Winter Play — When to Go and When to Say No

Applying the principles of turf science to common winter scenarios that arise on golf courses allows decision makers to implement preventative measures, assess risk, and make informed decisions that provide an appropriate balance between the needs of the turf and the expectations of golfers.

BY CHRIS HARTWIGER AND ADAM MOELLER

Above left: Cart or foot traffic on frost can be lethal to turf. Eliminating shade will reduce frost delays on this putting green. Above right: Cart traffic on thawing or wet soils can cause severe tire rutting and soil compaction. Completely restricting carts or limiting them to paths only is the best way to prevent this type of damage.

Golfers are always anxious to get onto the course and thus cannot help but be disappointed when they hear the words "frost delay," "frozen greens," or "cart path only." Unfortunately, golfers who enjoy playing all year inevitably will encounter periods when limiting access to the golf course is necessary. Despite the desire of golf course operators to satisfy their customers and succeed in the golf business, decision makers at golf facilities must understand that there are a variety of agronomic factors in play during the winter months that may require limiting access to the golf course. At the crux of winter issues are questions that every golf course decision maker must answer. How will turf that is slowly growing or not growing at all respond to play on a particular day? Will traffic from golfers result in short- or long-term harm to the turf that could affect course conditions in the spring and summer? Is the cost of repairing some damage less than the loss of revenue that occurs when access to the course is limited?

This article describes the environmental conditions and characteristics of cool-season and warm-season turf that make them vulnerable to winter injury. The most common issues regarding winter play are identified and guidance is provided to aid in the decision-making process.

CHANGING SEASONS EQUALS CHANGING GROWTH PATTERNS FOR COOL- AND WARM-SEASON TURF

No golf course is exempt from decisions about winter play, because the growth pattern of all turfgrasses changes as day length shortens and temperatures fall. However, the complexity of the decisions varies widely from region to region and often from winter to winter. When temperatures fall below the ranges considered optimal for turfgrass growth, there is a change in the response of turfgrasses to stresses from golf and course maintenance activities. Therefore, turf managers must adapt to a variety of scenarios that affect short- and long-term turfgrass health as weather patterns become colder. Furthermore, in some parts of the country the turf and soil freeze for long periods of time, adding additional considerations that must be taken into account when managing winter play.

Understanding seasonal climate trends and the growth patterns of

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Table 1		
	Degrees F	**Source**
Ultradwarf bermudagrass	20 - 24ºF	Anderson et al., 2002
Creeping bentgrass	-40ºF	Tompkins et al., 2000
Annual bluegrass	-4 - 14ºF	

Research has identified the air temperatures at which a 50% loss of turf is expected to occur for ultradwarf bermudagrass, creeping bentgrass, and annual bluegrass. It is important to note that these studies were conducted in highly controlled freeze chambers in laboratories. Due to the complex nature of winter injury in the natural environment, these temperatures may or may not inflict the same amount of damage on your course.

cool- and warm-season grasses is a prerequisite to making sound decisions regarding winter play. Both cool-season and warm-season grasses are distributed widely across the country. The optimum temperature range for cool-season turfgrass growth is between 60 and 75 degrees Fahrenheit, while warm-season turfgrasses have an optimum temperature range between 80 and 95 degrees Fahrenheit (Beard, 1973). Plant growth slows when temperatures fall below these respective ranges and, ultimately, all grasses can be severely damaged by temperatures below freezing (Table 1).

SUBOPTIMAL TEMPERATURES

Almost every golf course experiences periods when the temperature falls below the optimum range for turfgrass growth. When temperatures no longer support optimum growth, turfgrasses will recover from stress at a reduced rate. Therefore, golf traffic during periods of reduced turfgrass growth can result in increased amounts of worn turf. Additionally, warm-season grasses experience chilling stress as temperatures fall below 60 degrees Fahrenheit. The chilling stress disrupts the photosynthetic cycle and causes the leaves of warm-season turf species to turn brown. The brown, dormant warm-season grasses have no recuperative ability.

Additionally, there are a few soil-related considerations that can affect golf as temperatures fall into the sub-optimal range for turfgrass growth. As temperatures decrease, the rate of evapotranspiration decreases as well. In many climatic zones, precipitation can exceed evapotranspiration during the winter, and it is not unusual for soils to become undesirably wet for golf. While this may not have a significant impact on turf health, it does have implications when traffic is applied to wet turf. Wet soils are more easily compacted than dry soils, and turfgrasses will not reach their potential when grown on compacted soils.

In arid climatic zones, lower temperatures accompanied by seasonal winds can promote excessive drying and the accumulation of salts in the upper rootzone. High concentrations of salts can be harmful to turf and further slow recuperative ability.

FREEZING TEMPERATURES

As turfgrasses are exposed to temperatures below freezing at night and above freezing during the day, plant and root growth slows or

Golfer foot traffic on putting greens that are not growing can cause turf decline because new leaves are not being generated by the plants. Notice the healthy turf around the hole location, which was not subject to concentrated foot traffic.

Snow and ice cover on putting greens provides insulation to turf from direct low-temperature injury. However, melting snow and ice can refreeze and result in crown-hydration injury.

eventually stops, and turf managers must adapt accordingly.

The first concern during periods of freezing temperatures is an even further-reduced recuperative rate of turfgrasses — especially turfgrasses that continue to receive traffic. During periods of freezing temperatures, the leaves and roots of cool-season grasses may still be slowly growing even though all growth has stopped for warm-season grasses. The cumulative stress and damage caused by traffic during periods of freezing temperatures will mount for both cool- and warm-season grasses.

As temperatures fall further below freezing or freezing temperatures persist for longer durations, additional situations arise that can affect turf and soil health. The term *winter injury* is used to describe the damage that occurs (either naturally or as a result of traffic) under the wide variety of conditions that exist during winter. Winter injury can include damage from frost, desiccation, low-temperature kill, ice, crown hydration, and traffic on wet, frosted, frozen, or thawing soils. Warm-season and cool-season turfgrasses have different thresholds for damage, as do different grass species within these categories.

Cool-season turfgrass can also go dormant in the winter. Each winter is different and, although snow cover might not cause the course to be closed, the lack of turf growth warrants the use of cart-path-only policies in many situations.

STRESS FACTORS ADD COMPLEXITY TO DECISION MAKING

While suboptimal freezing temperature is one stress that can affect all turfgrasses, when one or more additional stress factors occur concurrently, winter injury may be exacerbated. Understanding the additional stress factors that affect turfgrass performance throughout the winter can help turf managers make proactive decisions that promote turf survival before the winter and helps course decision makers manage winter play.

Shade is an often-overlooked stress factor. During the winter, the sun angle reaches the lowest point of the horizon in the northern hemisphere. As a result, the amount of shade on golf courses increases. Obviously, this is a particularly serious issue on heavily wooded courses. In parts of the country that are above freezing but below the temperature range for optimal turf growth, shade further reduces recuperative ability even though temperatures may remain warm enough to support some growth. Furthermore, shade keeps soils colder and further limits turfgrass growth. In cases of direct low-temperature kill or crown hydration, it is common for the damage to be more prevalent and more severe in shaded areas.

Excessively wet soils are another stress factor that compounds the

Golf is played 12 months a year in many places, but concentrated cart traffic on turf subject to long periods of suboptimal temperatures can result in thin, weak turf that does not meet golfer expectations. Traffic should be dispersed over a wider area.

effects of low temperatures. Wet soils are prone to compaction that destroys soil structure. Turfgrasses grown on compacted soils have shallower, less-developed root systems that compromise the long-term health of the plants. Not only will turf underperform in compacted areas during the growing season, but these plants will be more at risk for both cumulative injury from traffic and acute injury from low temperatures.

Finally, traffic is one of the most important stress factors to consider. In one aspect, traffic is highly desirable because it means people are playing golf and enjoying the game. Unfortunately, traffic can cause cumulative injury to the turf over time. Concentrated vehicle traffic is the most damaging.

Short days, shade, and suboptimal temperatures are a bad combination for bermudagrass putting greens. Reducing shade can improve winter turf quality dramatically.

As stress factors stack up on each other, damage to turf is magnified. Salt accumulation, traffic, and shade are primary problems that affect winter play.

MAKING DECISIONS ABOUT WINTER PLAY

Making decisions about managing winter play on the golf course can be challenging. However, knowledge of how the previously reviewed factors affect turfgrass performance during winter can be applied to a variety of common scenarios. In each of the following scenarios, the risk for winter injury is assessed and science-based preventative measures are provided.

PUTTING GREENS

Scenario 1: Play on slow-growing or non-growing greens

The Problem: Golf is frequently played during times of the year when temperatures are below optimal ranges for turfgrass growth and the recuperative ability of turf is reduced. Under these circumstances, traffic from play can create uneven playing surfaces and thin turf that favors the invasion of undesirable grasses or weeds. Often the wear patterns from traffic are worse, or more pronounced, in shaded areas. On creeping bentgrass putting greens, wear and shade favor the invasion of *Poa annua*.

Risk Assessment: Any turf damage associated with playing on slow-growing turf is cumulative, not immediate. It may or may not be easy or fast to repair the damage during the next growing season. Increasing *Poa annua* population in creeping bentgrass putting greens is a good example.

Preventative Measures: Risk can be reduced to some extent by growing and maintaining a healthy stand of turf before the onset of cooler temperatures. Cultural and maintenance practices that are helpful in promoting healthy turf that will better withstand traffic in cool weather include:

- Appropriate annual aeration and topdressing programs
- Adequate fertilization
- Higher mowing heights
- Proactive shade management
- Maximize available cupping area

Fairway overseeding is used in certain areas where revenues are highest during the winter. In addition to the financial cost, playing quality is disrupted during establishment in the fall and, depending on the circumstances, the transition back to bermudagrass in the spring could also decrease playing quality.

Best Course of Action: Allow play and focus on the preventative measures described above. On creeping bentgrass putting greens, begin to limit play as average temperatures decrease in the fall. On bermudagrass greens, raise the cutting height before the turf enters dormancy to provide additional protection for the crown of the plant.

Scenario 2:
Play on frosted greens

The Problem: Frost-covered turf on putting greens is susceptible to immediate damage from traffic. Ice crystals on and inside the plant can puncture cell walls and cell organs. When foot traffic occurs on heavily frosted turfgrass surfaces, entire plants can be killed, leaving foot-shaped patches of dead turf.

Risk Assessment: Damage to the turf will occur immediately, and the symptoms of the damage become obvious as the turf grows. Healing may not occur until the next growing season begins.

Preventative Measures: In most climatic zones, frost is a common occurrence. The best preventative measure to minimize frost delays is to reduce morning shade on greens. Sometimes a light syringe cycle is used to dissipate the frost. However, careful judgment must be used or the irrigation water can freeze, further extending the frost delay and potentially making the greens and surrounds wetter than desired.

Bermudagrass managers may apply wetting agents to prevent early season frosts. Also, when a heavy frost is predicted, managers of bermudagrass putting greens may use lightweight covers overnight to prevent frost the following morning.

Best Course of Action: The time-honored tradition of not playing on frosted greens is recommended and has produced good results over time. In the big picture, the disruption to golf is small, yet it prevents injury to the turf. The advent of various social media outlets has improved the speed at which golfers can be informed about frost delays. Rapid and clear communication should reduce the inconvenience and make frost delays less frustrating.

Scenario 3:
Playing on frozen greens

The Problem: Temperatures remain below freezing for several days, and one or more putting greens remain frozen all day. Under these conditions, even cool-season grasses will not be growing and their ability to recover from traffic through growth is lost. There is a concern that foot traffic on frozen greens will cause more rapid wear injury under these conditions.

Risk Assessment: Any damage that occurs from playing on frozen greens will be cumulative.

Preventative Measures: There are no practical measures to prevent the soil from freezing or minimize damage caused by golfer traffic.

Best Course of Action: There are likely to be few, if any, golfers who want to play on a frozen golf course. Frozen golf greens do not hold most approach shots. The best course of action is to close the golf course and wait for conditions to improve.

Scenario 4:
Play on thawing greens

The Problem: It is common that for two to four weeks during spring the weather at many northern golf courses will generate increased play while the putting greens are thawing. However, while the top layer of thawing putting greens becomes soft and wet, the soil below remains frozen. Foot traffic under thawing conditions can cause root shearing at the interface between the thawed and frozen soil, causing damage to the root system. Additionally, minor-to-severe foot rutting can occur, causing short-term and possibly long-term surface-smoothness issues.

Risk Assessment: The chance for immediate turf injury is high under this scenario. Playing on thawing greens will damage the root system. The resulting damage will be expressed as the turf begins to grow in the spring. On creeping bentgrass putting greens, this type of damage can open the door for *Poa annua* invasion.

Preventative Measures: In parts of the country where the ground freezes for weeks or months, there is no practical measure that can be done to prevent putting greens from freezing. Appropriate core-aeration and top-dressing programs are recommended to help dilute organic matter and keep the top few inches of putting green soil dry. On northern courses, temporary

Cold temperatures can damage bermudagrass putting greens. The area to the left was damaged in one night when half of the cover was blown off this putting green.

Turf covers help protect bermudagrass putting greens from winter injury, but good judgment is needed when deciding when to remove them.

putting greens are sometimes installed for winter play. Temporary greens keep play and foot traffic off the putting greens.

On warm-season putting greens in the transition zone, turf covers are used to protect against low-temperature kill, but they also help prevent the greens from freezing.

Best Course of Action: This scenario is the most complex of any mentioned thus far. There is a good chance that greens will not thaw at the same rate due to different positions in relation to the sun and varying shade levels. The best course of action is to not allow any play on the days when the greens are thawing. The risk is simply too great to jeopardize the health and quality of the turf during the upcoming playing season.

Scenario 5:
Remove putting green covers or keep them on?

The Problem: Covers are used on bermudagrass putting greens to protect them from winter injury when nighttime temperatures fall below 25 degrees Fahrenheit. Sometimes a cold front will bring a series of nights below 25 degrees Fahrenheit while daytime temperatures rise above freezing. Should the maintenance staff remove the covers to allow golf if they know they will be covering them later the same day?

Risk Assessment: There is no risk of turf injury whether the greens are covered or uncovered during the day in this scenario.

Preventative Measures: Because this is a labor issue, preventative measures do not apply to prevent this scenario from occurring.

Best Course of Action: The best course of action at resort and daily-fee courses is to determine the cost of covering and uncovering the greens versus the revenue that will be gained. If there is not sufficient revenue to offset the cost, do not remove the covers. At private clubs, a fairly specific policy on when to uncover the greens and who is responsible for making the decision should be included in the club's maintenance guidelines. A well-written and widely published policy will greatly reduce debate on the issue whenever these conditions occur.

TEES, FAIRWAYS, AND ROUGH

These playing areas comprise most of the turf on the golf course. They are diverse in many ways, including soil type, drainage patterns, aspect in relation to the sun, amount of shade, cart path position, and more. The scenarios below are common to many golf courses, but because of the diversity of the playing areas, golf course decision makers must use careful judgment.

Scenario 1:
Play on slow-growing or non-growing turf

The Problem: This issue is particularly difficult on golf courses in areas with warm-season grasses and where year-round play occurs. Turf becomes thin or matted down under golf cart traffic. The quality of the ball lie diminishes, particularly for the high-handicap player. Also, the definition between the fairway and rough becomes difficult to distinguish. By spring, golfers often complain that "there is no grass on the fairways." Conditions will not improve until new growth emerges from the ground in the spring.

On cool-season courses, golf cart traffic on these areas prior to the onset of the winter can weaken turf and compact the soil, particularly if the areas are wet. Compaction increases the potential for winter diseases, *Poa annua* invasion or expansion, and lower-quality turf in the spring. In cases of very high traffic in combination with

other stresses, the turf can be killed and worn down to the soil.

Risk Assessment: Golf courses with moderate-to-heavy play during the fall, winter, and spring will often experience one or more of the problems mentioned above. The risk to the turf is cumulative over time, with one exception. Traffic on wet or saturated soils will immediately create ruts in the turf.

Preventative Measures: There are numerous steps that can be taken during the growing season and into the early portion of the fall to minimize, delay, or prevent traffic-related problems from expressing themselves.

- *Increase the height of cut in the fall.* A higher height of cut will result in greater protection of the crown of the turfgrass plant.
- *Later fall nitrogen fertilization on bermudagrass.* Research at Virginia Tech has shown that extending nitrogen applications into the fall may keep bermudagrass green longer and promote better recovery and earlier green-up in the spring (Reasor et al., 2012). It does not necessarily improve wear tolerance immediately, but it will keep leaf tissue green longer and help with course definition. Also, later nitrogen fertilization can delay the onset of the loss of leaves under traffic.
- *Growth regulator applications in the fall.* Research at the University of Tennessee showed that the use of the plant growth regulator trinexepac ethyl changed the architecture of the bermudagrass canopy and improved wear tolerance (Haselbauer, 2010). Observations in the field have shown that when late growth regulator applications are used in conjunction with the other two practices listed above, the result is a much denser canopy. This helps produce an excellent lie and turf that is better able to tolerate traffic.
- *Shade management.* Increasing sunlight levels always improves the growth and vigor of the turf. Reducing shade in high-traffic areas will produce stronger turf that is more wear tolerant as it heads into a period of suboptimal temperatures.
- *Core aeration.* This practice relieves soil compaction and improves soil structure, creating a better medium to grow a deeper, stronger root system that enhances the stress tolerance of the turf.
- *Topdressing.* This practice has been used extensively in the Northwest to provide firmer, more playable conditions during late fall, winter, and spring, when rainfall frequently exceeds evapotranspiration. Although topdressing does not replace the importance of having a good drainage network, it does make golf courses more playable during wetter times of the year.
- *Traffic management.* Proactively manage high-traffic zones during the growing season so that the turf in these areas is not weakened as growth slows.
- *Manage tee marker locations.* Rotate tee markers on a regular basis to disperse wear from foot traffic and divots. Reducing the number of tee markers (e.g., only one to two sets of markers per hole) and using forward or back areas on teeing grounds may be necessary to prevent concentrated wear, especially on tees where irons are used. Adjust teeing ground entry and exit points as needed to help spread wear from players gathering before they tee off. Pay particular attention to the tees on first and tenth holes.

Poor drainage, wet soils, shade, and traffic can be a lethal combination for any turfgrass. Alleviating one or more of these stress factors will help promote better winter playing quality.

- *Cart path expansion.* If winter play is popular and the cart path system is limited, expanding cart paths provides more options for keeping traffic off the turf when conditions warrant.
- *Perennial ryegrass overseeding.* This practice is used in some parts of the country as a way to provide winter color and improve the golfing surface in the spring. Unfortunately, the cost, disruption to playing quality from irrigation during establishment, and the risk of a bad transition in late spring do not make this a viable preventative measure in all but a small number of situations.

Best Course of Action: Implement as many of the above preventative measures as possible to create the healthiest, most stress-resistant turf. When turf is growing slowly, dispersing or spreading out golf cart traffic is of the utmost importance in order to minimize turf injury and avoid reduced playing quality in the spring. Keep carts on paths when conditions are wet enough to cause tire tracks or ruts.

Scenario 2:
Play on thawing or freezing turf

The Problem: Clay or other poorly draining soils are often the predominant soil types in fairways and roughs. In northern areas where soils are prone to freeze, internal drainage stops. Snowfall accumulates and melts, often resulting in saturated soils. Northern golf courses not only go through the freeze-thaw process regularly, but they also are prone to being very wet or soggy in the late winter and early spring. Both foot traffic and cart traffic can inflict serious damage to the turf and soil in the form of ruts and compaction. Root shear is also possible at the interface between frozen and thawed soil.

Risk Assessment: The chance of immediate turf injury is high under this scenario. Exposing thawing ground to golf cart and even foot traffic can cause significant and immediate damage. While some of the damage is obvious, other damage may not be fully expressed until the turf begins to grow actively.

Preventative Measures: Improving surface and subsurface drainage is the most beneficial preventative practice.

Best Course of Action: Keep golf carts on cart paths as the course is thawing. The decision to allow play should involve an assessment of soil moisture, the amount of thawing that will occur during the day, and the amount of play expected.

CONCLUSION

Golf is an outdoor game played on growing turfgrass plants. Inevitably, there will be times of the year when what is good for golfers might not be good for golf course turf. Most often, this conflict occurs in the late fall, winter, or early spring when weather conditions vary widely. Armed with a comprehensive understanding of turf performance, sound risk assessment, and the implementation of preventative maintenance practices, golf course operators can offer more golf during the winter with less risk of injury.

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CHRIS HARTWIGER *and* ADAM MOELLER *not only have years of experience playing golf in the winter, but they are consulting agronomists who have assisted many courses with these issues.*