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cold tolerance. Collaborative work with Penn State University may one day result in commercially available, turf-type Poa annua seed for use in Canada. Poa annua is such a prolific and successful weed species that could make a good putting surface if we could improve its winter hardiness.

Will prolonged ice or snow cover damage Poa annua or creeping bentgrass?

Tompkins, Ross, and Moroz Prairie Turfgrass Research Center, Olds College, Alberta (2nd yr of 3 year study)

Turf managers have always been concerned when greens become covered in ice. The question arises as to whether the ice should be removed. Research from the 1960s recommended removal of ice covers before 50 days. This study was designed to define specific ice cover tolerance, using laboratory and field data. Dr. Darryl Tompkins and his team discovered quite a difference between Poa annua and creeping bentgrass. Poa annua plants were dead after only 60 days covered in ice. In contrast, creeping bentgrass plants showed cold hardiness to -26 °C after 90 days of ice cover before 50% of the plant population died. After 120 days of ice cover, this cold tolerance was further diminished with 50% of the population dying at -16 °C.

A related field study compared the effects of snow cover, snow removed in February, ice cover and ice removed in February for the two grass species. Ice covered Poa annua plants were dead by late February after a period of less than 40 days. Creeping bentgrass plants in all treatments could tolerate temperatures below -20 °C into April. However, plants from plots where the snow and ice were removed had reduced levels of cold hardiness. Therefore, to be safe, ice should be removed from Poa annua within 30 days of cover, but bentgrass should survive 90 days of ice cover.

Is there a Biological control of grey snow mould?

Hsiang and Liu (5th yr of 7yr study) Dept. of Environmental Biology, University of Guelph, Ontario

Grey snow mould is a common disease of turfgrasses in areas where there are over 90 days of continuous snow cover during the winter. The disease is caused primarily by two fungi in the Typhula genus and is commonly controlled by synthetic fungicides on many golf courses in Canada. Although excellent control of this disease can be achieved with fungicides, societal concerns of the environmental effects of synthetic pesticides compel us to investigate alternative management approaches.

Dr. Tom Hsiang has been working with a fungus that has shown to have antagonistic abilities against the fungi causing the grey snow mould disease. Dr. Hsiang has been able to isolate a few very effective strains of this fungus that can suppress grey snow mold as well as a fungicide. Tests to ensure that this biological control for grey snow mould is not toxic to plants, animals and humans are currently being conducted and possible application techniques are being examined.

Can the microbes in your soil predict the health of your greens?

F.B. Holl, Dept. of Plant Science,

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University of British Columbia
(3 yr study completed in 1996)

Microbes found in soil can be both beneficial and harmful to plants. Plant disease work has taught us that problems in the rootzone can start well before we see any damage above the ground. Dr. Holl's research was designed to see if the microbial populations react to conditions that cause damage to turfgrass. The bacterial populations of two greens were evaluated at three golf courses in the Vancouver area. The superintendents were asked to select one good and one bad green based on their performance throughout a normal season. The greens were similar in construction, location and maintenance, but reacted differently to environmental stress.

The bacteria were identified in each green, grouped by their food sources and population shifts were noted. The bacterial populations changed when a green was under stress, but it is premature to determine whether this could be used to predict turfgrass damage. Ideally, if turfgrass damage could be correlated to an extremely high or extremely low presence of certain bacteria, those organisms could be used as early warning signs and management practices could be adjusted to avoid problems. Turfgrass-bacteria relationships are still being investigated.

Will the right variety or mowing height of creeping bentgrass stop Poa annua (annual bluegrass) from invading?

Smith, Avicilla and Cattani, Dept. of Plant Science, University of Manitoba
(4 yr study completed 1997)

Dr. Ray Smith and his team in Winnipeg wondered why some varieties of creeping bentgrass seem to be able to prevent annual bluegrass becoming established in a green and if mowing height had anything to do with this ability. They found varieties of bentgrass producing a lot of side shoots called tillers competed more effectively with annual bluegrass. Therefore, high tiller density would be a good bentgrass characteristic for combatting annual bluegrass invasion. Interestingly, they did not find mowing height to be much of a factor in the level of annual bluegrass invasion.

To compare the different bentgrass varieties and mowing heights, researchers need to be able to measure the percentage of each grass type in the research plots. Traditionally, this has involved counting the individual bentgrass and annual bluegrass plants, a very tedious and time-consuming task. The second part of this study was to test the use of computers to measure the percentage of each grass type based on colour difference. This method of estimating the bentgrass and annual bluegrass populations was compared to the standard method of counting individual plants. Unfortunately, the computer did not prove to be very accurate, but may have value in comparing healthy and diseased plants. So, the good news is that this computer technology may have benefits for turfgrass managers and scientists in the future for disease detection. The bad news is that graduate students will still be using tweezers to determine grass population statistics.

Will a mixture of bentgrass cultivars compete better with Poa annua than a single cultivar?

Eggens, Hsiang, Hall and Carey Guelph Turfgrass Institute, University of Guelph, Ontario (4 yr study completed 1997)

Golf greens have often been criticized for being monocultures, since a diversity of plants should be better able to withstand disease and weed pressures. The low mowing height of putting greens has limited Canadian golf courses to colonial and creeping bentgrass. However, many different varieties or "cultivars" of bentgrass are now available. This study was designed to see if mixing different types of bentgrass improved a green's competitiveness.

Poa annua (annual bluegrass) is a low-growing weed species that often invades greens. Unfortunately, Poa annua is not very stress tolerant and large patches can die out in mid-summer and during winter. For this reason, most clubs will try to eliminate it. Researchers at the Guelph Turfgrass Institute introduced Poa annua into single cultivar and multiple cultivar plantings of bentgrass to see if mixtures had an effect on annual bluegrass invasion.

The suspicion that diversity promotes vigour proved correct in this study. The multiple cultivar plantings did show increased dollar spot resistance and were able to withstand annual bluegrass invasion better than the single cultivar plantings. Although this may seem to clearly advocate mixing and matching bentgrass cultivars, it may not be that simple since colour and texture of the different cultivars must be compatible. Also, we do not know how long this effect will last. Any population study requires many years of observation to determine if effects are long-term or temporary.

Can native perennial grasses be used for turfgrass plantings?

S.R. Smith Dept. Of Plant Science, University of Manitoba
(3rd yr of 3 year study)

Many grass species seen growing in the Canadian prairies have survived very severe climate and soil conditions for generations. In an effort to reduce management requirements for turfgrass, Dr. Ray Smith and his graduate student Anthony Mintenko have been testing a number of native prairie grass species under different mowing regimes to determine if any have potential for golf course or landscape use. The two main characteristics that are being sought are drought and salt-tolerance. If any of the selections show promise, they may be used in future breeding programs to produce tougher grasses that will have good playing characteristics.

Can we genetically alter turfgrass to make it more stress tolerant?

S.R. Bowley, B.D. McKersie, K.J. Kasha Crop Science Dept., University of Guelph, Ontario
(3rd yr of 3 year study)

Plants, like people, produce something called free oxygen radicals when under stress. These oxygen radicals are believed to cause major disruptions at the cellular level. Molecular biologists have discovered a gene called Mn-superoxide dismutase (Mn-SOD) that produces enzymes that are scavengers of oxygen radicals and thus act to detoxify the free oxygen radicals. This is the same idea behind many antioxidant products such as certain vitamins that have been in the news recently.

Dr. Bowley and his team have successfully inserted this gene into alfalfa and the resulting plants have shown superior environmental stress tolerance. The stresses range from freezing and ice encasement to flooding and drought. The same techniques have been used to insert the gene into creeping bentgrass and perennial ryegrass. The goal is to create grasses that can withstand greater environmental stress. The team has successfully inserted the gene and is working to determine if the desired characteristics will be expressed in the adult plants.