Orchardgrass Die-off, Possible Causes and Preliminary Findings

The second technical session followed a mid-morning break. This session delved into the orchardgrass (OG) die-off problem currently occurring in the Mid-Atlantic states. Dr. Les Vough, Professor Emeritus, University of Maryland, moderated this session. It has been most noticeable in Virginia that lies just south of the Northeast Region, but early loss of OG stands is also occurring quite frequently in the southern part of the Northeast Region - Pennsylvania, West Virginia, and Maryland. The session was entitled **Orchardgrass Die-off, Possible Causes and Preliminary Findings**. The first speaker was Mr. Gordon Jones, doctoral candidate Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg. His presentation was entitled, *Understanding the causes of reduced persistence in orchardgrass hay stands in the Mid-Atlantic*. The problem of OG die-off was a personal issue with Mr. Jones as his Grandfather grew OG in southeastern Pennsylvania to sell as hay to horse owners and as a mushroom substrate to mushroom growers. His Grandfather found that OG was becoming less persistent over the many years that he had been growing it. His personal interest in the cause or causes of OG die-off was demonstrated by his keen insight into the problem and the great breadth of his research into the problem. He started his remarks by saying 1.1 million acres of OG exist in the Mid-Atlantic states. Farmers have noticed reduced yield and longevity of their OG hayfields. Lifespans used to be on the order of 7 to 8 years. Now they are lasting only 3 to 5 years. This represents a loss of $90 million dollars to OG producers in replanting costs and lowered orchardgrass yields. A 17-member Mid-Atlantic Orchardgrass Task Force was formed in the Fall of 2008. They cited three potential causes of decreased OG persistence: soil fertility, pests or diseases, and harvest management. Forty-three producers participated in a 2010 Mid-Atlantic Orchardgrass Survey. Seventy-four percent of the producers thought OG stands were declining faster than expected. Most producers first noticed problems between 2005 and 2010. Both well-managed and poorly-managed OG stands experienced poor persistence.

An example of what orchardgrass die-off looks like in a hayfield.

Mr. Jones began to verify or eliminate each of the potential causes for loss of OG stands. He began with the soil fertility cause. In the fall of 2012, he set up a nitrogen (N), potash (K), and sulfur (S) fertilization rate experiment on OG yield: 3 rates of N (0, 80, 160 pounds/acre), 2 rates of K (80 and 160 pounds/acre), and 2 rates of S (0 and 30 pounds/acre). Sulfur was included in the fertilizer experiment due to the reduction of sulfur deposition by coal fired utilities. Sulfur deposition in the Mid-Atlantic Region was reduced from a peak of 15 to 20 pounds per acre to 5 to 10 pounds per acre currently. 2013 yields of OG were significantly increased by N and K fertilization with the highest yield of OG occurring when both N and K were applied at the 160 pounds per acre rate. Sulfur had a minimal effect on OG production. Actually, the 30 pounds per acre rate of S was slightly depressive to orchardgrass yields at the 160 pounds per acre rate of N at both levels of K application rates. In early spring of 2014, Mr. Jones did a field survey of 53 OG fields on 35 farms in four Mid-Atlantic states (MD, PA, VA, and WV). The Northeast Pasture Consortium participated in this survey by providing him farmer names and locations who we knew grew OG and had reported persistence issues. Soil and plant tissue samples were taken to be tested for nutrient sufficiency and production practices recorded. Most fields had adequate pH, phosphorus (P), and K levels. Most OG tissue tested adequate for N, P, K, and S. The N:S ratio is critical to determining tissue sample adequacy. It should be no greater than 13:1. Based on this survey, Mr. Jones concluded that soil fertility does not appear to be driving decreased OG persistence. However, he did suggest these fertility recommendations: (1) Apply lime, P, and K according to soil test recommendations - increased K levels should help with persistence. (2) To maintain stands without a legume, apply about 75 lbs N/acre in March and an additional 75 lbs N/acre following each cutting except the last. (3) Consider a sulfur application in low organic matter soils.

Mr. Jones went to the next potential causative factor, pests and diseases. In the 2010 farmer survey mentioned earlier, 63% of producers reported no insect or disease problems. However, during the 2014 field survey conducted by Mr. Jones, leaf disease was found in 71% of the fields observed while insect

damage was found in only 8% of the fields.

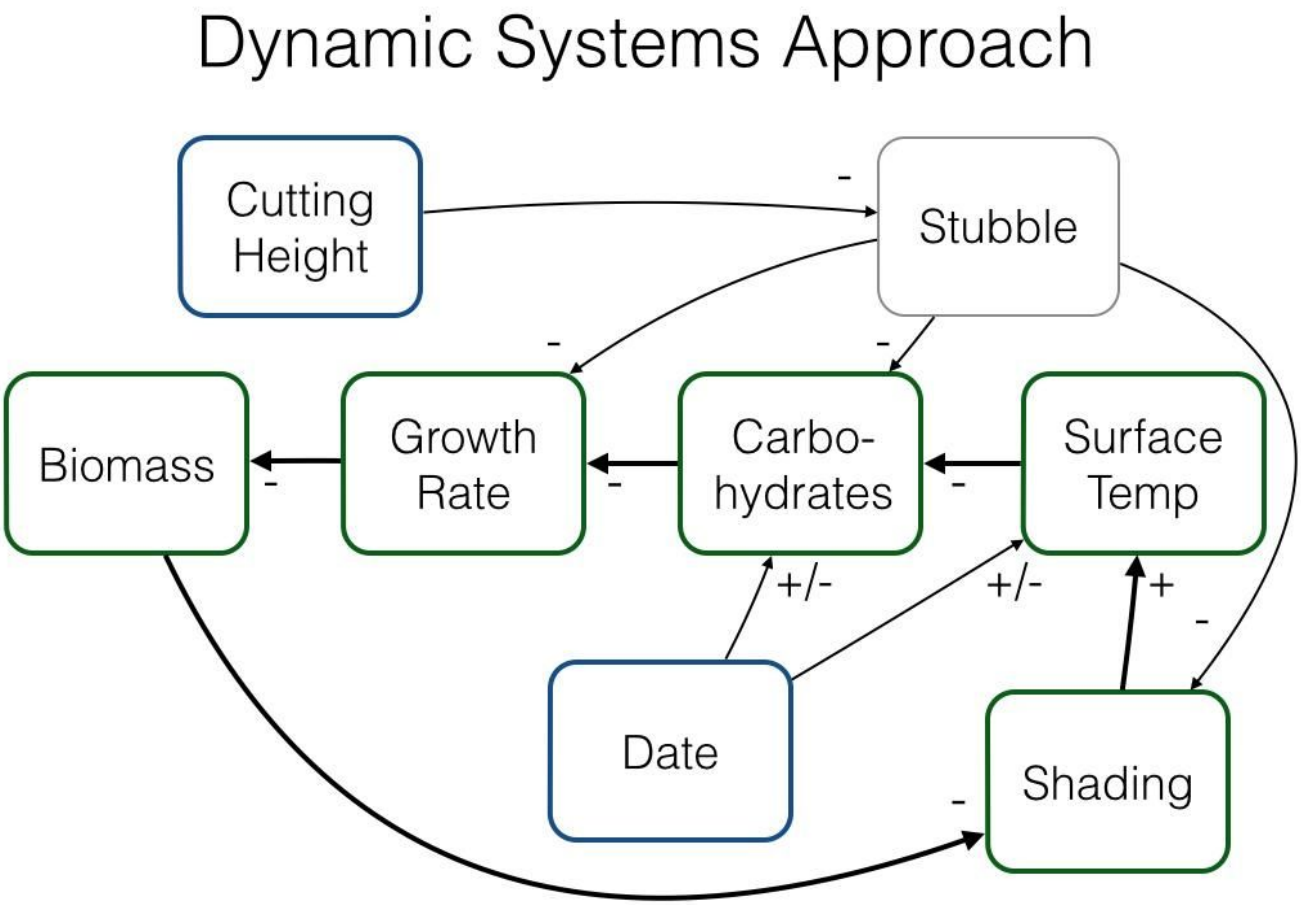
The commonly found OG leaf diseases are:

- Leaf Streak
- Anthracnose
- Purple Leafspot
- Summer Blight
- Powdery Mildew
- Scald

Leaf streak and anthracnose are the top two leaf diseases of OG. As prevalent as the leaf diseases are in OG, they do not seem by themselves to reduce OG longevity. Management of these diseases is difficult in pure stands of OG. No fungicides are labeled for pure OG. If considering reestablishment, rotate out of cool-season grass crops for at least one season. Plant resistant cultivars? Most cultivars do not state their resistance to various leaf diseases. Fertilizing to soil test recommendations may be helpful, but the 2014 survey would seem to refute that. Remove infected plant material is often stated as a helpful practice, but is easier said than done. Most haying operations are going to leave some infected leaf material in the fields. The process of baling the hay alone is likely to scatter disease spores about the field as the spores are beaten off of the grass blades in the baler and fall to the ground. Grazing OG will remove most of the spores, but the grazing disturbance will still spread some spores around as the muzzle of animal and their hooves can transfer spores from one plant or leaf to the next.

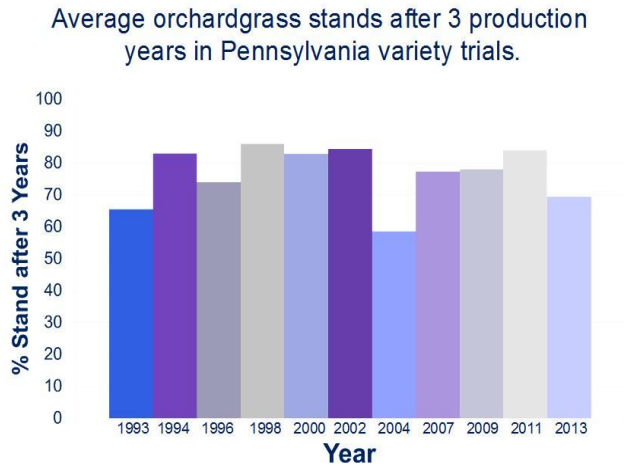
The harvest management potential cause was the last to be presented. Cutting height is frequently considered important, yet out of 20 studies no consistent conclusions could be reached. Sometimes a low cutting height is better; sometimes a high cutting height seems to be better. One study indicated that a 2-inch stubble height had an 88 percent of stand rating while uncut only had a 76 percent of stand rating and the 8-inch stubble height measured 79 percent. The 4-inch and 6-inch stubble heights went from 85 percent to 82 percent of stand rating. However, the range is rather narrow and the difference between each cutting height is not necessarily significant even though it did show a definite trend.

It appears that climate change may be playing a role in harvest management as it relates to cutting height, however. From 1970 to 2012, Virginia nighttime temperatures have increased. In Poland, earlier flowering dates have been observed. In the thirty years from 1972 to 2002, flowering has advanced on average about one third of a day per year (days after April 1). Warming temperatures coupled with low cutting heights and late harvests (beyond boot stage) are possibly causing OG stands to thin out quickly. Common practice is to cut it after it heads out. Mr. Jones will be observing cutting heights versus air temperatures as his next experimental investigation. His hypothesis is: (1) Too low cutting heights, later cutting dates, and warmer spring temperatures may be slowing regrowth rate and causing heat stress and reduced persistence. (2) This effect is likely compounded by drought condition, insect pests, diseases, and fertility imbalances. Using 3 cutting regimes, 1 inch, 3 inches, and uncut orchardgrass versus the range of temperatures observed when cuttings are made, he will measure stand percentage at the end of growing season and the following spring for stand recovery and persistence. Duane Hertzler said he thought stand density plays a role in orchardgrass persistence. Thicker stands would tend to protect each individual plant better from temperature extremes. A question was raised about whether or not grazing animals reinfect stands with diseases by grazing orchardgrass or be eating disease-infected hay. There are no studies to indicate this.



Cutting height and timing of orchardgrass harvest as it relates to its maturity, carbohydrate reserves, and air temperature conditions may play a large role in the premature loss of orchardgrass hay stands. For instance, too low of cut may actually cause a loss of carbohydrate reserves since they are stored mostly in the stem bases of orchardgrass, not in the root system as with certain other forages.

Dr. Marvin Hall, Professor, Department of Plant Science, Penn State University, University Park, PA presented *Observations from Pennsylvania* on OG die-off. He noted that southeastern PA does have issues with OG stand loss. However, in the northern tier of counties and western PA, no or very little premature stand loss occurs. He displayed a slide on the average OG stands after 3 production years in PA variety trials over a 21-year period from 1993 to 2013. No trend was apparent as there were random ups and downs in percent of stand count from year to year. The highest percent of stand was 86 percent in 1998. The lowest percent of stand, 58 percent, occurred in 2004, a drought year. Years 2002 and 2011 had 83 and 84 percent of stand readings, while the other years were at various levels of percent of stand count between 65 percent of stand and the readings recorded in 2002/2011. These trials were conducted at the Rock Springs Research Farm in central PA near University Park.



Twenty-one years of orchardgrass variety trials at Rock Spring, PA shows no trend in orchardgrass stand survival. (not all years are shown)

He showed three additional slides where different fungicide products and combinations were used pure OG stands and alfalfa-orchardgrass stands. Although there were some fluctuations in yield and stand persistence, none of those differences were statistically significant. In the case of the 2013 alfalfa-OG fungicide trials, the fungicide did reduce disease ratings significantly, yet yield and stand counts were not significantly different. It appears that most leaf diseases are rather benign. This work lent support to Mr. Jones observations on leaf disease impact on OG persistence.

Effect of fungicide on pure orchardgrass in Pennsylvania in 2014.

Treatment	Yield (lb/A)	CP (%)	NDF (%)	NDFD	Milk Yld (lb/t)	Stand in fall (%)
Check	16096 ab	17.9	55.9	57.3	2212	85
Priaxor + Induce	15747 b	17.7	54.7	56.6	2319	85
Headline SC + Induce	16784 ab	17.6	54.3	55.7	2296	83
Quadris + Induce	16643 ab	18.0	54.5	56.5	2335	85
Endura + Induce	16215 ab	17.8	55.1	56.4	2343	85
Priaxor + FastAC + Induce	18400 a	17.4	55.1	55.9	2299	85
Quadris + Warrior II + Induce	17661 ab	17.4	54.7	55.4	2293	85

4 year old stand

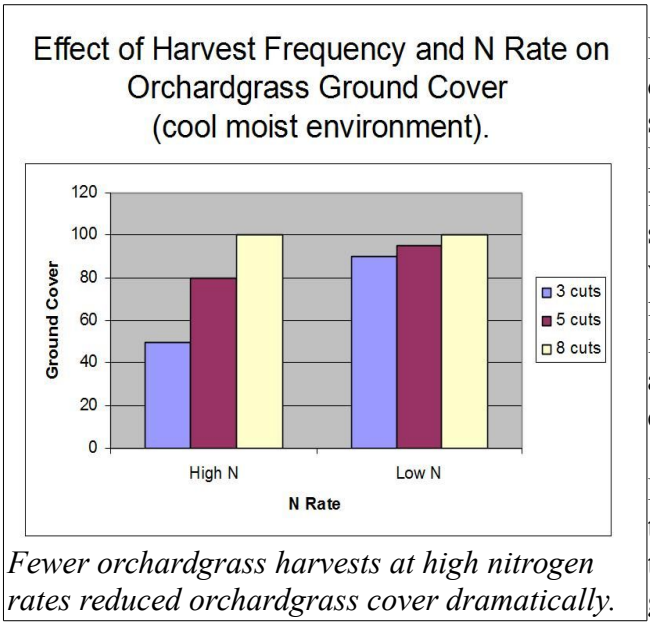
Pure orchardgrass stands treated with various fungicides and combinations were inconclusive in effect on yield and quality and had no effect on survival.

Dr. Sid Bosworth, Extension Agronomist, Dept. of Plant & Soil Science, University of Vermont, Burlington, VT presented *Observations on orchardgrass die-off in New England*. Orchardgrass stands are most affected by winterkill or ice sheets in New England. Even lost reed canarygrass due to ice sheet formation over them. Interior New England has harsh winters and constitute the northern limit for OG survival except for Maritime areas in Canada in Nova Scotia and Newfoundland where winters are milder or have more persistent snow cover to insulate the plants from severe cold snaps. He thought some of the winter kill may be induced by soil compaction on wetter soils and a short cutting height. A short cutting height could exacerbate ice sheet damage because there would be no stubble poking up above the ice sheet. A high residual height going into the winter could allow the stubble to stick up above thin ice sheets allowing air vents to occur to reduce carbon dioxide formation under the ice sheet that actually is the cause of plant death.

Dr. Bosworth also thought in mixed grass hayfields a lack of soil fertility, weed encroachment of bedstraw and poison parsnip, and late harvests due to rainy weather could also reduce OG stands. Another cause of loss seems to be heightened leaf disease in recent years when followed by summer drought.

Dr. Ed Rayburn, Extension Forage Agronomist, West Virginia University, Morgantown, was the last presenter for this session. His presentation was *Orchardgrass Die-off and Management in West Virginia*. Orchardgrass die-off is not a common reported problem in WV. When it is observed, it is on sandy soils in the Ohio River Valley and on low potassium (K) testing fields. The latter problem is related to the wholesale use of 19-19-19 fertilizer broadcast on fields that shorts hay crops such as OG on K. Probable reasons for lack of OG die-off in WV is (1) few pure stands of OG, (2) mostly occurs in mixed stands of grasses and legumes, (3) low N rates applied to hayland and pastureland, and (4) hay meadows with OG are cut for first crop hay with aftermath grazing the rest of the growing season.

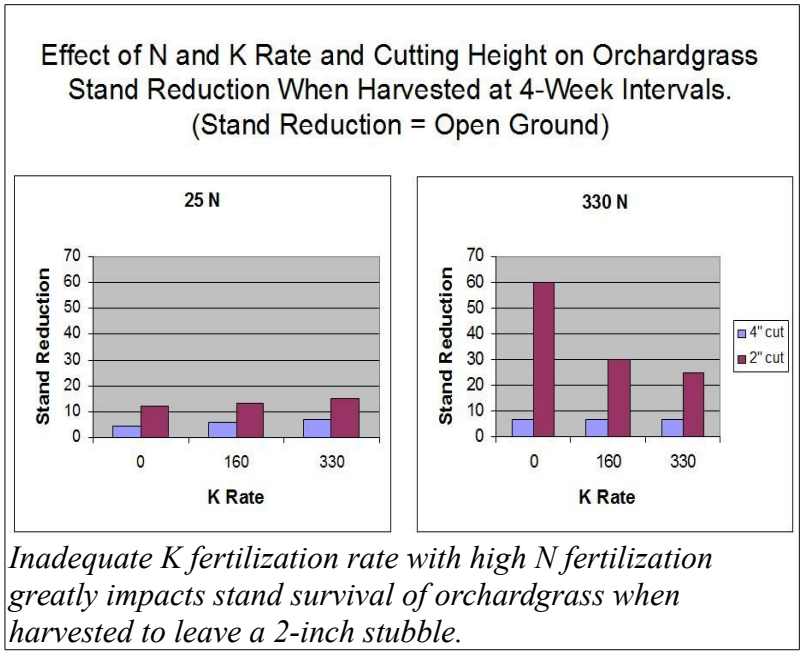
He pointed out that there are grass forage alternatives to orchardgrass, naming tall fescue, smooth bromegrass, timothy, and reed canarygrass.



Fewer orchardgrass harvests at high nitrogen rates reduced orchardgrass cover dramatically.

In a 1970's published OG cutting study done at WVU over an 18-year period at several sites, there was no stand loss by cutting OG to a 1.5-inch stubble height. Eighty-two percent of the time there was no differences in hay yield by cutting it to a 3.5-inch versus a 1.5-inch stubble height. However, when OG was grown with Ladino clover in a 10-year study and it was harvested at a 2-inch stubble height versus 4 inches, the lower cutting height produced more hay and decreased yield variability while having a higher clover content.

In more recent studies, high N fertilizer rates applied to OG tended to reduce ground cover the most when the OG was only cut 3 times (50% reduction in ground cover). When cut 5 times yearly, the ground cover was reduced 20%. When cut 8 times yearly, the ground cover was still 100%. At a lower N fertilizer rate, the loss of ground cover was slight, dropping only 10% when cut 3 times a year. If K was not applied at a high N fertilizer rate of 330 pounds/acre and the OG was cut to a 2-inch stubble height, stand loss was 60 percent at the 0 rate of K. When 160 and 330 pounds of K were applied per acre at the high N rate, the stand loss decreased to 30 percent and 25 percent, respectively when OG was cut to a 2-inch stubble height. In this latter study, regardless of N rate and K rate, leaving a 4-inch stubble height kept stand loss to less than 10 percent. Orchardgrass needs adequate soil K to be productive. However, it will luxury uptake K if over-fertilized with K. 1.75 to 2.0% K in forage dry matter (DM) will maximize yield without luxury consumption. This is equivalent to 42 to 48 lbs. K_2O per ton of forage DM. Potassium below 1.6% of forage DM disrupts N metabolism in plant. Current recommendations of K fertilizer rate of application to high production orchardgrass fields tend to be conservative at WVU and Virginia Tech.



Inadequate K fertilization rate with high N fertilization greatly impacts stand survival of orchardgrass when harvested to leave a 2-inch stubble.

Dr. Les Vough ended the session by observing that in southern Maryland, OG is only lasting one year. He attributed it to farmers cutting back on K fertilizer while still applying N at normal rates of application. Dairy farmers are putting manure back on OG hayfields especially in summer. This exacerbates the problem by applying much more N than K as the manure is much higher in N than K content. Sometimes OG is being planted on fields that are more adapted to growing timothy. Disc mowers have hurt OG stands. Operators tend to cut too low and actually scalp areas of a hayfield. Some operators with a wry sense of humor say they even-off the field with their disc mowers. Dr. Vough said Benchmark Plus OG has better persistence than European varieties being sold in the US.