



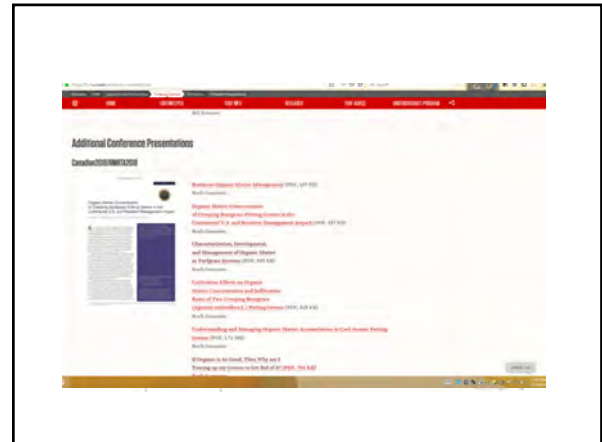
Biostimulants

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ROCKY MOUNTAIN REGIONAL TURFGRASS ASSOCIATION



Biostimulant

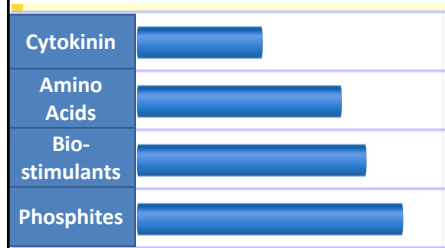
- Biostimulant, in its simplest definition, is anything that stimulates life. For turf managers we will define a biostimulant as anything that helps grass growth, exclusive of nutrients.

“An elicitor, in biology, is a molecule that enhances the production of another”

- ## Product Claims
- Increased stress tolerance
 - Increased disease tolerance
 - Lower water use
 - More efficient water use
 - Tolerate lower water quality
 - ...and others

- ## Biostimulants
- Liquid
 - Dominant delivery method
 - Granular

Do you use any of the following in your program?



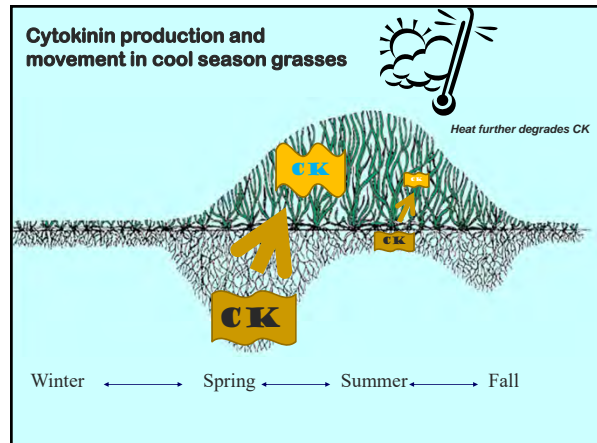
Literature Review

- ✓ Elicitors that have been identified include phytoalexins, specific amines or amino acids, carboxylic acids, phosphites, silicon, glycoproteins and oligosaccharides, peptides, jasmonic acid, salicylic acid, sugar analogs and others.....
- ✓ AKA- phytohormones, biostimulants and snake oils.

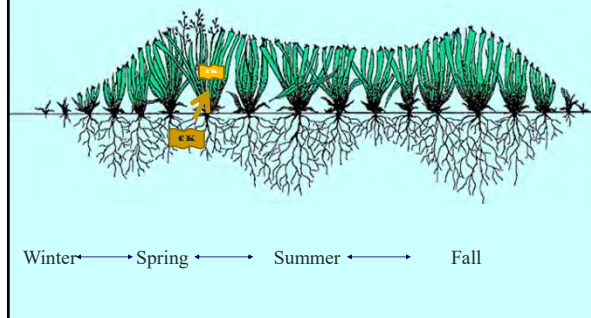
Cytokinins (CK) are a class of plant growth substances (plant hormones) that promote cell division. They are primarily involved in cell growth, differentiation, and other physiological processes. Their effects were first discovered through the use of coconut milk in the 1940s by a scientist at the University of Wisconsin–Madison named Folke Skoog.

Cytokinins are involved in many plant processes, including cell division, shoot and root morphogenesis, chloroplast maturation, cell enlargement, auxiliary bud release and senescence. The ratio of auxin to cytokinin is crucial during cell division and the differentiation of plant tissues

Cytokinin production and movement in cool season grasses



Annual Bluegrass is similar to other cool season grasses except.....

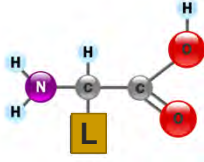


Cytokinin Summary

- Early research was very inconsistent
- Better understanding resulted in fine tuning recommendations
- Seaweed is very high in CK hence seaweed extract products are available

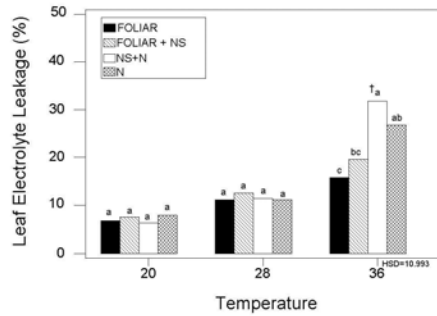
Amino acids are molecules containing an amine group, a carboxylic acid group and a side chain that varies between different amino acids.

These molecules are particularly important in biochemistry, and have many functions in metabolism. One particularly important function is as the building blocks of proteins, Amino acids are also important in many other biological molecules, such as forming parts of coenzymes, and in N transport

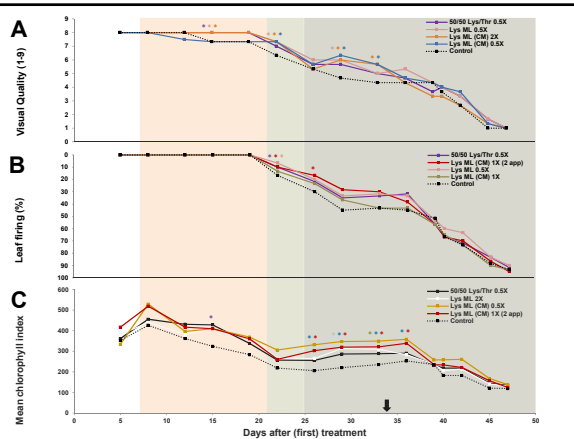


Activity of Foliar Macro-Sorb Amino Acids

- Gordon Kauffman, Ph.D. (Penn State)
- perennial ryegrass
- “ramped” temperature stress (68-97° F)
- Treatments:
 - FOLIAR
 - FOLIAR plus nutrient solution (NS)
 - NS + an equivalent amount of N contained in FOLIAR
 - NS + N
 - N



36° C (97° F)



Amino Acids

- When environmental conditions are optimal the plant produces more than adequate AA's
- Under heat and drought stress production is severely limited
- Much like CK topical applications during stress may be beneficial

Some believe that AA & CK are not “true” elicitors

- Simply substitution of plants inability to produce them.....

Phosphites

- ✓ **Phosphite salts are documented to increase plant health and resistance to numerous soil borne pathogens.**

Phosphites

- ✓ **Phosphite (H_2PO_3) differs from Phosphate (HPO_4) in that one O atom is replaced by one H atom.**
- ✓ **There are many salts of phosphites.**
- ✓ **Several phosphite salts are now registered as fungicides and several are used in liquid nutrient formulations.**

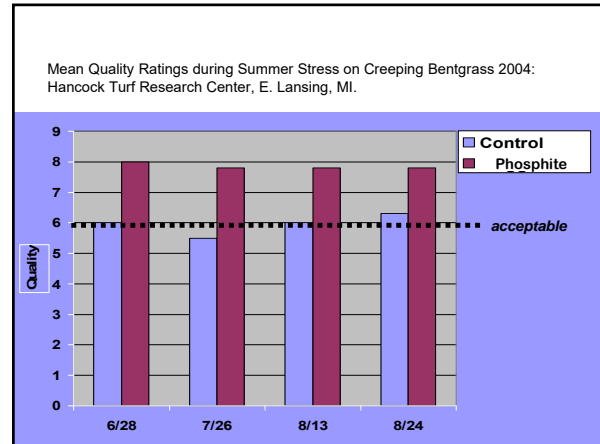
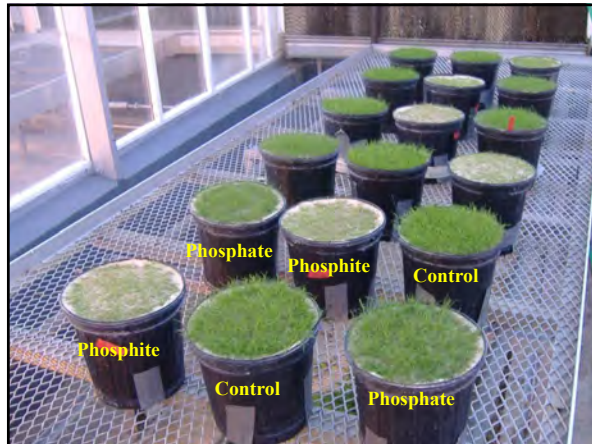
Phosphites

- ✓ **Research shows that the phosphites do have a direct effect on plant health and restrict some pathogens.**
- ✓ **Research shows phosphites do not provide phosphorous nutrition and some research that suggests in the absence of good P fertility phosphites may be detrimental to plant growth.**

Confusion

- ✓ **The AAPFCO has historically allowed P from PO_3 as a nutrient but has changed its position to remove phosphite as a nutrient on the label.**
- ✓ **Some states and Canada have removed P from phosphite from their labels.**





Physiological Effects of Phosphite Formulations On Turfgrass Challenged with Pythium and Heat Stress

**Virginia Tech University
2005/2006
E.H. Ervin, D. McCall, and X. Zhang**

Objectives

- **Is formulation important in terms of phosphite source and additives?**
- **Do all formulations provide equivalent fungicidal activity and plant physiological response?**

Summary

- **At the perennial ryegrass fairway in Moneta, VA all the treatments except one provided similar, and adequate, control of pythium blight.**

Phosphites have also been shown to:

- Reduce bermudagrass and Paspalum decline
- Suppress anthracnose
- Dr. John Dempsey

Silicon

- The positive properties of silicon against plant disease have been recognized for centuries.
- Several researchers are now looking at recent evidence that silicon may also induce 'systemic acquired resistance' in plants, sometimes referred to as SAR.

Silica for Increased Ball Roll and Traffic Tolerance



Treatments

- 3 commercial products
- 3 technical grade materials
- 2-3 rates of each material
- Silica containing material
 - 0.2 to 85 g Si per 1000 ft²
- Applications made every 14 days
- Stimpmeter (Ball Roll Distance) 1 and 3 DAT
- Traffic tolerance with traffic simulator

- Treated Control
 - 22g Na
 - 26g K
- Tech Grade #1-2
 - 43 or 85g Si
 - 12 or 24g Na
- Tech Grade #3-4
 - 43 or 85g Si
 - 31 or 62g K
- Tech Grade #5-6
 - 43 or 85g Si
 - 37 or 74g K
- Ocean Organics #1-6
 - 2 formulations
 - 8, 16 or 32g Si
 - Other stuff
- Floratine #1
 - 43g Si
 - ~0.4 g K
 - Other stuff
- Grigg Bros. #1
 - 1.1g Si
 - 26g K
- Grigg Bros. #2
 - 0.2g Si
 - 26g Ca
- Grigg Bros. #3
 - 0.9g Si
 - 17g Ca
 - 17g K

All Rates per 1000 ft²

Results

- No differences between
 - Ball Roll Distance
 - Color
 - Quality

Traffic Simulator



Traffic Results

- No differences among treatments for increased traffic tolerance or recovery unless K was the carrier

Wear Tolerance

- Spraying potassium silicate at 1.1 and 2.2 kg Si/hectare or soil applying (drench) at 22.4 kg Si/hectare
- Wear injury was reduced about 20% on two greens-quality ecotypes of Seashore paspalum
- However, potassium alone or together with Si produced the same effect.
- Little evidence that Si alone enhanced wear tolerance

Trenholm et al., 2001

Silicon – Take Home

- There is an “*observed*” increase in structural rigidity of turf well supplied with Si. This is the primary reason for its use on putting greens. Structural rigidity “*may*” increase green speed without lowering cutting height.
- Mowing quality is also “*observed*” to increase
- Evidence exists that there is greater resistance of plants well supplied with Si to some forms of fungal attack.

Establishment- *From N to Mycorrhiza*



Experimental Process

- Solicited cooperators
 - Follow each company’s recommended protocol
 - Included treatments to separate out each component of each protocol
- Kentucky bluegrass blend
- 90:10 Spec. sand:Dakota Reed Sedge Peat

From N to Mycorrhiza??

- **Biostimulants**
 - cytokinins, AA’s etc.
- **Mycorrhiza**
 - “*form a mutualistic relationship with the roots of most plant species*”

Experimental Process

- **Two planting dates:**
 - Mid-summer (Suboptimal)
 - Late-summer (Optimal)
- **37 treatments; 111 plots**
- **Analyze**
 - Fertilizer
 - Mycorrhizae
 - Biostimulant
 - Liquid (foliar) fertilizer

Treated Control Andersons Golf Products

- **Preplant incorporated**
 - 21-3-20 Poly S
 - 16-25-12 Poly S
 - A-TEP Hi-Mag
 - 3.3#N, 2.5 #P, 2.4 #K / 1000 ft²
- **Weekly applications after germination**
 - 17-3-7
 - 0.8 #N / 1000 ft²
- **Also used in combination with other products**

Company 1

- **Mycorrhizae (Mix with seed)**
- **Biostimulant (Preplant)**
- **Fertilizer (Preplant)**
 - Slow release N-38%N
 - Slow release N-40%N
 - 16-25-12
- **Recommended use rates**
- **Used alone and in combination**

Company 2

- **Mycorrhizae (Mix with seed)**
 - every 30 days
 - biostimulant
- **Fertilizer**
 - 4-6-4 (Preplant + 30 days)
 - 5-2-4+Fe (60 + 90 days)
- **Recommended use rates**
- **Used alone and in combination**

Company 3

- **Preplant**
 - Fert/biostim Blend
- **Foliar (Weekly after germination)**

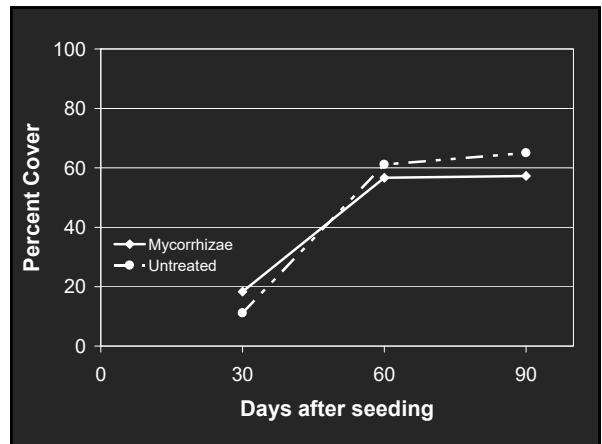
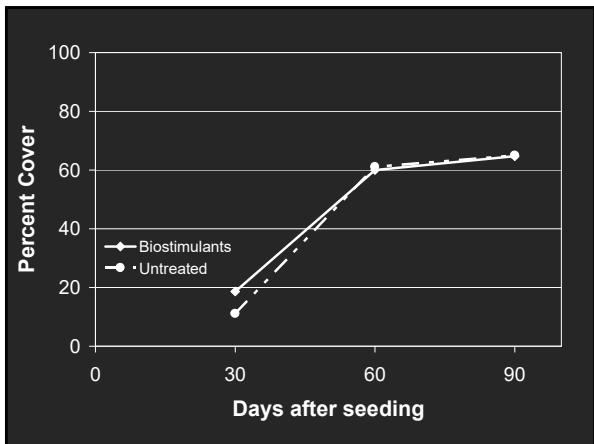
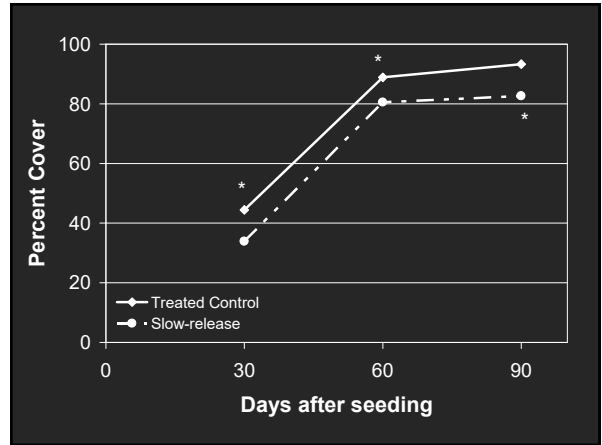
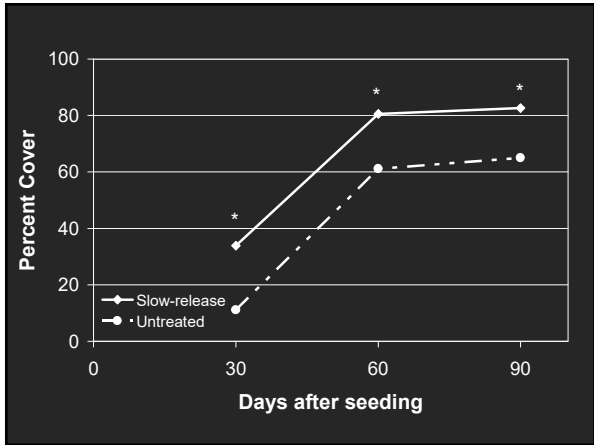
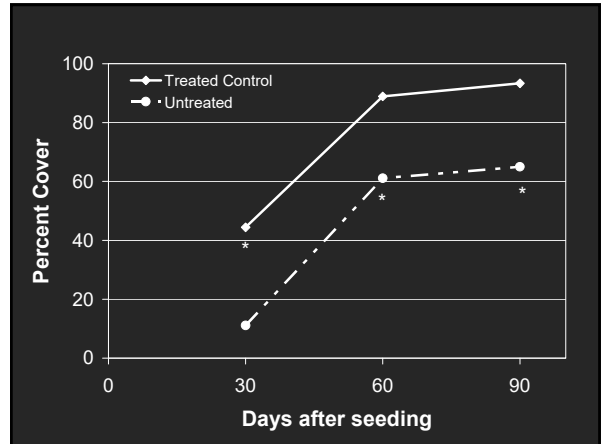
– Foliar N	19-1-6
– Foliar P	6-12-6
– Foliar K	3-0-10
– Foliar Silica	2-0-16
– Organic Source	4-0-1
- **Recommended use rates**

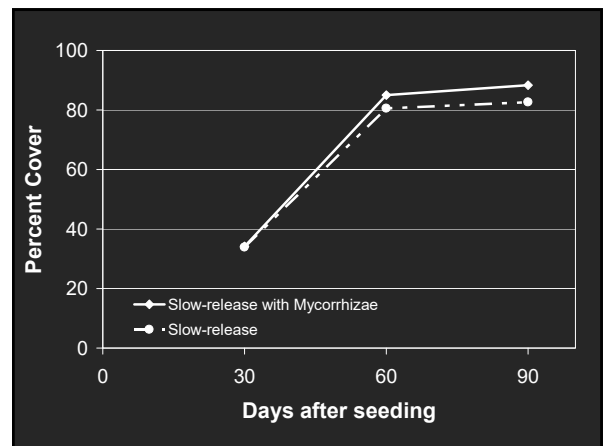
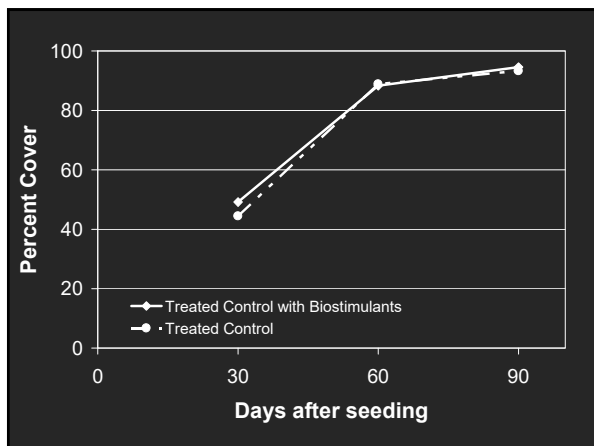
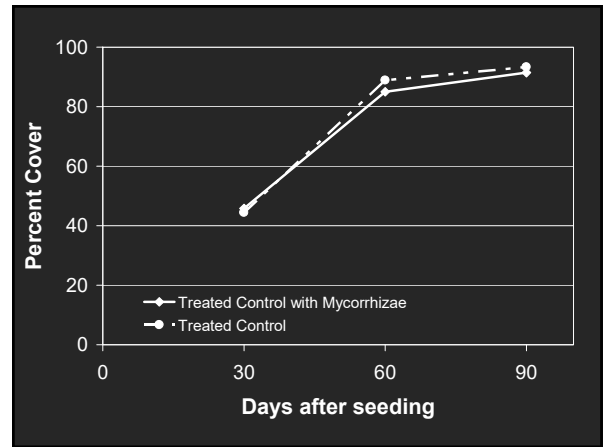
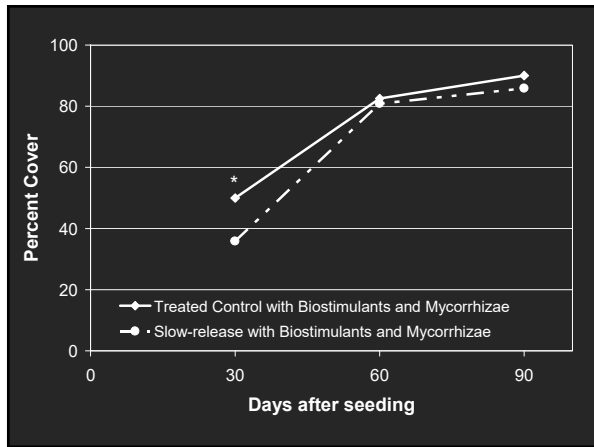
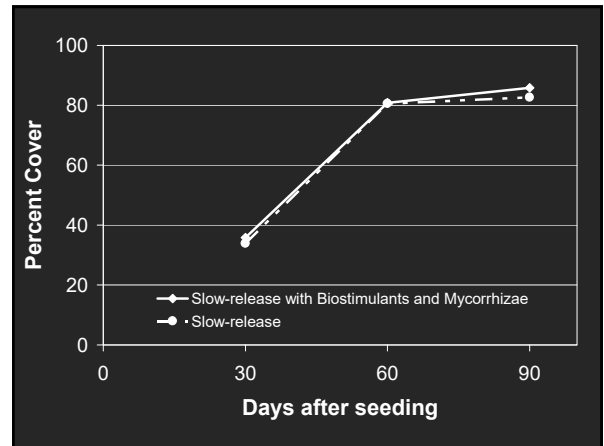
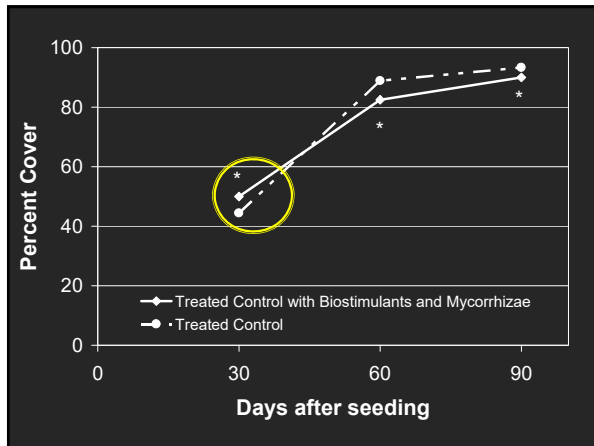
Company 4

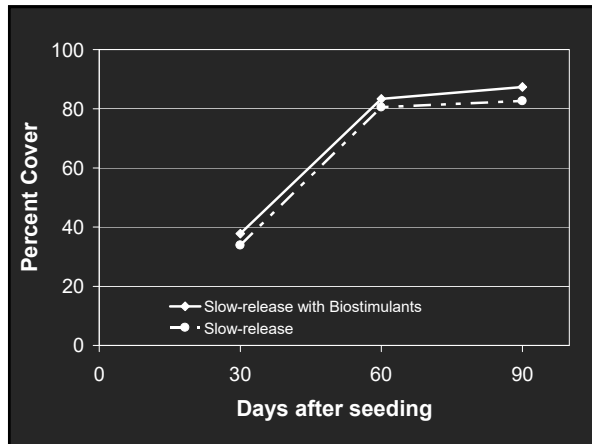
- **Preplant**
 - seed nutrients
- **Foliar (Weekly after germination)**
 - Even weeks
 - experimental 103
 - micronutrients
 - humic based nutrients
 - non-fungicide pathogen protection
 - Odd weeks
 - experimental 203
 - Foliar silica
 - organic amino acids, proteins, and carbohydrates
 - non-fungicide pathogen protection
- **Recommended use rates**
- **Summer seeding did not include Foliars with Conventional fertilizers**

Company 5

- **Preplant**
 - Conventional Fertilizer
- **Foliar (Weekly after germination)**
 - Foliar 1
 - Foliar 2
 - Foliar 3
- **Recommended use rates**







Top Treatments

1. Any treatment with fertilizer

- *Mycorrhizae and/or biostimulant did not significantly speed up establishment
- *Foliar fertilizers did not speed up establishment

Bottom Treatments

1. Untreated
2. Mycorrhizae and/or biostimulant alone

Bottom Line for *Establishment*

- Amount of N and P applied
 - At establishment
 - During first 30 days after germination
- Readily available fertilizers provide best establishment
 - Quick vs. slow release
- Little benefit for establishment was realized from mycorrhizae, biostimulants or foliar fertilizers

Questions?