Applying topsoil to greens and surrounding area with a broadcast type fertilizer spreader to prevent winter injury.

Turfgrass and the Common Cold

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As winter sets in it may be well to review some of the problems associated with turf management during the period when the grass is dormant or in a semi-dormant stage.

DESICCATION: Any and all grasses may be affected by desiccation. During the winter of 1967-68, severe desiccation caused extensive damage to turf over much of the nation. High windswept areas are most susceptible, but any area may be affected.

Conditions which bring about desiccation may be dry, frozen, or saturated soil. With dry or frozen soil, moisture is simply not available and wilting occurs because the plant is transpiring more moisture than the roots can absorb. When the soil is saturated, oxygen is excluded and the roots are unable to absorb the moisture that surrounds them because the cell walls become less permeable.

Large quantities of water at a single application during winter may only compound the problem, but light timely applications, such as may be made with a power spray machine, will usually provide sufficient moisture to keep the crown of the plant alive until moisture is again available to the roots.

PLANT HARDINESS: Plant hardiness is a characteristic of the turfgrass species. Nevertheless, there are exceptions in almost every species. They are due to improved varieties as well as to external factors in the environment.

Dr. James B. Beard of Michigan State University has rated the relative cold hardiness of 19 turfgrasses. He published his findings in the Quarterly Bulletin of the Michigan Agricultural Experiment Station in February, 1966. Basically,

he found creeping bentgrass and roughstalk bluegrass to be the most cold-hardy of those tested. Kentucky bluegrass was also quite cold tolerant, with annual bluegrass, red fescue, redtop and tall fescue falling into an intermediate category. The least cold-tolerant of the grasses was annual ryegrass. A later evaluation included warm season grasses. It placed bermudagrass at the bottom of the scale with zoysia slightly above, and intermediate between perennial ryegrass and annual ryegrass.

FERTILIZATION: Sim H. Reeves Jr., in completing his Master's degree at Texas A & M University, has uncovered some interesting facts about the influence of fertilization on cold-hardiness.

Reeves' studies of Tifgreen bermudagrass and St. Augustine grass indicated that nitrogen alone did not seem to have a major influence on cold-hardiness. However, it did exert a direct influence on the assimilation of phosphorus and potash, and the ratio of the three elements to each other did influence cold-hardiness. Nitrogen and phosphorus seemed to reduce cold-tolerance but their effect was offset by the uptake of potassium.

As tissue content of nitrogen increased, the assimilation of phosphorus and potassium in the plant also increased, although a high ratio of phosphorus to potassium did not seem desirable for optimum cold-tolerance. The detrimental effect of high phosphorus levels seems to stem from the influence of this element on the conversion of sugar to starch. The effect of phosphorus on high energy compounds such as ATP (Adenosine-5'-triphosphate) and on the plant protein may also influence cold-hardiness.

Turf must have a source of carbohydrates for winter survival. These carbohydrates may be stored in the stolons and rhizomes in warm-season grasses, while the carbohydrates are stored in the crown of cool-season grasses as simple sugars. These carbohydrates must be built up during a time when there is an excess of plant sugar produced by photosynthesis above the amount needed for new growth of the plant.

Dr. Beard has reported that late fall fertilization stimulates growth and tends to increase the plant tissue hydration which makes the turf more susceptible to cold injury. He also states that turfgrasses usually reach a peak of hardiness during mid-winter, and then decline.

Notwithstanding, studies at Virginia Polytechnic Institute, the University of Rhode Island, and Texas A & M University have indicated that nitrogen is essential to photosynthesis and the production of carbohydrates. Winter applications of soluble nitrogen do indeed increase carbohydrates in the plant and are beneficial to top and root growth in the following months. As yet the decreased cold-hardiness which may have resulted from winter fertilization has not been a major problem in the areas where the studies were conducted. Because of a lack of winterkill on turf receiving late fall and winter fertilization, the theory has been advanced that winterkill is less a result of improper fertilization than it is a result of such climatic factors as rate of freezing, rate of thawing, number of times frozen, and length of time frozen.

Certainly more study needs to be given the prospect of winter fertilization as related to cold hardiness. There is a great deal of evidence now that indicates distinct advantages for winter fertilizer applications. It also appears that further studies on the use of soil heating and/or different types of natural or artifical mulches may be quite beneficial in eliminating winter injury to high value turf.

SOIL WARMING AND MULCHES: For many years the technique of covering golf greens in the winter with brush, pine boughs, or straw has given varying degrees of success in protecting the greens against winterkill, but, the process was messy and time-consuming. More recently, interest has centered around artificial mulches and coverings, as well as soil heating. Polyethylene covers seem to work very well to protect turf and produce active growth in new plantings during the winter. However, the question of when they can be safely removed is still a perplexing one.

Plastic screens similar in appearance to normal window screen have done well in giving winter protection to putting green turf in studies at the University of Rhode Island. Black and green-colored plastic screening over turf has given the grass a consistently better rating than turf that was left uncovered. This screening is easy to apply and stabilize, and usually may be used for several seasons.

Among the first large scale installation of a soil warming system in this country, was in Busch Memorial Stadium, St. Louis, Missouri. Studies are now being conducted on both cool and warm season turf to evaluate this technique for various adaptations.

DISEASE: After a discussion of mulches and coverings for greens, it would be well to add that adequate disease prevention is required under these materials to avoid severe injury. In a large portion of the United States and Canada where cool-season grasses are grown, the snowmolds, *Typhula itoana* and *Fusarium nivale* are the main diseases of concern during the winter.

Typhula itoana, also called Typhula blight,

snow scald, or grey snowmold, begins its activity in late fall with the coming of cold weather. Small fruiting bodies called sclerotia, which are about the size of a pinhead, are a unique characteristic of *Typhula*. These fruiting bodies are found embedded in the leaves and crown of the turf during the summer months and infect the plants when the weather conditions change in the fall. Optimum conditions are produced by snow falling on unfrozen ground. Turf is usually killed or severely damaged by this disease and preventive measures should be taken against its occurrence.

Fusarium nivale is usually less damaging than *Typhula itoana* although severe infections may cause a crown rot which produces dead spots in the turf. This disease, commonly called pink snowmold, derives its name from the pinkish color of the fungus strands produced by the *Fusarium*. Snow is not required for this disease to occur, and it may infect the turf at any time when there is high humidity and a temperature of 32° to 65° Fahrenheit.

Fungicide applications for snowmold prevention should be made just prior to the first snowfall and repeated when the turf is free of snow cover in mid-winter and again after the final spring thaw. Certain granular materials having a mercury base are now on the market and provide protection for several months without reapplication.

Penncross and Congressional bentgrass show some resistance to pink snowmold, and although this disease has been reported on bermudagrass, it is an uncommon problem in the area of warm season grasses.

WINTER TRAFFIC: For years it has been apparent that traffic on the golf course is a major source of concern at any time and much more so during the winter when turf has little chance for recovery. In warmer areas south of the transition zone, overseeding cushions the dormant turf on greens, but even this is ineffective in preventing damage when the temperature is cold enough to freeze the soil.

Articles relating the devastating effects of winter traffic are plentiful but even so, many refuse to heed warnings and insist not only on golf at any time, but the use of the course for winter sports such as sledding, skiing and snowmobiles. This is really a matter for individual clubs to decide but it would seem more equitable if decisions were made by the entire golfing membership rather than by a few proponents of winter sports. The option of whether to open or close the course might well be given to the golf course superintendent and his Green Committee. The reasoning behind an open course at any time is outdated unless the membership is prepared to accept less than the best and spend more to get it.

Greens dry from the edges first because of soil texture difference between the green proper and the collar. Drying occurs in winter as well as summer. Severe desiccation caused cracks in edge of the green above.

One answer to this problem of winter play which seems to be the most acceptable to all concerned is to provide alternate winter greens and, if possible, alternate winter tees. The course may then be played at any time without causing damage to the permanent turf. This has worked very well at many courses, and the expenditures for the alternate playing surfaces can be less than $500 a year.

Winter traffic takes its toll. Its effects appear as weakened or dead turf, shallow rooting, poor soil structure, displacement of soil into ruts and depressions, and the encouragement of such weeds as *Poa annua* and knotweed. Attrition from foot or vehicular traffic is a great concern on dormant turf. This type of damage is especially severe when the soil is frozen and has no resiliency. When the soil has thawed in the top one-half inch or so and remains frozen below this depth, traffic often causes a shearing effect which prunes the turfgrass roots.

Frost covered but growing turf is immediately damaged by traffic of any kind. Traffic causes a rupturing of the plant cells in the grass blades

and they quickly die. If root reserves are insufficient to sprout new tops, the whole plant dies. Where air temperatures are favorable, frost can be removed by syringing greens, otherwise traffic should be prohibited until the danger of damage has passed.

Soil displacement and compaction are very much in evidence following some winter play. If allowed to take place, they have to be reckoned with the following year. A golf green should be built with a stabilized soil that resists compaction to certain limits. Unfortunately, most greens are not so constructed. A mushy soil can be displaced physically by footprinting or rutting even though it is compacted as far as possible. A compacted soil is characterized by lack of pore space which sometimes makes it impervious to moisture and does not allow for a proper exchange of air and gasses. Turf roots grow only with difficulty in such soils and proper maintenance is increasingly more difficult even with the best machinery and knowhow.

Poa annua rapidly increases under winter play, and it seems that golf spikes make an excellent planting tool for the seeds by pushing them into contact with the soil and reducing the competition from other grasses. Knotweed, too, loves a compacted soil and comes on when the soil reaches a point of compaction where nothing else will grow.

ICE AND SNOW COVER: Snow cover is usually beneficial to turf provided proper preventative measures have been taken against disease. In many areas, snow cover is encouraged by the use of snow fences.

Ice cover is entirely another matter. Theories of how ice cover damages turf and what to do about it are many and varied. A number of superintendents break up the ice layer and remove it. Others melt it with organic fertilizers or top-dressing. In fact, a fairly heavy top-dressing in the fall before ice forms seems to be a most beneficial practice. Most superintendents will agree that damage is likely to occur if some measures are not taken to remove the ice sheet within 20 to 25 days after formation.

THATCH: We have observed that new plantings are seldom damaged by winter injury although older turf surrounding it may be completely killed. Thatch accumulation could easily be a contributing factor because it acts as an insulator to prevent soil from absorbing or radiating solar heat, and it harbors disease.

Thatch is a little-considered factor among the causes of winter injury, but we are certain that an excess of thatch works against good turf at any time.

SUMMARY: Winter weather is very inconsistent and brings about hazardous turf management conditions. Nutrition research and continuing studies into techniques of protecting turf against the ravages of cold weather gives us new information and new insight each year. But for the most part, we are living in 1969-70, and we're still very much at the mercy of Mother Nature's common cold.

A water main leak in freezing temperatures is real winter trouble.