thumb is to apply about ½ lb. of nitrogen per 1,000 ft² every 7 to 10 days for the entire first season of establishment;
- Use turf seedling color as a guide to fine-tune the fertilizer rates;
- When the bentgrass needs to be mowed on a consistent schedule, the amount of clippings per mowing may be used as a guide for fertilizer applications;
- If soil temperatures are above 60 degrees, try to supplement the available forms of nitrogen with Milorganite or some other form of slow-release organic nitrogen;
- A monthly 1 lb. rate of slow release organic nitrogen can serve as the foundation of the fertility program during grow-in, and the weekly light applications of soluble fertilizers sustain vigorous bentgrass growth and development;
- Furthermore, there is practically no chance of burning the turf or causing a flush of growth using natural organic sources of nitrogen;
- Skips or overlaps are rarely a concern because low nitrogen analysis fertilizers can easily be divided and spread across a green in two or three directions, also, most natural organic fertilizers also provide slow release micronutrients to the root zone;
- Phosphorus levels also must be monitored, typically, 1 lb. of phosphorus per month for the first couple of months during grow-in is sufficient;
- Micronutrients are easily applied through one or two applications of a micronutrient package such as Anderson Fertilizer product 13-2-13 (AGC 13M5.2) or when seeding, Floratine Germinex Talc TG;
- Poor fertility management of sand-based greens is probably the number one mistake made during establishment;
- Never make heavy applications of soluble fertilizers. During the first months of establishment weekly light fertilizer application are recommended.

Sand Bunkers

The maintenance of sand bunkers has improved dramatically. The following are methods to improve sand bunker maintenance and keep costs as manageable as possible in the long term.

Start with the right material, using good sand is a "must" and can prevent numerous maintenance nightmares. Use a USGA-standard particle size and shape. The best particle sizes for bunker sands are confined to a narrow particle-size range. The upwards of 60% of the particles in the sand you use should be between the 0.25 and 1.00 mm in diameter. Other factors to consider are particle shape, color and cost. Generally, the best bunker sands are quartz-based and angular in shape to provide reasonable firmness.

Angular sands have flat sides, which interlock with those of other particles to establish stability. This is important because it provides firm footing for a good golf swing. Angular sands also better resist excessive washing from bunker slopes (due to irrigation or rain) and they minimize "fried-egg" lies.

Sand Bunkers (continued)

You can perform in-house testing to evaluate and compare sand angularity or sharpness. One method involves using a pocket penetrometer and recording how much pressure you must apply to press a golf ball into moist sand samples set up in a box. Another is to use oven-dry sand and measure the angle of repose. Pile the material to the highest angle possible without the grains beginning to avalanche down the side of the pile. The more angular the particle, the greater the angle of repose it can achieve. In other words, greater angularity allows you to pile the sand more steeply before it starts to slide downward.

Color should be secondary in importance and has more to do with aesthetics than function. That is not to say that color is irrelevant. White sands create more maintenance problems because they show contamination much more readily. However, there's no denying that white sands are beautiful. They show up well and create a wonderful visual scene for the golfer. Nevertheless, particle shape and cost are of much greater importance from a maintenance standpoint. A word of caution: Some sands that technically fall within USGA guidelines still may not be suitable or acceptable to some or all of the members of your club. Test sands available in your area with your members.

To maintain good playing conditions in bunkers, the bunkers must be raked, edged, weeds need to be controlled and most importantly, sand bunkers require proper drainage. In addition, superintendents must cut down on cost by extending the life of bunker sands by reducing contamination.

From the moment you add new sand to a bunker, contamination occurs, shortening the sand's remaining useful life. Because contamination is the most significant factor leading to costly renovation of sand bunkers, you should perform all bunker maintenance in ways that minimize contamination. Improper maintenance allows silt, clay and organic matter to accumulate in the sand. These fine particles gradually fill in pore spaces between the sand particles and cause poor drainage, discoloration and allow the material to become hard and crusted (Photo 4).

You can slow this "aging" of sand bunkers with proper maintenance. Good maintenance practices will increase the useful life of bunker sands and significantly lower expenses by delaying costly bunker renovations. More importantly, you can achieve good playing conditions by practicing proper raking, edging and weed control and by assuring that bunkers drain well. Ultimately, playing conditions take precedence over other maintenance considerations.

Sand Bunkers (continued)



Photo 4 Arrow shows crusted contaminated sand, #6 greenside bunker

Many superintendents often assign the task of raking bunkers to a new or less-proficient employee. This can be false economy. Correct and careful raking prevents the need for costly additions of sand and premature renovation. Also, because raking bunkers is one of the most frequently performed maintenance practices, it has the potential, if done improperly, to cause the most problems and complaints.

Unfortunately, not many courses have the budget to hand-rake bunkers. However, there's no doubt that hand raking is the ideal method to ensure a fair lie. It also has several other distinct advantages. Hand raking offers the opportunity for a trained employee to check bunker depth on the floor and slopes. In addition, it minimizes mixing of organic matter, such as leaves and clippings, into the sand, cutting down on contamination. The greatest benefit of hand raking is uniformity. Golfers want and expect to be able to play sand shots out of sand that is consistently firm and uniform throughout the course.

Preferences of surface characteristics vary from golfer to golfer. Two golfers in a foursome may prefer a smooth surface while the other two prefer furrows, so you can't please everyone. The surface characteristics you create can vary from smooth to distinctly grooved or furrowed and depend on the raking procedure and type of rake you use. Remember that it's more important to be consistent than to have any one particular type of surface.

Sand Bunkers (continued)

You can use any method of hand raking as long as you exercise care that you don't leave ridges of sand at the termination of either the backward or forward stroke. Do not get in a hurry as this could leave waves in the sand. Give careful attention to raking the perimeters of bunkers. Rake the sand on the fairway side of the bunker, or backside, so that the sand is level with the turf. This will ease difficult lies.

Since the introduction of power sand rakes, bunker raking is not as laborious and costly as it once was. But if you factor in lower bunker quality, increased aging of sand and the cost of the machines, the savings are not as great as they first appear.

As previously noted, putting new or less-proficient employees on power sand rakes can be a false economy. Correct and careful raking of each bunker is important: The bunker-rake operator should be one of the best-trained employees and should be rewarded as such.

Bunker-rake cultivation tools include a wide range of implements from which to choose. Different sand types and ages require different cultivation tools. Shop around and you will find the best for your sand bunkers. On my last visit superintendent Beck discovered a cultivation attachment for the mechanical sand bunker rake; this may prove to be a useful tool.

Drive mechanical bunker rakes into a bunker and then lower the cultivation tools. Drive slowly around the bunker in a circular or figure-eight pattern. Do not create waves or deep furrows. Keep power rakes 18 to 24 inches away from bunker edges and off of slopes. Improper use of mechanical bunker rakes or having the wrong cultivation tools can lead to mixing of sand and soil. This occurs when the machine gets too close to the edge of the bunker or the cultivation tools are too deep for sand.

Lift cultivation tools or rakes before exiting the bunker and always enter and exit at different points. The operator should smooth up the exit point by hand raking. Most importantly, rake and smooth all edges by raking sand back toward the edges. Greenside bunkers should have at least a 2-inch lip to prevent the use of a putter for bunker shots. You always should carry a manual sand rake on the machine for the hand raking that you'll need to complete the job you begin with a power rake.

It is critical that you monitor sand depth closely if you use mechanical rakes. Bunkers should have at least 4 to 6 inches of sand on the bottom. Do not let raking shift the sand around; this means that it will be too thin in some areas.

Grass encroachment into bunkers is a continual problem. Therefore, to maintain the original shape, you must edge bunkers. Edging frequently with string trimmers or reciprocating or a mechanical edger will minimize the need for more severe edging. During favorable growing conditions, edging may be necessary every 2 weeks. Also helpful would be to spray a turf growth regulator on the bunker edges, this will slow the edge growth so repeat edging intervals can be extended.

Sand Bunkers (continued)

If you do not edge the grass periodically, the turf will grow inward, reducing the size and obscuring the shape of the bunker. Some bunker edges at Windmill Ridge have grown inward several feet, and the original perimeter can only be found by digging or probing. Frequent edging should prevent this problem. If you need to perform more severe edging to reestablish the original edge, rake back the sand and use straight-blade hand shovels. Then be sure to remove all debris and turf roots.

Occasionally the use a mechanical edger or reciprocating trimmer will be necessary. This can leave a "cutter" effect with no turf growing on the bunker edge. A reminder, sand and turf should meet on the back side, so the exposed edge effect is not what you want there.

During all edging procedures, remember not to contaminate the sand any more than necessary. This also includes mowing around bunkers. Use caution to keep from blowing large volumes of clippings into the sand: clippings add to the aging process of the sand.

In addition, you may want to consider using Zoysia. Their slower growth cuts down on encroachment into bunkers and they blend in well with Bermuda grass.

Sand washing is without a doubt the single largest source of sand contamination, pumping water and throwing sand back on bunker faces after heavy rains is one of the most costly and labor-intensive tasks you'll face.

Preventive maintenance will help reduce this cost. The way to minimize the impact of washouts is with good drainage; not only in the bottom of the bunker but also at the top of the slope, where a "smile" drain can be of benefit. Also, see that water does not enter the top of the bunker.

The very best subsurface drainage is a must for bunkers. A superintendent should perform any maintenance or preventive practice possible to increase drainage to prevent washouts and contamination.

Greenside bunkers that receive a lot of play can have a substantial build-up of sand over time (number 7 greenside bunker). You should monitor this and return the sand to its original elevation and distribution. Wind also can have the same effect.

The latest technology for preventing contamination and lowering maintenance costs is a bunker stabilizer that is blown in as you would gunite concrete. You line bunkers with a 2-inch layer of this material and allow it to dry before adding sand. The material remains resilient but eliminates mixing of soil and sand. On steep faces, this material allows you to place as little as 1 to 2 inches of sand. The ball does not "plug" and rolls toward the bottom of the bunker after impact.

Sand Bunkers (continued)

By using good maintenance practices and being conscious of contamination, you can lengthen the life of bunker sands and diminish maintenance costs. You also can enjoy your trips to the pro shop to interact with golfers who have just finished a round of golf on smooth, well-maintained and uniform bunkers.



Photo 5 Number 8 greenside sand bunker

Fairways



Photo 6 Fairway #5

After the application of Revolver™ (foramsulfuron) herbicide several areas of fairways showed signs of turf stress, this is a temporary discoloration and soon should grow-out. The control measure was generally successful but a need still exists to spray at least one additional application of a broadleaf herbicide to capture late germinating and other stubborn weed species.

Tees

The tees are just beginning to completely break dormancy. Aeration and vertical mowing would be two cultural practices that would improve appearance and playability.



Photo 7 Number 10 tee, beginning to grow out of dormancy

Conclusion

The overall condition of the golf course has improved steadily since last fall.

The greens have received the second aerification of the spring.

Soil test will be available soon and a nutrition program can be formulated for the remainder of the season.

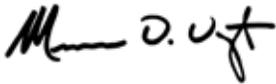
Fairway weed problem has been essentially solved. An application of a broadleaf herbicide and perhaps a spot spray of several areas for grassy weeds may need to follow.

Sand bunkers remain an issue. Although sand has been redistributed edges are not defined and drainage is a factor due to contaminated sand. A complete sand replacement is the only known repair for this problem. Also, this is the only method to determine if the existing drainage system is operating properly.

My next visit in June will concentrate on maintenance practices recommended for the remainder of summer.

Any questions or comments, please feel free to contact me at your convenience, email mvogt@mcmahongroup.com or cell number (636) 448-0699.

Respectfully submitted,



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