Perennial Ryegrass Yields 2,000 #/A by 2020

Reality or Pipe Dream!

Saskatchewan Forage Seed

Dave Grafstrom, University of Minnesota

January 11, 2018

Where Are We Located?

Minnesota

Lake of the Woods

MN Magnusson Research Farm
40 acres, 6 miles NW Roseau, MN

Presentation Outline

- General crop economics
- Ryegrass economics
- Theoretical perennial ryegrass seed yields
- Management strategies for high ryegrass yields
- Fertility
- Growth Regulators
- Diseases
- Summary

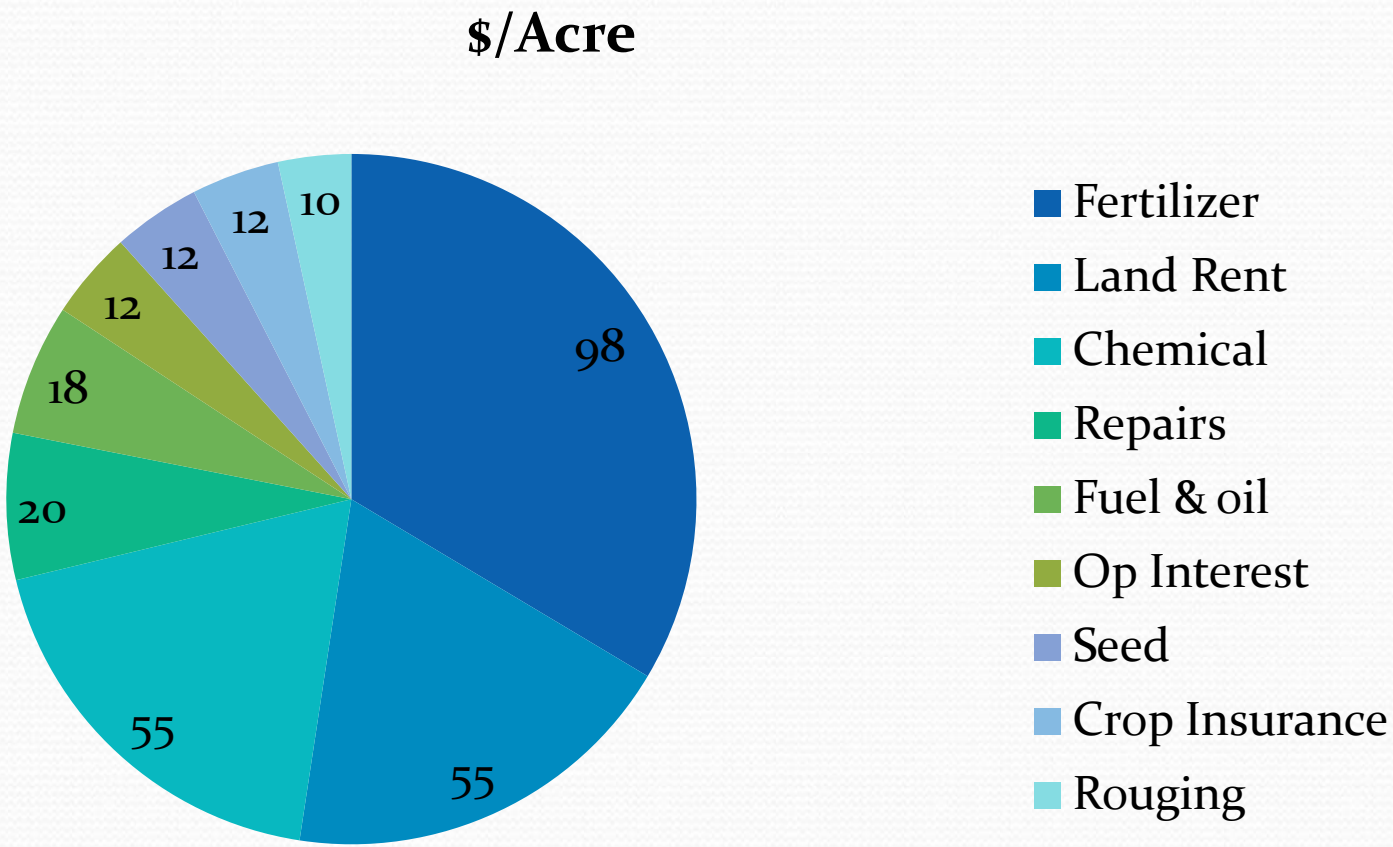
Estimated 2018 Cost/Returns

01/8/18	2018	2018	2018
Projected	Ryegrass	Wheat	Soybeans
Yield per Acre	800	60	37
Price/ Unit	$ 0.60	$ 6.14	$ 8.56
Gross Income	$480.00	$368.4	$ 316.72
Total Costs	$381.50	$351.33	$ 289.37
Profit Per Acre	$ 98.5	$ 17.07	$ 27.35
Profit Margin	25.8%	4.9%	9.5%
BEP	$ 0.48	$ 5.86	$ 7.82

Estimated Production Costs ($/A) for Perennial Ryegrass in 2018 ($381.50)

- $12.00 – Seed
- $98.00 – Fertilizer
- $55.00 – Chemicals
- $10.00 – Rouging
- $18.00 – Fuel & Oil
- $20.00 – Repairs
- $10.00 – Custom Hire
- $55.00 – Rent
- $12.00 – Interest (op)
- $12.00 – Crop Insurance
- $1.25 – Lease (mach)
- $45.00 – Indirect Costs (dep., hired labor, mach & building interest)

Perennial Ryegrass - Direct Expenses for 2018 ($306.20)



Perennial Ryegrass Profit Margins at Various Yield Goals

01/8/18	2018	2018	2018
FBM Projected	Ryegrass	Ryegrass	Ryegrass
Yield per Acre	800	1000	1200
Price/ Unit	$ 0.60	$ 0.60	$ 0.60
Gross Income	$480.00	$600.00	$720.00
Total Costs Direct + Overhead	$381.50	$381.50	$381.50
Profit Per Acre	$ 98.5	$218.50	$338.50
Profit Margin	25.8%	57.3%	88.7%

Yield Drives Profits

- **Average yields: negative cash flow**
- **Utilize technology (GPS, auto steer, GIS mapping, Satellite, UAS)**
- **Engage entire management team**
- **Regular crop scouting**
- **Understand grass seed plant growth and development, GDD model & pest patterns**
- **Control controllables**

Control the Controllables

Control

- Crop/variety selection
- Timings of crop inputs
- Nitrogen rate & timing
- Regular budget review
- Pay close attention to details
- DETAILS MATTER
- Utilize all management resources
- When to swath
- When to buy inputs?

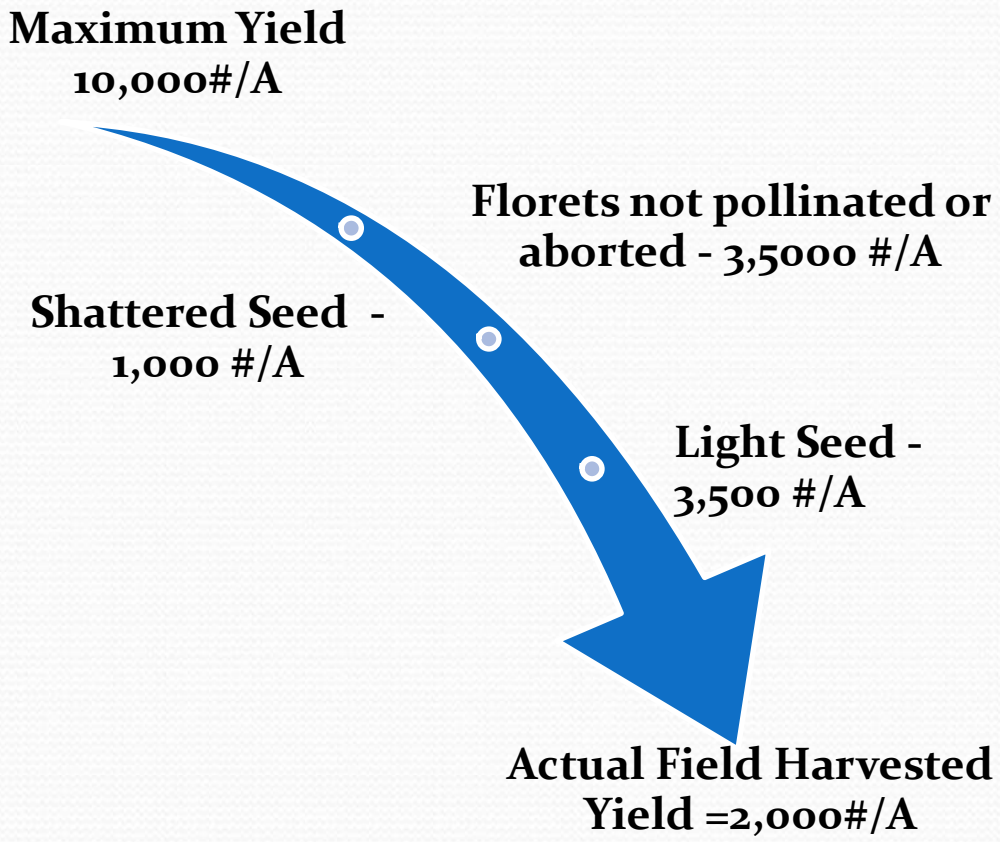
No control

- Weather
- Commodity prices
- Input prices
- Government programs & policies
- Interest rates
- Global economy
- Agriculture policy

What are Top-end Perennial Ryegrass Yields on Your Farm?

What are the major factor/s limiting seed production on your farm?

Theoretical Seed Yield for Perennial Ryegrass



Yield Components: Perennial Ryegrass Seed Production

- 12,022,560 culms/acre
- 21 spikelets/spike
- 9.4 florets/spikelet
- 0.213 seeds/floret
- 0.00000419 pounds/seed
- 2215 pounds/acre

Oregon State University, USDA Drawing

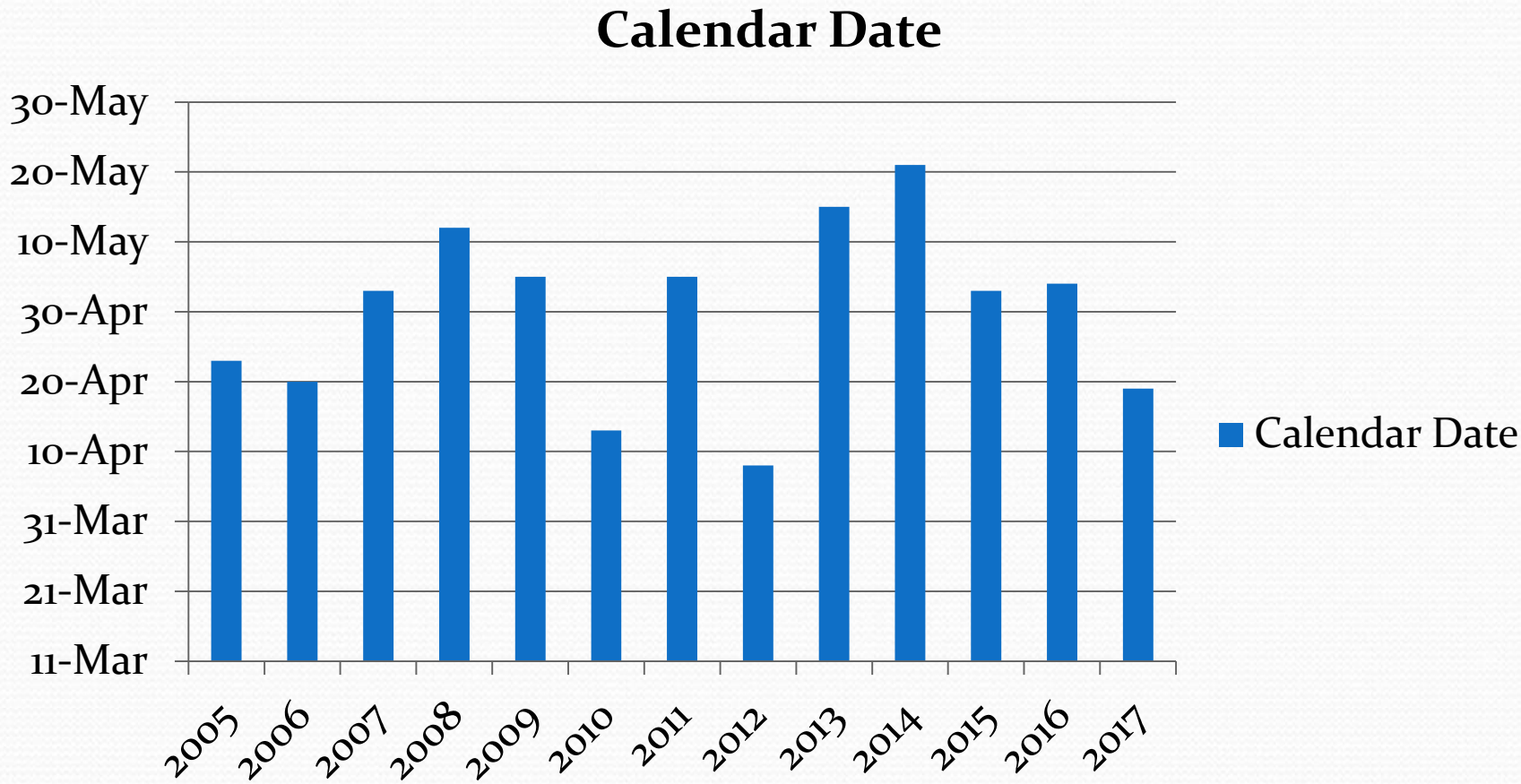
How Do Perennial Ryegrass Yields in MN Compare to West Coast?

- Oregon data suggests over 2,000 #/acre
- MN average - 800 #/acre
- High 20% - 1,200#/acre
- U of MN Magnusson Research Farm – Over 1700#/acre
- Area seed conditioners field documented yield approaching 1,500#/acre

TO MAXIMIZE PERENNIAL RYEGRASS YIELDS, WE MUST UNDERSTAND THE GROWTH, DEVELOPMENT, AND POTENTIAL PEST PROBLEMS AND PATTERNS

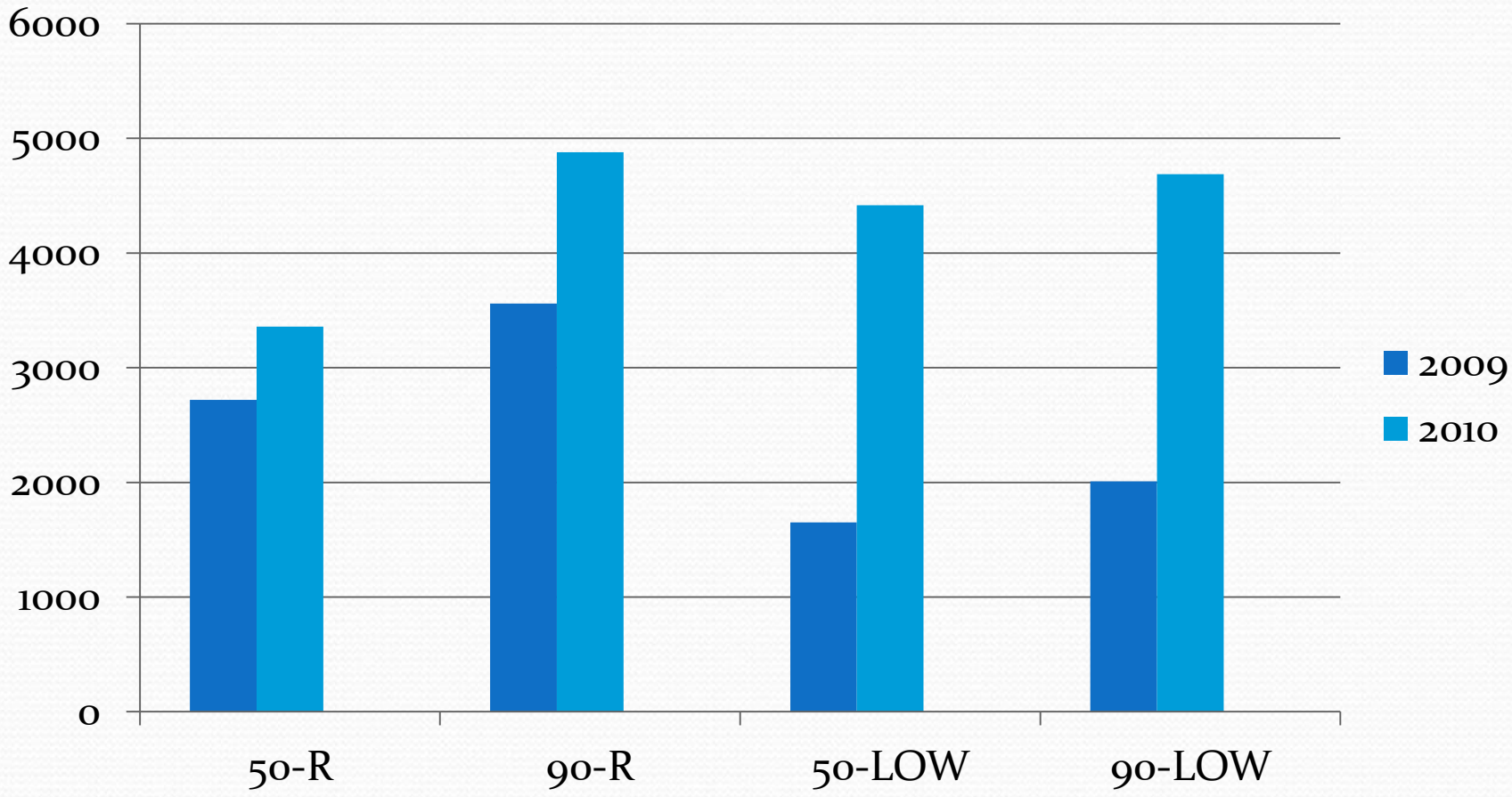
Leaf and Stem Rust in Lake of the Woods County

Lake of the Woods Ice-Out Date, 2005-2017



DNR Data, Average Ice-out Date, Average May 3;
Earliest April 8, 2000; Latest May 21, 2014

Perennial Ryegrass Biomass Production influenced by Nitrogen Rate, Location and Year



Data from Eric Koeritz

Growing Degree Days

What is it?

GDD – Can be used to estimate the growth and development of plants and insects

How is it calculated?

- **GDD = (Tmax + Tmin)/2 - Tbase**
- **Tmax = Daily max temp**
- **Tmin = Daily min temp**
- **Tbase = Base temp for plant/insect**

Growing Degree Day: Example

Daily Temperature Data

- **High temp for day was 65 and low 45 F**
- **(65+45) = 110/2 = 55 – 32 = 23**

- **23 GDD were accumulated on this day**

Ryegrass GDD Model

- **Works well to predict ryegrass growth stages**
- **Can be used to predict pest outbreaks (mildew in bluegrass and rust in ryegrass)**
- **The big limitation of the GDD model - does not account for level of plant growth (e.g. thin, medium or lush)**

Perennial Ryegrass Growth Stages

- Vegetative
- Tillering
- Jointing
- Flag leaf
- Full head extension
- Pollen Shed (anthesis)
- Mature Seed

Perennial Ryegrass Growth Stage by GDD

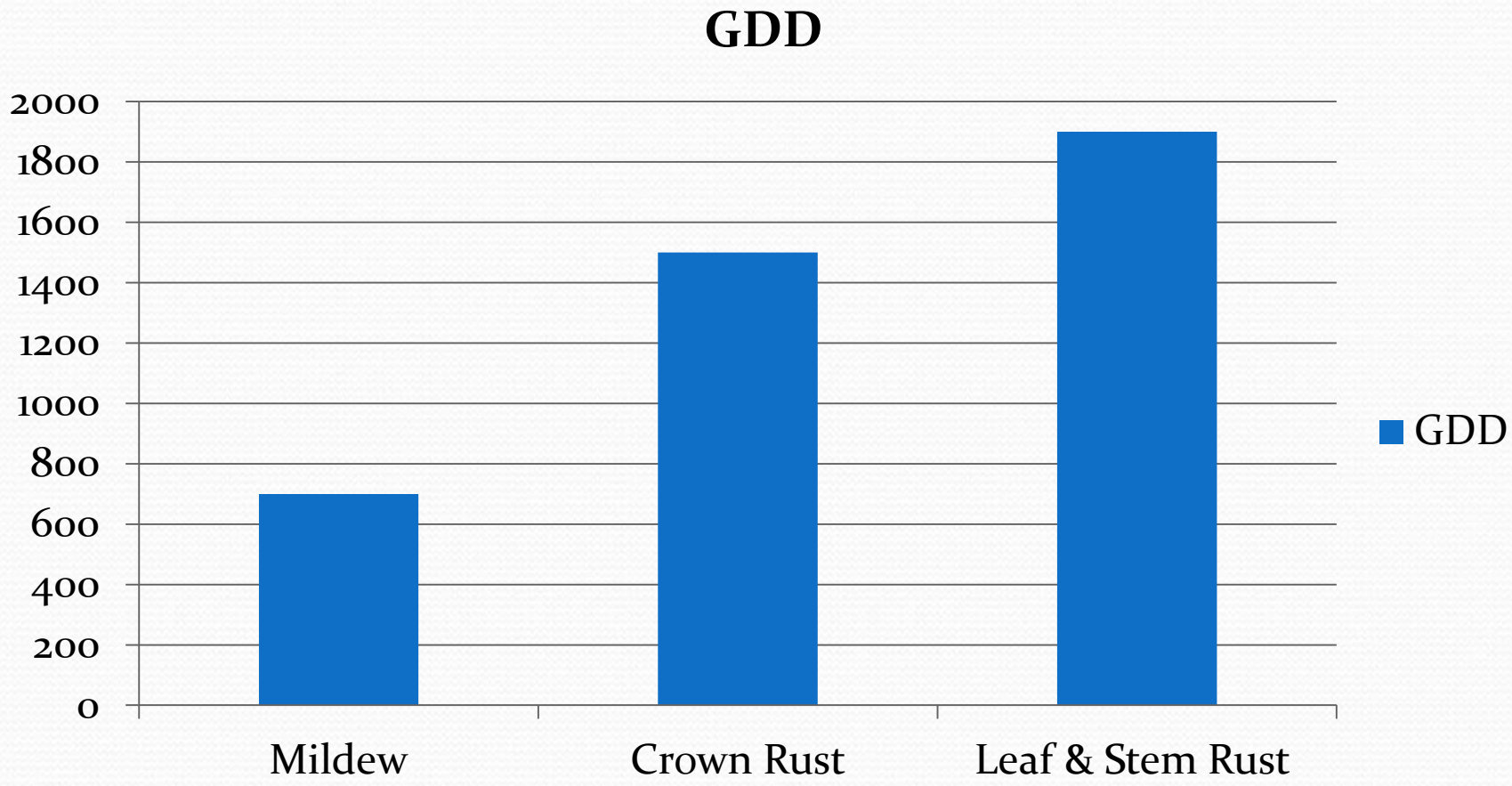
Plant Stage	GDD
• 2-3 Leaf	500 - 650
• 1-2 Nodes	700 - 850
• 2-3 Nodes	900 - 1050
• Boot Stage	1100 - 1250
• 50% Headed	1300 - 1550
• Pollen shed	1600 - 1750
• Swathing	2750 - 2900

Averaged over years & locations

GDD Uses in Grass Seed Production

- Herbicide timings
- Growth regulator schedules
- Fertilizer timings
  - Fall, spring or split applications
- Monitoring for pests
  - Mildew, rust, grasshoppers

Average GDD Accumulation to Onset of Leaf Diseases in Turf Seed Production



Factors Affecting Perennial Ryegrass Seed Yield

- Stand losses (winterkill, heavy straw…)
- Time of seeding (spring or fall)
- Fertility (nitrogen losses?)
- Full straw load (biomass)
- Control lodging
- No rust control
- Weed control
- Reduce cleaning losses
- Harvest & storage

Perennial Ryegrass Fertility

- Nitrogen must be available in the spring at spike initiation 400 GDD
- Perennial ryegrass yields not limited by nitrogen content of 140#/A Rolston et al 2010
- Linear response of seed yield and nitrogen rate; 12.32 # seed for each # nitrogen (Rolston et al 2010)

- Crop decision making guides
  - GDD model
  - Light meter?
  - Biomass produced?
  - Days to 50% lodging?
  - Tissue testing?
  - Foliar nitrogen?

Perennial Ryegrass Fertility Trial
Magnusson Research Farm - 2011

	Amount of added	Application	**seed yield**	Harvest		
Trt.#	fertilizer/source	Timing****	**#/ac.**	Ht(in.)	Lodging***	Date
1	0		**470**	18	1.0	7/29
2	60+0+0	Fall	**901**	21	1.3	7/29
3	100+0+0	Fall	**1441**	23	2.5	7/29
4	50urea+50coated N	Fall	**1222**	21	1.5	7/29
5	100+0+0+22s	Fall	**137**	23	2.5	7/29
6	140+0+0	Fall	**15 3**	23	4.0	7/31
7	90urea+50coated N	Fall	**1501**	23	4.5	8/1
8	(25+25)(25+25)**	Split	**1421**	23	2.5	7/30
9	60+0+0	Split	**1325**	22	2.3	7/29
10	100+0+0	Split	**141**	22	3.3	7/31
11	100+0+0+22s	Split	**1441**	23	4.0	7/31
12	140+0+0	Split	**1554**	24	5.0	8/1
13	75urea+25coated N	spring	**15**	23	3.3	8/2
14	60+0+0	spring	**1215**	22	2.0	7/29
15	100+0+0	spring	**141**	22	2.5	7/31
16	100+0+0+22s	spring	**1503**	23	2.0	8/1
17	140+0+0	spring	**1514**	23	3.5	8/2
18*	80+0+0	Fall+liquid	**1155**	21	1.8	7/29
19*	100+0+0	Split+Liquid	**1155**	22	2.5	8/1
20*	80+0+0	Fall+liquid	**10 4**	21	1.5	7/29
	LSD @5% level		**15**	1.6	1.0	1.4

Nitrogen Stress on Left

Photosynthetically Active Radiation (PAR)

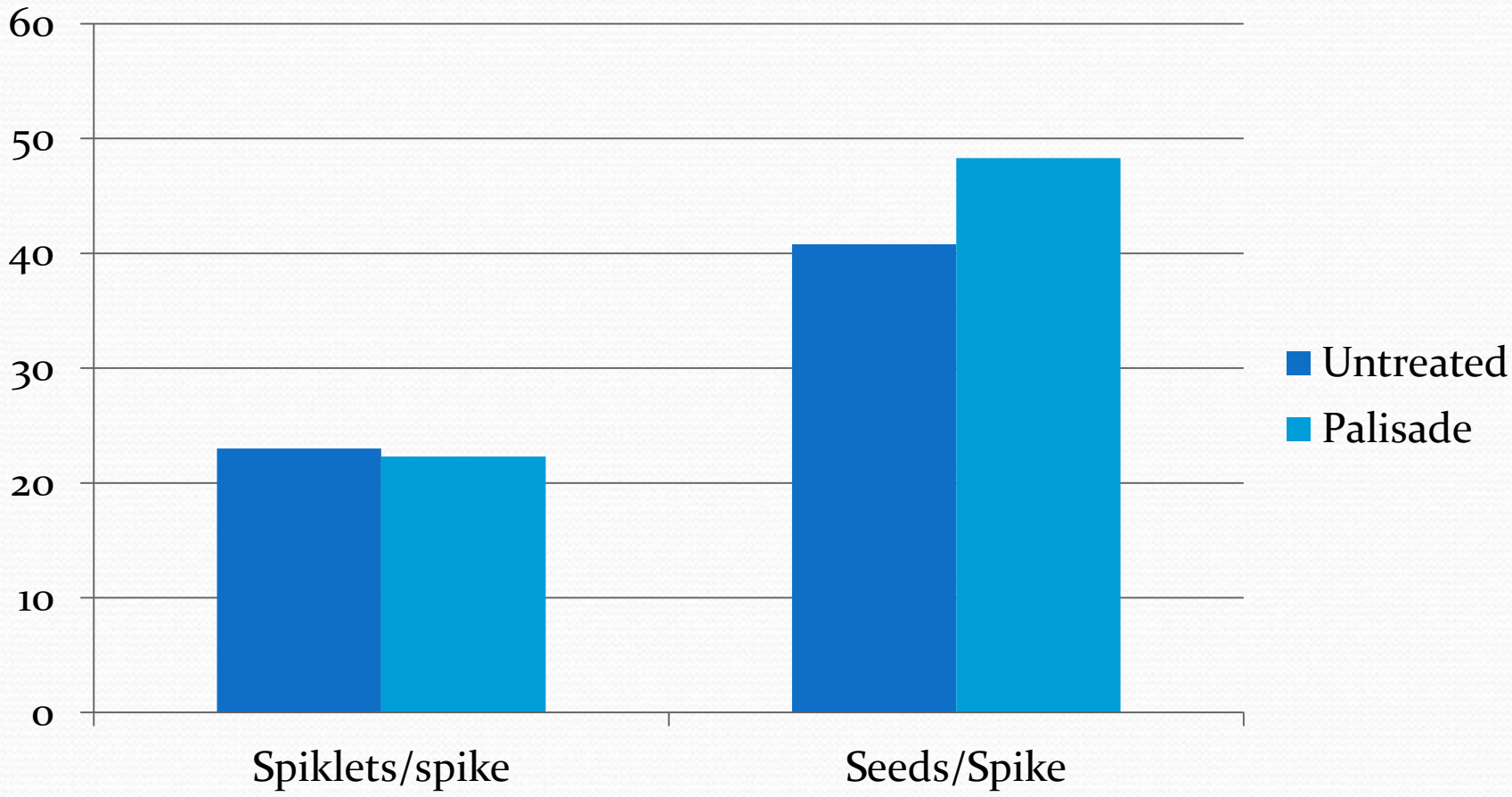
PAR in Perennial Ryegrass

- **Reduction in PAR to ryegrass seed head decreased yields up to 16% (Trethewey et.al)**
- **Strong correlation for seed yield and light interception at flag leaf**
- **Ryegrass seed yield increased 26.7 #/A for each 1% increase in PAR**

Chlorophyll Meter

Growth Regulator & Pollination

Perennial Ryegrass Spike Morphology Influenced by Growth Regulators



Chastain et al, 2003

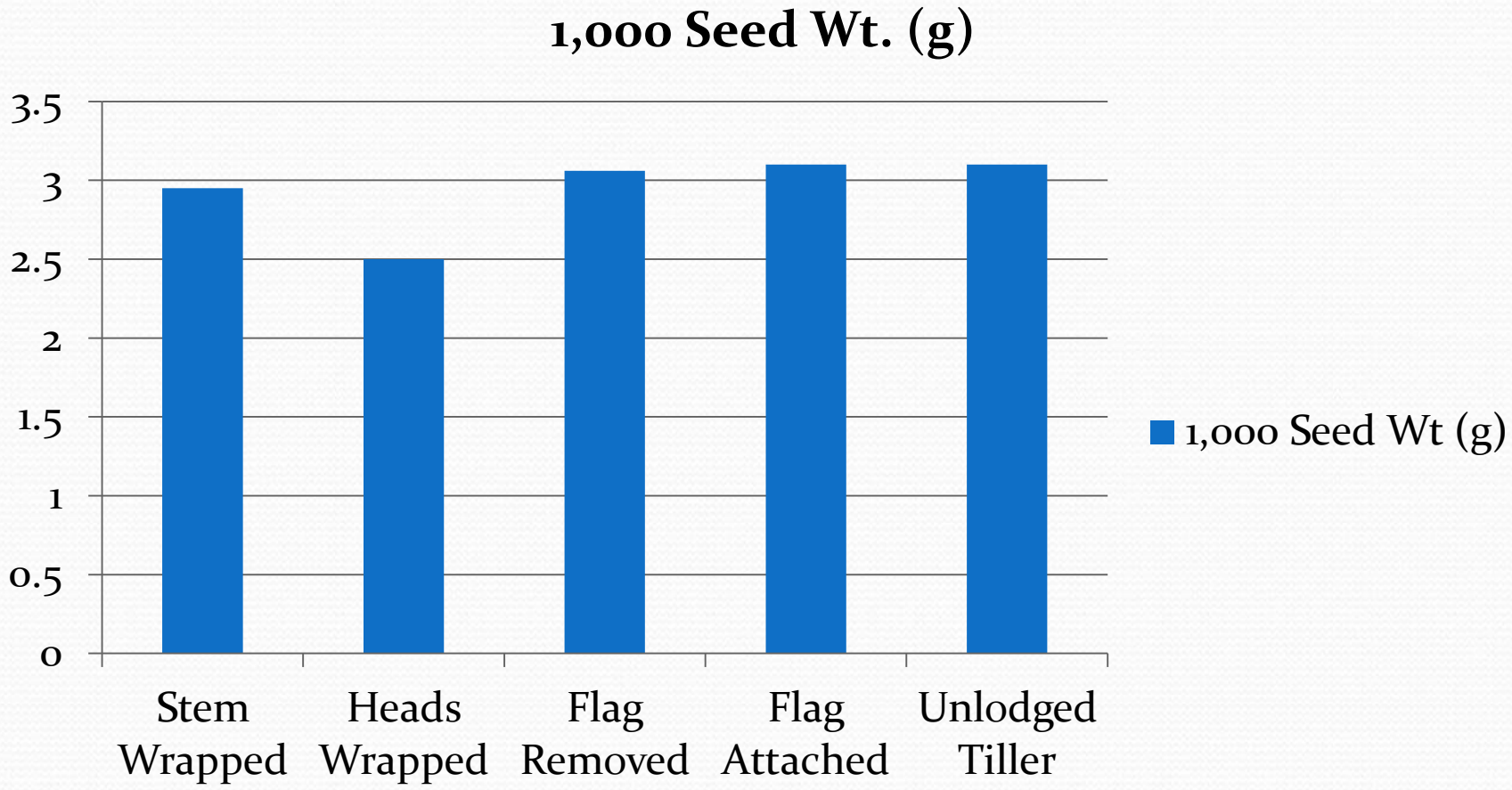
Lodging in Perennial Ryegrass

Growth Regulators

- U of MN trials - average yield increase over 200#/A
- Early lodging promotes vegetative tillering (Rolston 2007)
- Growth regulator improved yields 30-50% (Rolston 2004)
- Seed yield increased 19.7 #/A for each delay in days to 50% lodging (Trethewey et.al)
- Days to 50% lodging good predictor of ryegrass yield

Growth Regulator Trial – Steve Helmstetter

Perennial Ryegrass Seed Weight Influenced by Shading



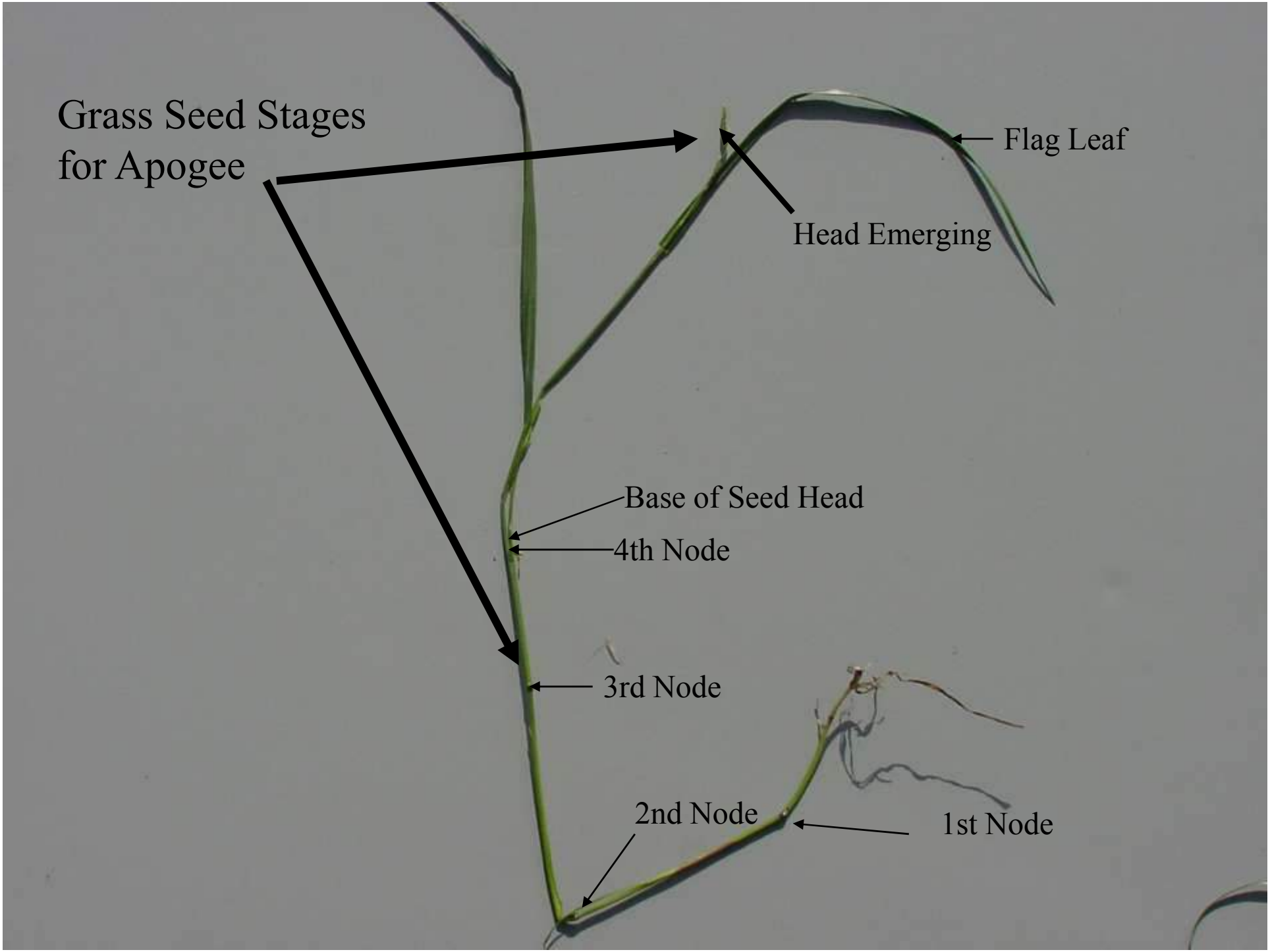
Trethewey et al, 2010

Growth Regulator Research

- **Apogee (*Prohexadione calcium*)**
- **Palisade (*Trinexapac - ethyl*)**
- **Both products reduce lodging by a reduction in cell elongation (gibberellin)**

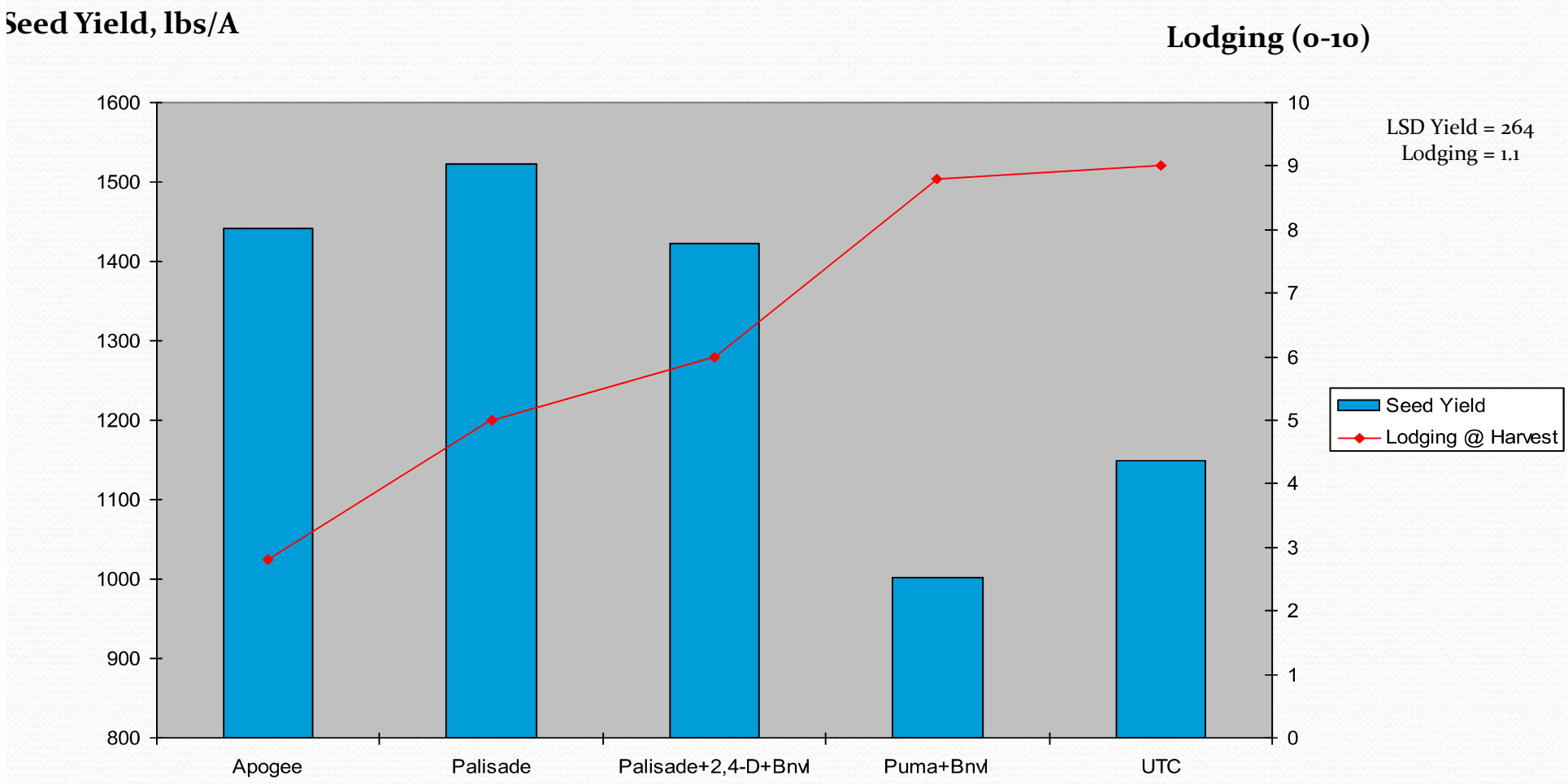
Growth Regulator Research in Ryegrass

- **Reduce lodging**
- **Better pollination**
- **Increase tillering**
- **Improved seed set**
- **More efficient swathing/harvesting**
- **Reduction in small seed/fines**


Grass Seed Stages
for Apogee
Flag Leaf
Head Emerging
Base of Seed Head
4th Node
3rd Node
2nd Node
1st Node

WH X TQ Perennial Ryegrass

David Dahlgren Farm. Roseau, MN.

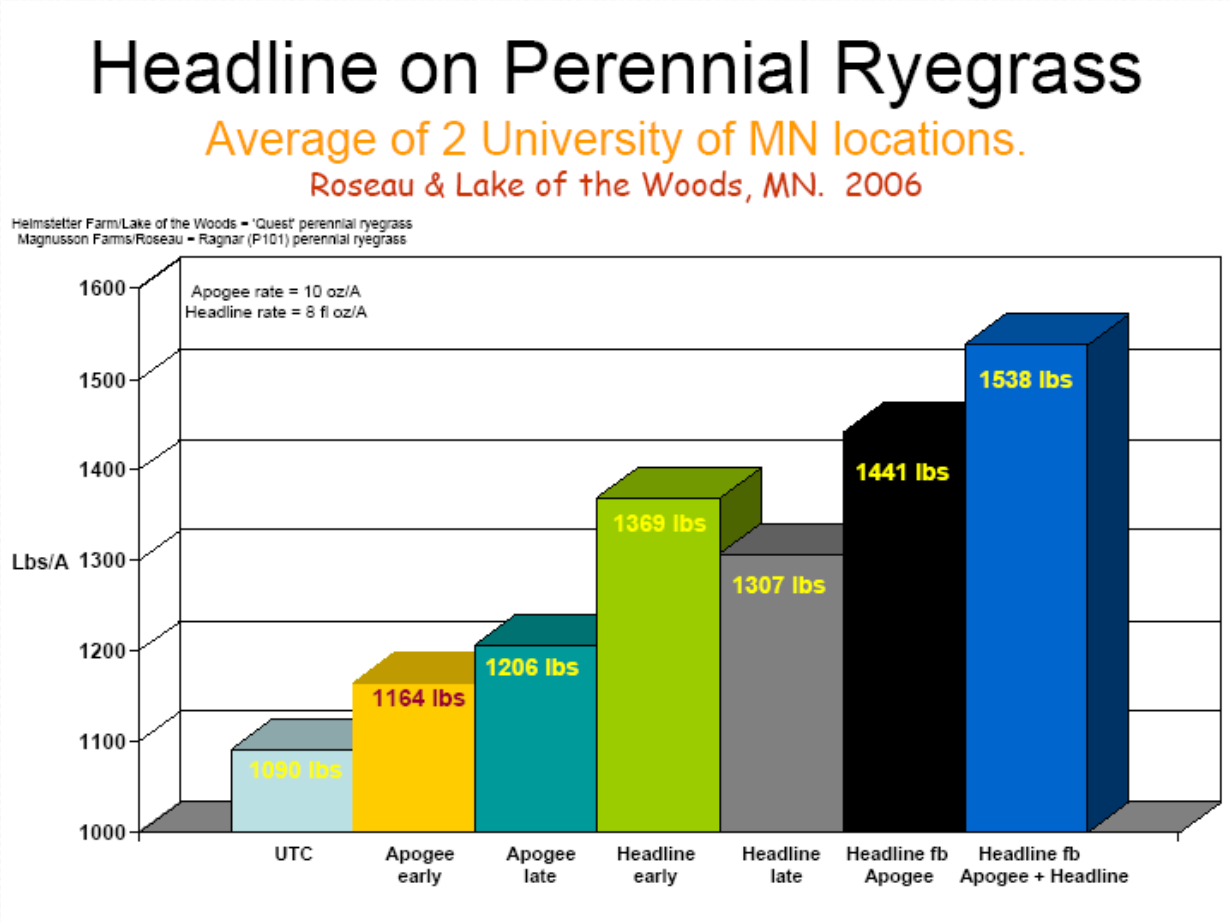


Apogee @ 16 oz/A + 0.25% NIS + 2 pts 28% UAN. Palisade @ 1.5 pt/A. 2,4-D + Banvel @ 0.75 pints each. Puma @ 10 oz/A

Apogee Applied at 2-3 node

rms, Rose

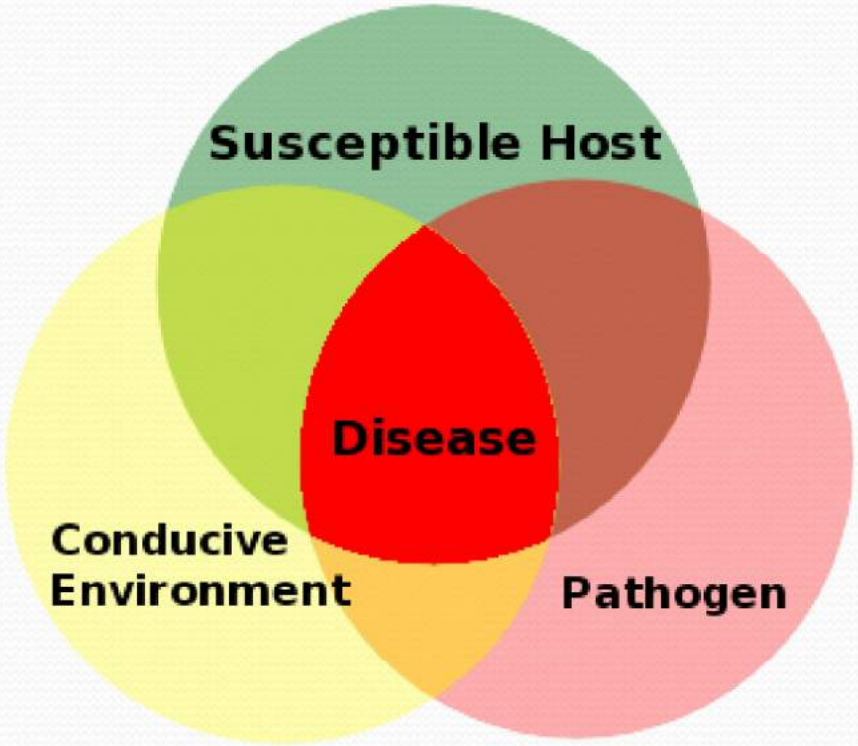
BASF Sponsored Data



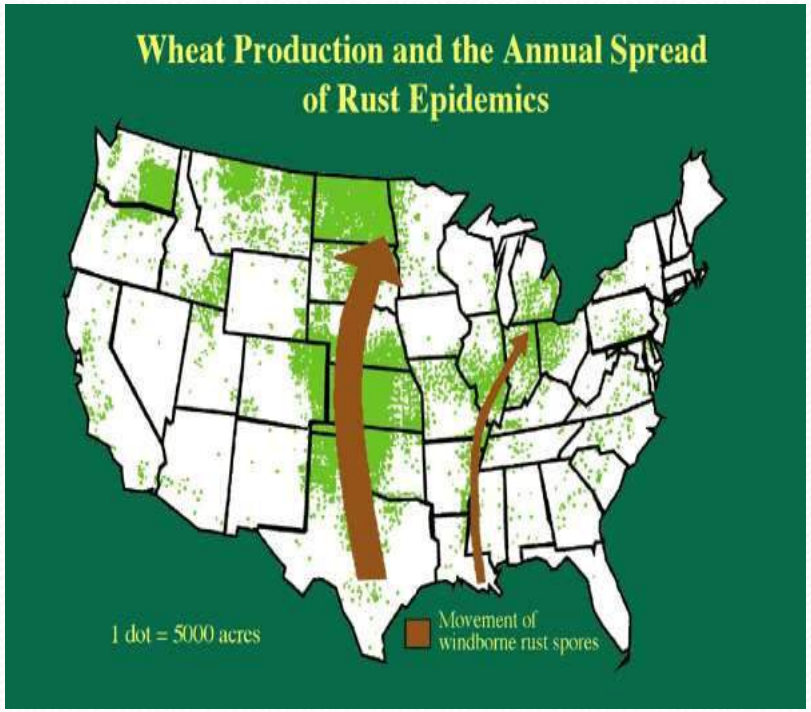
Leaf and Stem Rust in Ryegrass

What do we know about Rust?

Disease Triangle



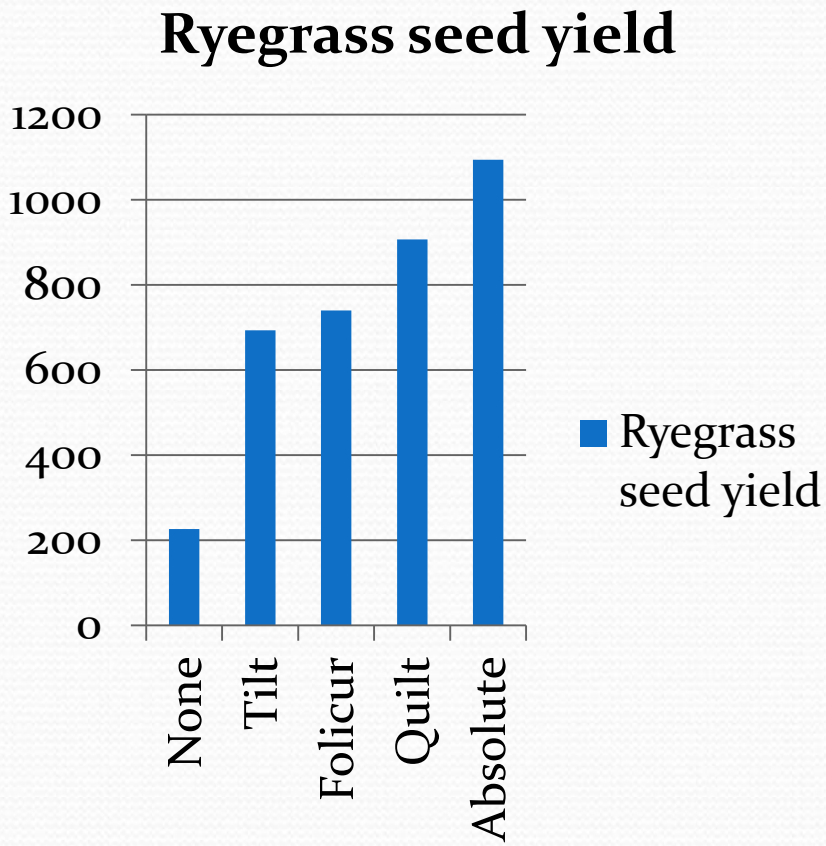
Puccinia Pathway




Crown Rust on Perennial Ryegrass

Powdery Mildew

Fungicide Trial 2010, D. Pieper



- **Treatments applied 6/22/2010**
- **Heavy rust pressure**
- **Folicur & Absolute applied with spray additive**
- **LSD (0.05) = 238**
- **Local infection?**

Wild Oat and Barnyardgrass Seed

- Normal cleanout approximately 20%
- Wild oat and Barnyardgrass seed will increase cleanout an additional 5-10%
- 800 # yield = $40/acre
- 1200#yield = $60/acre
- Mow low areas
- Keep weed seed out of good seed


LEXION

What is Top-end Perennial Ryegrass Yields on Your Farm?

What is the major factor/s limiting perennial ryegrass seed production on your farm?

Summary

- **Ryegrass is a profitable crop**
- **Know your cost of production**
- **Yields drive profits**
- **Understand perennial ryegrass growth patterns, stages and pest patterns (GDD model, pest scouting, newsletters)**
- **Details matter – timing is critical**
- **Nitrogen, growth regulators, fungicides are key factors to maximize yields, assuming good ryegrass stands**
- **If mother nature smiles, 1,500 # perennial ryegrass yields are possible**