

Laughing Turfgrass Warms Mother Earth

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What kind of a title is that? That's what I hope you're asking anyway. When I was asked to write an article for this issue of TurfNews I was uncertain what to write about. However, since I am currently conducting research at Kansas State University on the topic of nitrous oxide emissions from turfgrass, I thought that it may be appropriate to address this topic. So kick off your shoes, settle down on the couch and relax with a cup of hot chocolate and a warm blanket wrapped around you and let's find out what this is all about!

Some of you may have already connected the dots between nitrous oxide and the first word in the title of this article and have figured out that nitrous oxide, or N_2O , or dinitrogen monoxide, is also known as "laughing gas". Nitrous oxide is described as a "colorless gas with a pleasant, sweetish odor and taste, which when inhaled produces insensibility to pain preceded by mild hysteria, sometimes laughter." (Disclaimer: Prolonged inhalation causes death so please use caution if you are running out to buy nitrous oxide to experience this mild hysteria. Neither I nor K-State nor KTF endorses the use of nitrous oxide for recreational use nor have I ever "inhaled").

So what exactly is the connection between turfgrass and nitrous oxide? Well, one of the main two elements in N_2O is N, or nitrogen. Any crop or plant ecosystem such as turfgrass that is fertilized with N is a candidate for emitting N_2O into the atmosphere. So, if laughing gas is coming off the turf, why isn't the grass laughing then, you might ask? The straightforward answer I suppose is that turfgrass like most other plants has a bad sense of humor and doesn't laugh at anything (gosh, I know some people like that...never mind!). Actually, the concentrations of N_2O coming off of turfgrasses are very small, on the order of parts per million or even parts per billion (ppb). There is, in fact, laughing gas constantly present in the atmosphere although in very low concentrations of about 314 ppb. Sadly perhaps, this is not enough to keep us laughing all the time, but is high enough to affect other things in the atmosphere.

Which brings us to the link to the next words in this article's title... Warms Mother Earth. Nitrous oxide, like carbon dioxide, is a greenhouse gas. And although there is much less N_2O in the atmosphere than carbon dioxide, N_2O has more than 300 times the warming power of carbon dioxide. But let me back up. Most of you have heard about the greenhouse effect. Lately most talk of the greenhouse effect has been in the negative context of global warming and climate change. In truth, none of us would be able to survive on the earth were it not for the greenhouse effect. The invisible "greenhouse gases" that surround the earth form a sort of invisible "blanket" which traps heat from the sun and keeps the surface layer of the atmosphere (where we and our turfgrasses live) warm, and allows our survival.

A more scientific way of describing the greenhouse effect is that greenhouse gas molecules in the atmosphere absorb shortwave radiation from the sun and thus, trap solar energy in the atmosphere and collectively raise its temperature until it reaches a sort of equilibrium. The problem, we are told, is that anthropogenic (a fancy word for human) activities are adding significant amounts of greenhouse gases into the atmosphere which increases the collective power of the atmosphere to absorb and hold heat. In other words, and to use an analogy, it's kind of like you on your couch wrapping another blanket around yourself perhaps even if you don't

need one...in effect, you may get too warm. Similarly, the end result of these anthropogenic emissions of greenhouse gases into the atmosphere may be global warming and climate change.

So why are we measuring nitrous oxide emissions from turfgrass at K-State, especially if the amounts are so minute? The first answer is that scientists are trying to determine the global “atmospheric N₂O budget” by estimating the amounts of nitrous oxide emitted into the atmosphere by various plant ecosystems and industrial processes. Not a lot is known about nitrous oxide emissions from turfgrasses, and this uncertainty leaves a possible “gap” in the atmospheric nitrous oxide budget. Because turfgrass is often fertilized with N at similar levels as some agronomic crops, and because agronomic croplands are considered significant contributors to increases in atmospheric nitrous oxide concentrations, it is surmised that turfgrasses may also contribute measurable amounts into the atmosphere. In fact, recent research by scientists at other institutions has determined this to be true. And because urbanization is rapidly increasing the number of acres worldwide into turfgrass, research is needed to determine just what is going on here to fill in this gap in the global atmospheric N₂O budget.

Does this mean turfgrass is bad or that this will cause problems for the turf industry? Certainly there are groups who already dislike the turf industry who may cite this as another bad thing about turfgrass. However, turfgrass is not “lighting a fire” to the atmosphere nor is the turfgrass industry likely to come under attack any more than agriculture, which feeds our growing population. Turf certainly has valuable aesthetic and in many cases, environmental values (for example, turf is used in buffer strips on stream banks to reduce pesticide and fertilizer runoff into surface water). Thus, turfgrass is not as environmentally unfriendly as some would like to say.

A more likely scenario would be that agricultural producers (and turf managers) may in the future be encouraged to use best management practices (BMP) to reduce emissions of nitrous oxides from their turfgrasses. The goal of course, would be to mitigate global warming and climate change. Perhaps you have heard of incentives already being introduced into agriculture for farmers to sequester carbon in their soils. While carbon sequestration is another story and perhaps one I will address in the future in this publication, its goals are identical...mitigate global warming and climate change by reducing greenhouse gas concentrations (carbon dioxide) in the atmosphere.

While BMP in turfgrass have not yet been defined explicitly (research such as ours at K-State will hopefully help determine that), common sense may be the best guide for the time being. Don’t over-fertilize with N and don’t over-irrigate your turfgrass. Both lead to higher emissions of nitrous oxides into the atmosphere. Of course, over-fertilization and over-irrigation also wastes \$\$ spent on fertilizer and irrigation, *and* result in leaching and runoff of fertilizer N into ground or surface water. So avoiding these practices is not a bad thing anyway.

So, if on your couch you are getting hot with that blanket wrapped around you, go ahead and throw it off and go pour out your hot chocolate and replace it with a glass of iced tea if you are so inclined. Then step outside your door and take a look at your turf, look at the sky, enjoy their beauty, and then realize that someday you as turf managers may be asked to help take a blanket off of ol’ Mother Earth. Oh, and don’t forget to laugh hysterically!