

Is winterkill going to be a problem this year?**February 3, 2022**

To put it mildly, it can be very unsettling when turf doesn't green up in the spring. "Winterkill" is a generic term that is used to define turf loss during the winter. Winterkill can be caused by a combination of factors including crown hydration, desiccation, low temperatures, ice sheets and snow mold. Because of the unpredictability of environmental factors and differences in other factors such as surface drainage, the occurrence of winterkill is highly variable and can vary greatly between locations and even the same species in proximity.

Winter Desiccation

Desiccation occurs when turf is unprotected by snow cover and subject to drying cold winds for extended periods during the winter. Under these conditions, the exposed turf can lose significant moisture in crown tissues (where new roots, leaves, and stems are produced), resulting in the death of the plant. Damage is most frequently observed on susceptible species growing on elevated sites exposed to prevailing winds. Desiccation is most common on annual bluegrass at low mowing heights, but can also occur on golf course fairways, lawns, and sports turf. All cool-season turfgrasses can suffer from winter desiccation injury. Proactive measures to protect against winter desiccation include heavy sand topdressing applications in late fall, fabric covers, and various types of wind screens around exposed putting greens and other sensitive areas. Weather in much of Nebraska this winter has the potential to cause significant desiccation to susceptible species and locations. We are discussing this winterkill topic first and in greater detail because there are management strategies you can do now and buffer the possibility of extensive winterkill this spring. Let's start with weather conditions much of Nebraska has been experiencing and why we think winter desiccation injury is possible.

Weather Summary: A lot of warm days and a fast-moving storm, called a derecho, that spawned 30 tornados made for a wild December in Nebraska. We experienced our warmest December on record this year, as did the aggregate U.S. monthly average temperature. The extremely warm conditions helped spawn what is typically a summertime event rolling across the state on the 15th. High straight-line winds, hail, rain and tornados were all experienced in this event, causing localized damages and school closures for a large swath of Nebraska. Conditions were mostly dry with little snowfall to start the winter. Drought saw a general worsening in the south and southwest with 35% in drought at the start of 2022. Precipitation-The warm December resulted in a general lack of snowfall around the state. Spencer, Valentine, Chadron and Harrison reported the highest monthly totals of 10 to 14 inches. Areas in the Sandhills, northeast and western Panhandle received around four to six inches. Elsewhere, totals were less than three inches, with many locations not reporting any snow. Monthly precipitation totals were similarly highest in the central and across the northern tier of Nebraska at a half inch to an inch. The rest of Nebraska reported anywhere from zero precipitation to half inch. In the southeast quadrant, the monthly total was half inch less than normal and much of the state received about a quarter inch less than normal. The past 15 years has seen a tendency toward wet Decembers, with four of Nebraska's

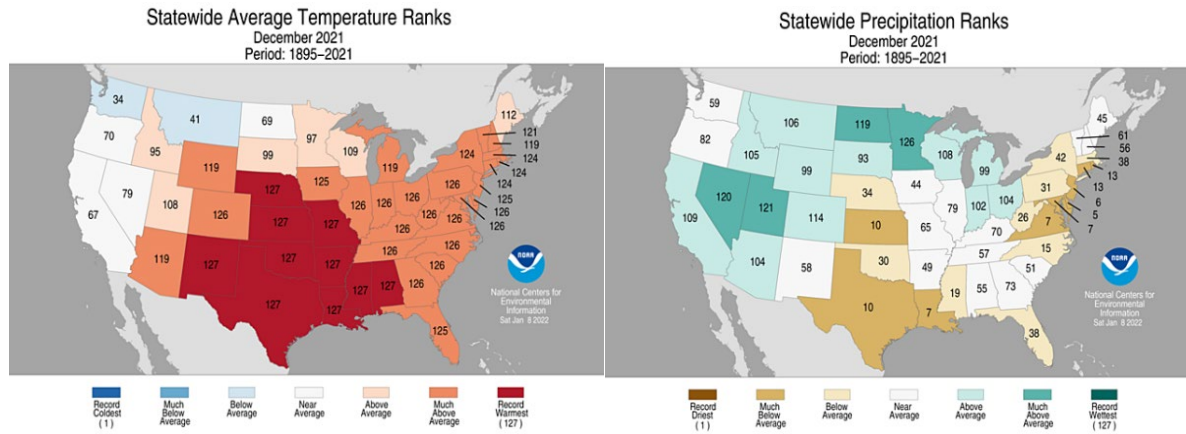
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top ten wettest occurring since 2006. However, that was not the case this year. The statewide average precipitation of 0.34 inch ranks as 34th driest on record and is 0.35 less than normal for December.

Projected Outlook-The Climate Prediction Center (CPC) released their updated January temperature and precipitation outlooks on December 31st which indicates that below normal temperatures are favored for all of the state with the exception of the southern Panhandle and the western half of the southwestern climate district. There are equal chances for above normal, normal, or below normal precipitation statewide. Nebraska lies on the southern periphery of expansive area of below normal temperatures forecasted for the Pacific Northwest eastward through the north central High Plains (ND and SD). Nebraska is also sandwiched between two areas of above normal precipitation forecasted for the northwestern United States and the eastern corn belt (Great Lakes, Ohio river valley and mid-Mississippi river valley). Numerical models indicated that during the first three weeks of January the United States will be dominated by an upper air ridge over the west coast and an upper air trough extending southward from the Hudson Bay low which includes the eastern half of the country. Nebraska appears to be on the western fringe of the upper air trough which would support cooler than normal temperatures but would also support quick warmups anytime the trough shift slightly east of the state. As additional pieces of energy rotate around this trough, quick moving Alberta Clippers moving southward will bring reinforcing shots of Arctic air. If any of these Alberta Clippers come down the front side of the Rocky Mountains, then upslope flow conditions from cold air damming against will have the ability to generate accumulating snowfall across the western third of the state. As we approached the final 10 days of the month, the GFS model hinted at a relaxation of this pattern and a movement back toward a more aggressive precipitation pattern for the western half of the country as Gulf of Alaska low begins to move toward the west coast of the United States. We unfortunately did not see above normal precipitation in January. This is further confirmed in the early February snowstorm that worked south and east of Nebraska offering no respite from dry conditions. Low moisture and temperature fluctuations coupled with above average winds, has set much of Nebraska up for desiccation injury.

Winter watering on sensitive sites or sites that historically are drier in the winter is recommended to limit desiccation. This should not be a typical irrigation cycle as your goal is to rehydrate the crown of the plant and not stimulate growth. In the absence of frost-free hose bibs, water may need to be trucked to sensitive sites.

**Figure 1**

Departure from Normal Temperature (F)
12/1/2021 – 12/31/2021

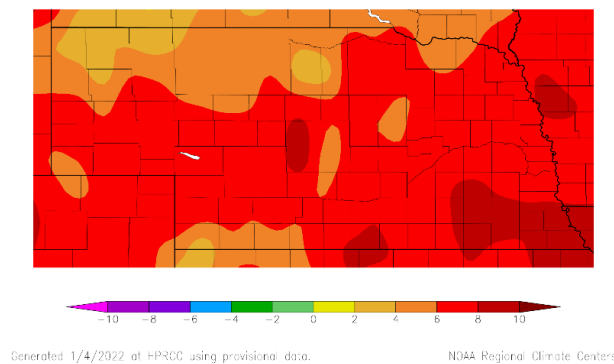
**Figure 2**

Figure 1 and 2 are a summary of the above info garnered from the Nebraska Climate Center.

Crown hydration

Crown hydration usually occurs in late winter following periods of thawing and freezing. During Nebraska winters, temperatures often rise above freezing for a few days up to a week at a time. Some turfgrasses (most notably annual bluegrass and perennial ryegrass) begin to deacclimate and crowns become hydrated. If a rapid drop in temperature below freezing follows the thaw, ice forms inside the crowns of hydrated turfgrasses and will either rupture cell membranes (when ice forms inside of cells) or draw moisture out of cells (when ice crystals form between cells). Crown hydration injury is most pronounced on turfgrasses growing in depressions and poorly drained soils. During warming periods in late winter, surface soil temperatures rise, and some thawing takes place. However, the soil remains frozen beneath the surface and water does not drain from depressions. When water refreezes during a rapid and dramatic drop in temperature, the deacclimated plants are killed. Annual bluegrass and

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perennial ryegrass are more susceptible to crown hydration injury than creeping bentgrass because it emerges from dormancy and begins taking up water from the soil. Creeping bentgrass does not resume growth as quickly and does not take up water and is not as susceptible to crown hydration injury during. In Nebraska the loss of annual bluegrass, especially on highly maintained golf and sports turf, due to crown hydration is sometimes viewed as a positive,

Direct Low-Temperature Kill

Turfgrasses can sometimes be damaged by what is known as direct low-temperature kill. This type of winterkill occurs during extremely cold temperatures early in the winter following a relatively warm period in late fall. Typically, plant tissues undergo a dehydration process in late fall in response to gradually decreasing temperatures and shorter photoperiods. The dehydration process is accompanied by an increase in cellular solutes (potassium ions, sugars, etc.), allowing the plants to "harden off" or acclimate to freezing temperatures. Warm weather during late fall can delay the acclimation process and allow plants to become susceptible to ice formation in crown tissues with a sudden and dramatic drop in temperatures. Low-temperature kill is caused by ice crystal formation at temperatures below 32 degrees F. Factors that affect low-temperature kill include hardiness level, freezing rate, thawing rate, number of times frozen and post thawing treatment (Beard, 1973). Soil temperature is more critical than air temperature for low temperature kill because the crown of the plant is in the soil. It is difficult to provide absolute killing temperatures because of the numerous factors involved. Beard (1973; Table 1) provided a general ranking of low-temperature hardiness for turfgrass species that were autumn-hardened. In Nebraska newly seeded or younger tall fescue stands, especially when seeded later in the fall can be thinned or lost completely, when conditions are favorable for direct low temperature injury and winter desiccation.

Table 1

Low-temperature hardiness	Turfgrass species
Excellent	Rough bluegrass
	Creeping bentgrass
Good	Kentucky bluegrass
	Colonial bentgrass
Medium	Annual bluegrass
	Tall fescue
	Red fescue
Poor	Perennial ryegrass

Ice sheets

Ice sheets are often blamed for killing turf when, in fact, it is crown hydration and subsequent refreezing that has resulted in the kill. The reason for the confusion is that, as snow melts and refreezes, creating ice sheets, the ice sheets are often in poorly drained areas where crown hydration can occur because of the standing water. As the ice sheet melts away, the area damaged closely mirrors where the ice occurred, and therefore, the conclusion is that ice sheets caused the kill. Beard conducted research on ice sheets on three turfgrass species: Kentucky bluegrass, creeping bentgrass and annual bluegrass. Kentucky bluegrass and creeping bentgrass survived 150 days of ice cover without significant injury; annual bluegrass was killed somewhere between 75 and 90 days of ice cover (Beard, 1998).

Snow mold

The two diseases commonly called snow mold are Typhula blight (gray snow mold) and Microdochium patch (pink snow mold). Gray snow mold requires extended periods of snow cover; pink snow mold can occur either with or without snow cover. If snow mold injury is a recurring problem, preventive fungicide applications are the best control option.

Proactive Diagnosis

If you suspect winterkill, samples can be taken from turf areas, moved inside and placed in a warm, sunny area to see if the turf greens up. If the soil is dry, be sure and apply water. If there is no green-up within a couple of weeks, the turf was severely damaged. Not rocket science but can be helpful to determine the need for corrective actions in the spring. The UNL turfgrass team has pulled samples and we will keep you updated via turf iNfo on what we see and provide management strategies if needed. Might be a time to be pragmatically realistic and hope for the best and plan for the worst.

Literature Cited

Beard, J.B. 1973. Turfgrass: Science and Culture. Englewood Cliffs, N.J.: Prentice-Hall.

Beard, J.B. 1998. Winter ice cover problems? TURFAX. 9(1):1-2,5.

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