



Wondering About Winter

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The crisp fall mornings remind me of peaceful times on the golf course; play slows, expectations appear easily satisfied and our courses heal the wounds from a challenging season. Our distinguished editor begins his trek to view the brilliance of the northeastern deciduous forests and I can enjoy two weeks without a reminder of my Grass Roots deadline—HaHa! (I truly jest, as I heartily enjoy preparing my article, *because* it makes me wonder.)

The Golf Turf Symposium is upon us, and for a few days we will all be thinking winter, mindful of the devastation that many of our courses experienced, yet hopeful that answers await from our investment in education and research.

Now that I have experienced one complete season in Wisconsin and traveled the state, I can easily say that the winter poses our biggest challenges and greatest mysteries. It might have been a unique year.

Dr. Beard states in his text that “prolonged ice cover of more than 30 days rarely occurs in our country”. Was it the prolonged ice cover? Several superintendents became so concerned with the ice that they proceeded onto the frozen tundra, armed with their core cultivators and removed it. Did they lose less grass?

What happens under the ice? Do toxic gases, such as cyanide, build up as a result of anaerobic conditions (lack of oxygen)? If so, I would think that these gases would not discriminate among species.

Why does annual bluegrass survive less time than bentgrass or Kentucky bluegrass?

Experiments with ice-encased forage grasses provide some insight. Researchers from Canada have shown ethanol does accumulate and most likely is responsible for inducing plant death. Interestingly, research concerned with flooding and grass growth under prolonged water (anaerobic conditions) has mostly been conducted with the warm season grasses. This work demonstrated that some of the grasses continued to grow even more under water up to 90 days.

This was suggested to be a result of ethylene (a precursor to ethanol) stimulation.

Conditions are different under low temperatures, but, the plants are still oxygen deprived as they are under ice and supposedly dormant. Dr. Beard conducted the foundation research in this area in 1968 and now 20 years later we realize we need more answers and Dr. Roberts from New Hampshire is leading the way with the turfgrasses. As I write this fall, I recall the *wet* fall of 1992. Research has shown plants that receive excessive moisture do not fully acclimate to low-temperature and are less “hardened off” than plants that experience slight moisture stress. We know moisture stress stimulates an increase in the hormone abscisic acid (ABA).

Plants that become low-temperature acclimated have high ABA levels and this has been correlated with being “hardened off” and dormant. Is it possible that our plants never properly acclimated as a result of excessive moisture?

Much of the hormonal research has been conducted with perennial fruit crops. ABA levels decline as the winter progresses until in early spring. Then temperatures rise, the hormone gibberellin is stimulated and deacclimation begins. If this process occurs during freeze-thaw cycles and the plant is not “hardened off”, cells have elevated free water with a higher freezing temperature and cell membrane function, vital for cell growth, is disrupted. These elevated cellular water levels might be similar to what we call “crown hydration” and intimately involved with the deacclimation process.

Interestingly, Dr. Jiwan Palta, UW-Madison Professor of Horticulture, has shown that these cells injured by internal freezing can be recovered and growth resumed. This is an area that my research program is beginning to address.

How could a pondering of this subject exclude mention of our major winter-killed species, annual bluegrass? Is it possible to sustain annual bluegrass through the winter? Does the perennial biotype survive and the annual die as a rule?

Clearly, the majority of annual bluegrass plants do survive, but how? Is it related to reserve carbohydrate levels that reduces the amount of free water available in the cells? Is it adequate or luxury consumption of potassium (K) that also results in less free water available for freezing?

How do our fall fertility programs influence winter survival? We are conducting experiments investigating the effects of high amounts of K on reserve carbohydrate levels and will be monitoring these levels as well as crown moisture content.

Last year we tried to apply PGR's in the late fall to exploit their ability to increase carbohydrate reserves. The plants were all killed; therefore, we need to look closer at earlier applications, different rates and close monitoring of changes in carbohydrates and moisture during the winter for correlations.

Other factors worth mention include wind and traffic of frozen unprotected turf. Also, what is the role of low-temperature pathogens? Are winter injured plants more susceptible to the snow molds or do the snow molds predispose plants to more severe low-temperature kill? Dr. Meyer, Catherine Smejkal, and Steve Millett are actively investigating the snow molds for mercury alternatives, both culturally and biologically.

Certainly, we are excited about the prospects of reduced incidence of snow mold *and* it would be interesting to see if it results in less winter injury.

One thing is for sure when it comes to winter survival of the turfgrasses; many questions remain unanswered. The process of understanding this series of interactive stimuli and responses is continuing. Most likely there are several factors that ultimately occur to cause plant death.

My interest level in this area is extremely high and one of the reasons is a short visit I had this spring with Jim Hugget from Long Island Sod Farms. Jim and I looked out over his 100 acres that emerged from the spring with substantial winterkill. As we looked over the field that represents a severe economic loss, he asked what I thought was the problem.

“Well”, I said, “could be this, could be that, could be the other thing, or might be all of them”. He looked over at me with a sincere and genuine gaze and said, “we could sure use some answers to this problem”.

I wish I had them, and it sure makes me wonder...🌱