Optimizing The Turfgrass Canopy Environment With Fans

Fans can help overcome poor growing environments.

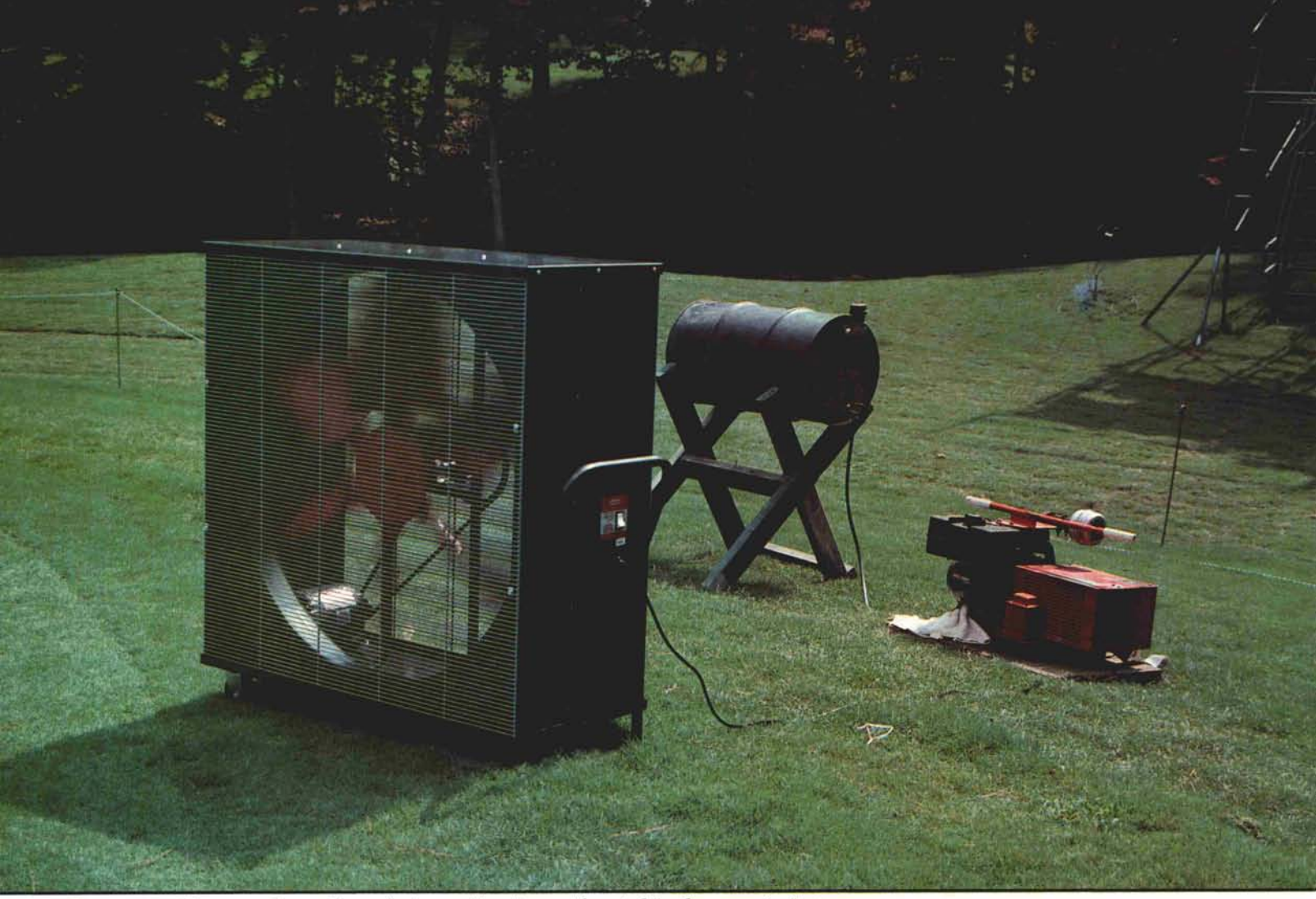
by PATRICK M. O'BRIEN

ALTHOUGH most people in the turf industry have seen electric or gas-powered fans used on the golf course, the rationale for their use often is misunderstood. As an agronomist for the USGA Green Section, I am frequently asked questions about the use of fans. To help those involved with this issue, a discussion of the benefits and liabilities of the use of fans is presented.

Affect on the Health of Bentgrass Putting Greens

Years of experience have shown that golf superintendents have the most trouble growing bentgrass or *Poa annua* greens during the summer at a site surrounded by trees or other barriers that allow almost no air movement. A USGA-type green provides a very effective base for growing putting green turf, but it cannot compensate for the lack of air circulation. In this environment, disease and higher rootzone moisture associated with these areas cause turfgrass plants to decline. Fans help improve air flow across greens, and the survival of bentgrass has been shown by Taylor to improve at sites with the increased air movement provided by fans.[1] The positive effects of fans drying out the soil and increasing evapotranspiration are the two major benefits influencing the bentgrass. Fans offer little cooling benefit to the turfgrass, which is contrary to most popular opinion.

Fans are sometimes mounted in trees instead of using poles.



Gas-powered fans can be used as a last resort in sites not located in close proximity to an electrical source, but they require intensive labor to operate.

Which Greens Need Fans?

Fans should be specifically used to help improve turf quality at problem green sites. By far the most popular use of fans is at *boxed* or *pocketed* sites surrounded by trees or other features that restrict air movement. In the past, these sites have been more prone to summer decline caused by disease, excess moisture, and surface algae. Green sites with wet rootzones also benefit from a fan program. Even small problem areas at *open* sites can benefit from the use of fans directed to the specific problem area.

Placement of the Fans

Most superintendents place two stationary fans at the 10 and 2 o'clock positions at the rear of the green, approximately 15 to 30 feet from the edge of the green. Fan height above the green surface normally is 10 feet or less with these stationary fans. Most fan companies sell poles that are usually seven feet tall, since OSHA requires finger guards on any fans positioned at lower heights. Finger guards can restrict air flow distance by up to 12%. Hand guards, which restrict air flow less than finger guards, are required for fans on poles taller than 7 feet. Trees are sometimes used instead of a poles, if available.

The key is to position the fan as close to a green and as low to the ground as possible to generate maximum air flow across the green surface. The main goal is to achieve a 3- to 4-mph wind speed over the turfgrass canopy. If fans are too far away or elevated too high, wind speed power will be lost by deflection off the grass itself, or by natural friction loss. A Turbometer, which costs about $120, is an effective instrument to help determine fan placement at each site. The Turbometer should be set on the green surface during measurements, and with the fans running, check various areas around the green for the 3- to 4-mph wind speed.

Another popular method to help determine fan location is the use of engineering flags. On a calm morning, place engineering flags over the green surface at 3- to 5-foot intervals with the flag height at approximately 3 inches above the ground. Clipping the metal pole on the engineering flags to a 3-inch length will speed this step. Turn the fans on and adjust the fan position until most of the flags are waving. Other superintendents check fan position by igniting smoke bombs at several sites on a green to detect air movement.

When to Operate

Golf superintendents need to pay attention to fan schedules, since each site may have different requirements. Fans usually run 24 hours per day at green sites that hold soil moisture and at pocketed areas. Running fans from early to mid morning to the early evening is advised at the small problem sites on certain greens. Other sites may

require fan usage only during the early morning to mid morning when dew and surface moisture are greatest. In the Southeastern Region, surface moisture also can come out of the rootzone during the daylight hours, even at times of very high humidity. Fan use seldom will be required at open-air sites on sunny days with low humidity.

Fan Types

Nearly all fan types commonly seen have done a good job when positioned and run properly. Caged, oscillating, or turbo fans are the most common types observed. Oscillating fans are by far the most popular at golf courses. In the past, fan oscillating motors have caused problems, but today oscillating motors have improved power, similar to the other fan motors. Fan diameters can range from 22 to 48 inches. Because most fans are stationary to poles elevated above the greens, fan diameter size has been increasing with the demand for additional air movement from these products. Many fans now can throw a column of air more than 200 feet. With the improved power of many fans, some air movement can occur even at areas where the fan is not directed. Stationary fans do have the potential to dry the turf, since wind speeds can be much higher than 3 to 4 mph next to the fan. Extra irrigation may be needed for the turf in some situations when these fans are used.

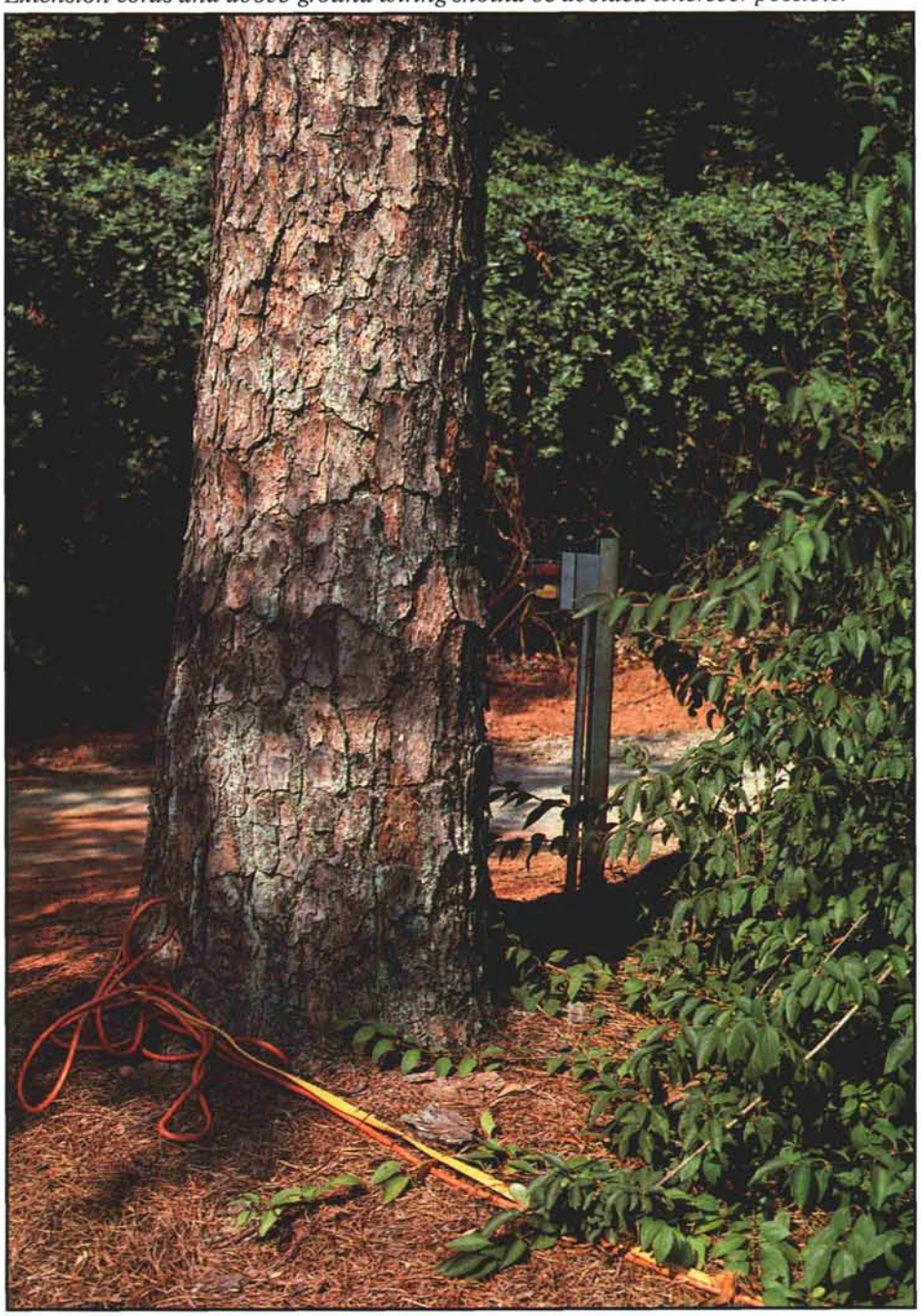
Portable or *floating* fans are also popular, and most courses have at least two available. Most portable fans are the 48-inch cage types. A combination of both permanent and portable fans is a plus at some problem greens. Portable fans are used to treat special areas that require extra air circulation, such as a wet soil condition. Many superintendents move these floating fans to problem sites late in the evening and allow them to run all night. The fans can be positioned right next to the green during the night to provide an extra "blast" of air without affecting golfers. The portable fans can be repositioned and moved further away from the green the next morning, especially taking into consideration the hole location for that day. The additional air movement and mixing from this fan, especially when combined with the prevailing wind and the permanent fans, promotes faster drying. Portable fans can also be used at the maintenance building to help cool the mechanic's working area on hot days.

Tips on Installation

Setting up the electrical system for the fans on an existing golf course is very difficult, so a certified electrician should do all electrical work. Unfortunately, the electrical wire at the irrigation control boxes is too small for the high current requirements of electric fan motors, so alternative power supplies are needed. Usually, water coolers, irrigation pump houses, lift pumps, bathrooms, maintenance buildings, and clubhouses are sources of electrical power. Often, sites with fans are not close to any of these sources, and new meter service then is the only option. Gas generators are a last resort, with the inconvenience of refilling the generator with gas, transportation requirements, and the extra noise. New golf courses should initially install larger wire coming into the irrigation control boxes so that if electricity is required later for fans, the larger wire can handle the additional amperage for a fan motor.

Most fans used today have single-phase motors, although three-phase motors are preferred because of their higher power efficiency. Smaller wire

Extension cords and above-ground wiring should be avoided wherever possible.



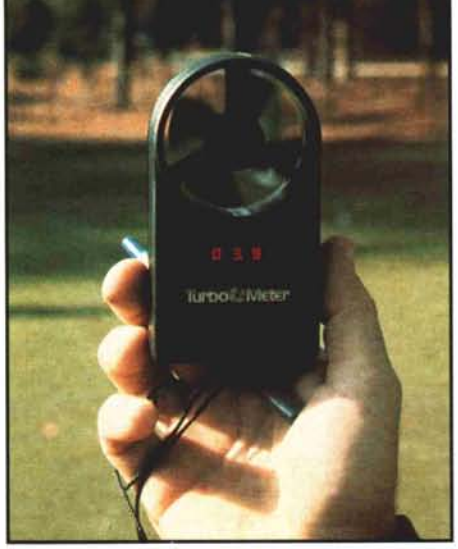
can be used for three-phase motors, resulting in a lower initial installation cost. Many water coolers, irrigation and lift stations, and clubhouses have three-phase power for fans near these sites. Sometimes step-down transformers are needed, especially for the oscillating motor, which is always single-phase power, and luckily these transformers usually cost just $30.

All new electrical equipment and service must meet the local codes. Tables are available to calculate the wire size needed based on the distance from the power sources to the fan and the resistance loss in the wire. Direct burial cable wire (usually #4 or #6 cable) normally is pulled into the ground with a vibratory plow on a ditch-witch trencher with minimal disturbance to the surface, although occasionally small trenches are made to insert the wire. Wire depths vary according to the local codes, but most installations require an 18- to 24-inch depth. Wire is sometimes placed in a plastic conduit (depending on the local codes) under cart paths and service roads and across bridges for additional protection. Avoid the use of junction boxes whenever possible, as they could become sources of problems later.

At the green installation site, the wires, switches, timers, and plugs usually are placed in a sealed irrigation valve box with drainage. Avoid wiring the fan directly, as removing the fan later with this type of connection system is more difficult. Installing an extra plug to power a portable fan that may be needed later is always a plus, but a larger size wire will be needed initially to handle this extra power requirement. Timers also can be installed in the valve box to vary the operation of the fans. At The Honors Club, course superintendent David Stone has even connected his fans to the irrigation radio controllers. A switch to turn the fan off and on is another plus. It is always a good idea to install a ground fault interrupter at the plug to act as circuit breaker to enhance the safety of maintenance workers and golfers. Circuit breakers at the meter also help to avoid electrocution concerns. Afterwards, have an inspector check all electrical work to insure that all local codes are met.

Costs

Fans are used most during the months of May through September in the southern portion of the United States. Obviously, operation time will vary depending on the location of the golf course and the weather each summer. Most utility companies offer seasonal or full-time service for these meters. Flexible programs depending on the projected power consumption and usage are offered by many power companies, and consultants can detail your options. Most superintendents report typical electrical power costs for running two fans at a green site average between $75 and $100 per month.



The Turbometer is one tool that can be used to help determine fan locations around a green.

Fan Maintenance

Fans have required very little preventive maintenance so far on golf courses. Rust spots and scratches will occur over time just from being outside. A few fan distributors even offer annual maintenance services to wax and paint fans, but so far very few customers have taken advantage of this service. Most superintendents bring the fans inside the maintenance building or into a pole barn for the winter months. In any case, the structure must be tall enough so the fans can be stored in an erect position so moisture cannot enter the fan motor. Pole fans are easily disconnected by unscrewing the poles from their stands. The outside electrical components are protected by capping the plastic storage box. Some superintendents prefer to leave the fans at their permanent sites, especially if not enough storage space is available at the maintenance area. Heavy-duty fan covers that will not tear or blow away are now available from most distributors.

Noise

The auditory effects of fans are also a consideration. Most courses have home sites near some of their greens today, and some residents may be close enough to hear the fan motor noise. Educating your neighbors about the importance of the fans is essential for the superintendent. Letters sent to these homeowners each spring discussing the agronomic value and fan operational hours may help reduce complaints.

Effects on the Rules of Golf

Fans do have an impact on the Rules of Golf, depending on whether they are permanently or temporarily installed. Any time fans are installed in a permanent base, the golfer can assume the fan won't be moved. Permanently positioned fans are considered immovable obstructions according to the Rules of Golf. If the fan interferes with the lie of the golf ball or the swing or stance of the golfer, relief is provided under Rule 24-2. Sometimes the fan may be found between the golf ball and the hole location. Under this Rule, line-of-sight relief is not provided for with permanently installed fans, and the ball must be played as it lies.

Fans that have been set up on a temporary basis are treated as temporary immovable obstructions. Intervention on the golfer's line of play would warrant relief.

If a golf ball deflects off a fan, it is a *rub of the green* and the golfer plays the ball where it lies. If a fan deflects a golf ball out-of-bounds, the golf ball is still considered out-of-bounds.

Conclusion

Fans have made a major impact on many golf courses by helping the turf survive where it previously had died each summer. Many golfers also enjoy the additional comfort of a cool breeze while putting. However, sometimes fans are a nuisance to golfers because of the extra noise and their impact on the Rules of Golf. These negative factors must be weighed against the gain of improved health and playability of putting green turf.

[1]Gene Rupert Taylor II. 1995. The Effects of Mechanically Induced Air Movement on the Temperature, Water Potential and Soil Moisture Percentage of Creeping Bentgrass (*Agrostis stolinifera* L.) Golf Greens. MS Thesis, North Carolina University.

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