Wheat Stem Rust Ug99: Recognition, Risk, and Response.

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Outline

Recognition

- biology and characteristics

Risk

- Historical significance
- New challenges: Ug99
- Current status

Response

- How to look for stem rust
- How to report stem rust

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Recognizing Rusts

Wheat leaf rust

Bean leaf rust

Oat crown rust

Image Citations: United States Department of Agriculture, Agricultural Research Service

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What is wheat stem rust?

- Fungus, *Puccini graminis* f. sp. *tritici*
- Common names:
  - stem rust
  - black rust
- Infects:
  - wheat
  - barley
  - barberry
- Occurs worldwide

Image Citation: United States Department of Agriculture, Agricultural Research Service

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What does stem rust do?

- Most important disease of wheat, globally!
- Drastically reduces growth and yield, up to 70 %!
- Brittle stems can fall over or “lodge” hampering mechanical harvest.

Lodging as a result of rust infection.

Image Citations: Top − United States Department of Agriculture, Animal and Plant Health Inspection Service, Bottom − United States Department of Agriculture, Agricultural Research Service

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Hosts

Image Citations: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org, #5448929 and Wikimedia Commons.

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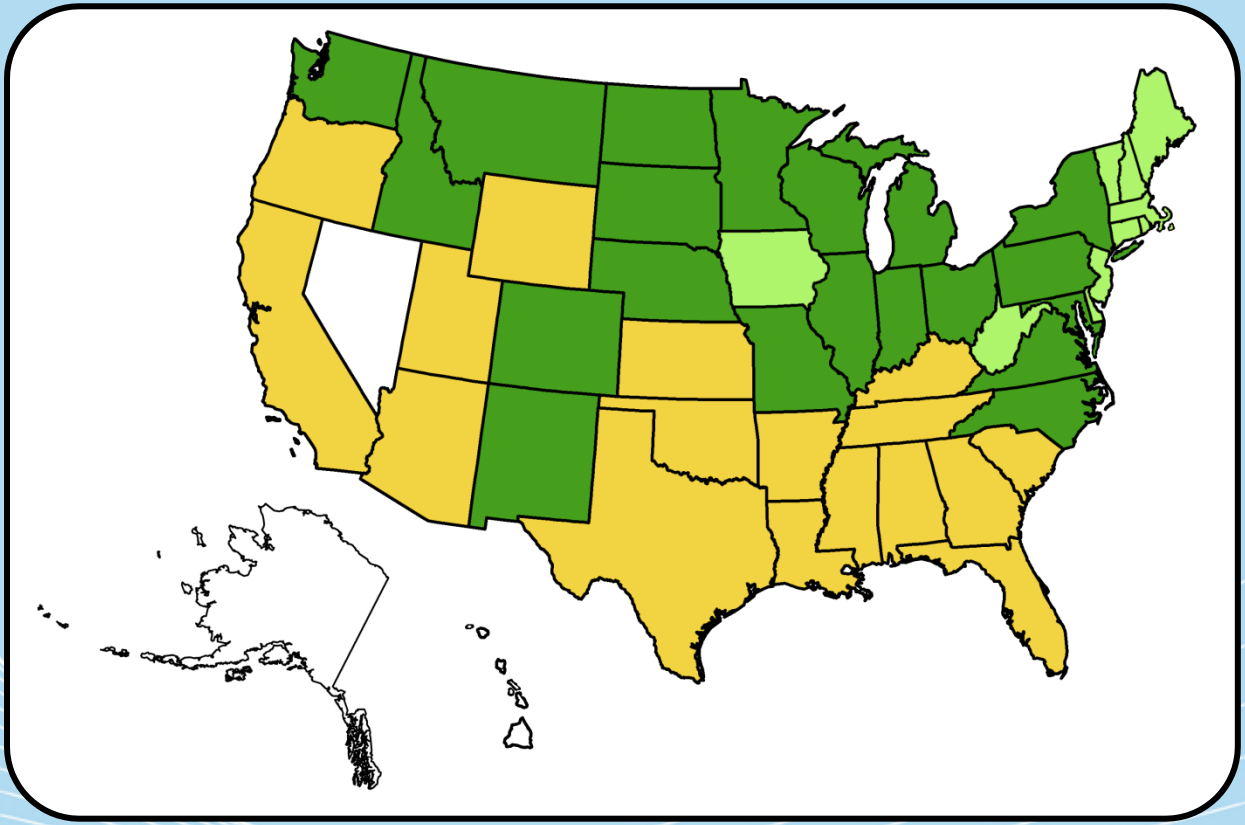
Distribution of Common Barberry and Wheat in the United States

Dark green indicates states that have both barberry and wheat.

Light green indicates those states that have barberry but no wheat.

Yellow indicates those states that do not have barberry, but grow wheat.



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Life Cycle of Wheat Stem Rust in Northern Climates

Fall Year 1 | **Winter Year 1** | **Spring Year 2**

Urediniospore → Teliospore → Basidiospore

Summer Year 2

Spermatia →  → Aeciospore

Wheat

Still on Barberry

Barberry

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Image Citations:
Wheat - Mary Burrows, Montana State University, www.bugwood.org, #5418725; Barberry - Haruta Ovidiu, University of Oradea, www.bugwood.org, #2168056

Life Cycle of Wheat Stem Rust in Southern Climates

Fall Year 1 | **Winter Year 1** | **Spring Year 2**

Wheat

Urediniospore

Wheat residue or volunteer plants

Urediniospore

Wheat

Image Citations:
Wheat - Mary Burrows, Montana State University, www.bugwood.org, #5418725; fallen wheat - William M. Brown Jr., www.bugwood.org, #5357107

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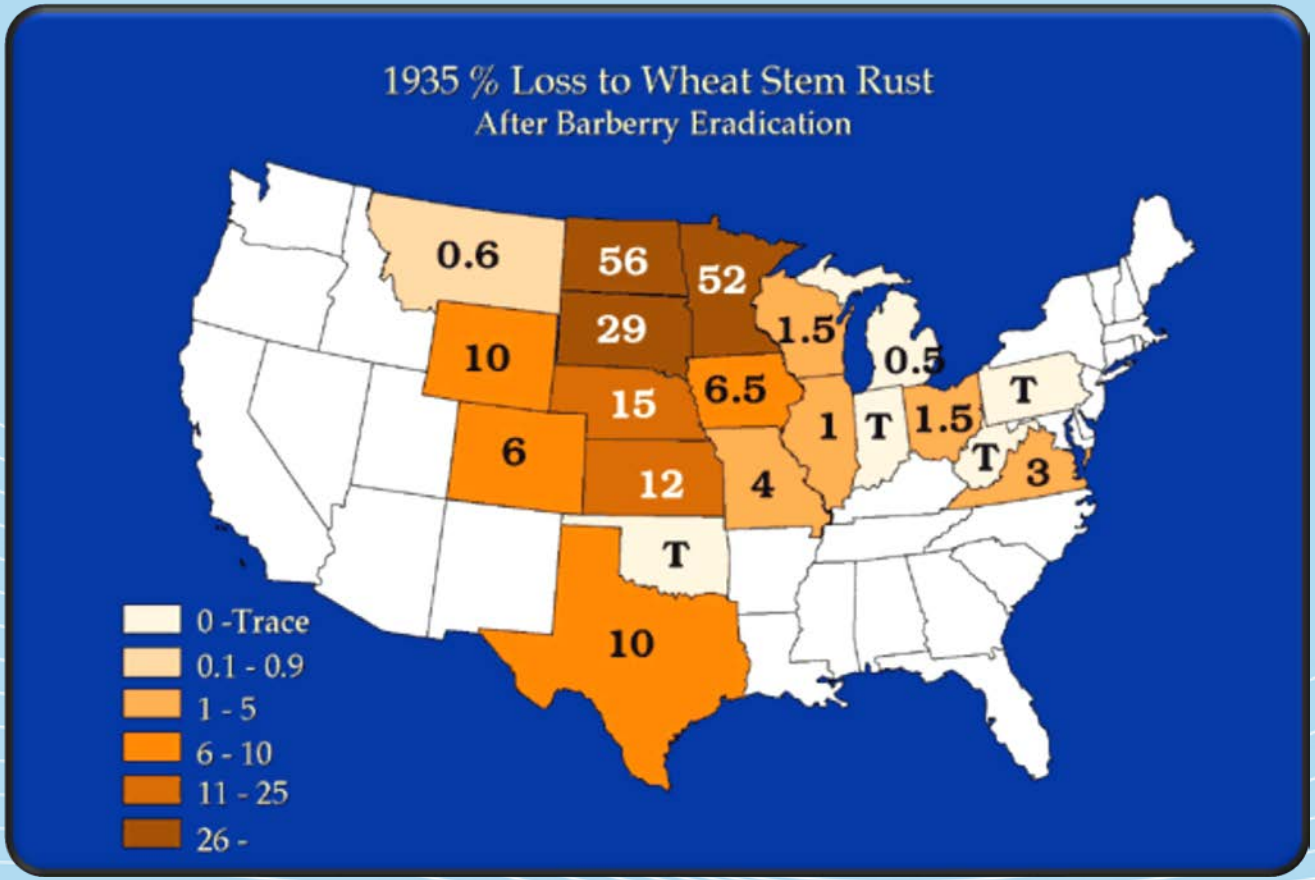
Summary

- Northern climates
  - Resting structure for overwintering and genetic recombination and sexual reproduction on alternate host are needed to continue the life cycle
- Southern climates
  - Asexual reproduction to complete life cycle
  - Overwintering occurs in urediniospore stage
  - No resting structure or alternate host needed
- Global warming will cause a change management strategies

Historical significance - problem

1900 – 1960: severe outbreaks in the U.S. and Canada



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Historical significance - solution

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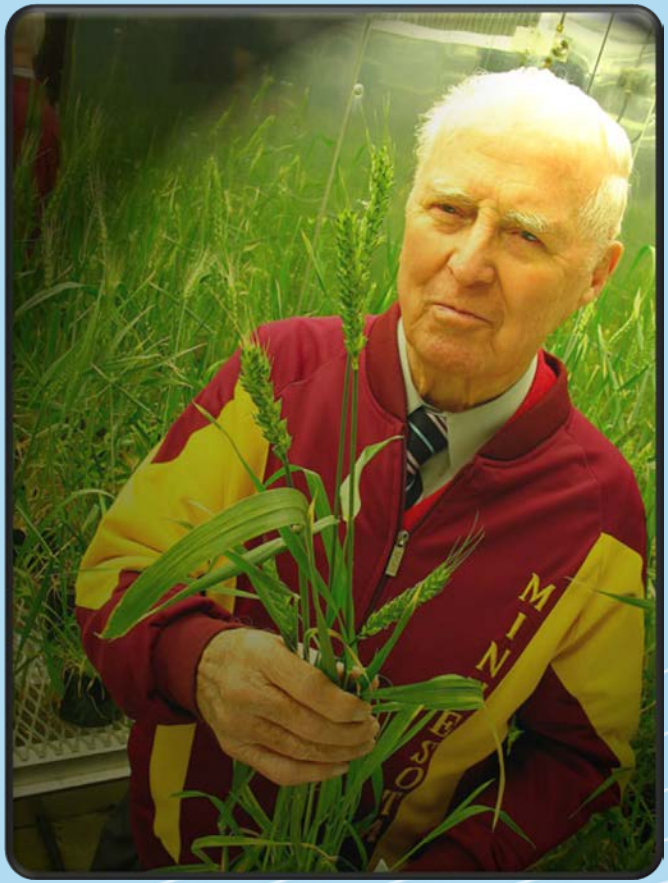
Historical significance - solutions



Norman Borlaug, father of the "green revolution."

Image Citations: Clockwise from top left: pulic-domain-image.net, usaid.gov, publicdomainimage.net

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Historical significance - solutions

Effective management by utilizing wheat cultivars that are resistant to stem rust fungus.

Image Citation: Boyd Padgett, Louisiana State University

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New challenges - U.S. outbreaks

- Stem rust is changing to overcome plant resistance.
- In 1985-1986, localized outbreaks affected wheat production the southern Great Plains.
- Localized outbreaks on barley with recent epidemics occurring in the northern Great Plains in 1989 and early 1990's.

Image Citation: Boyd Padgett, Louisiana State University

New challenges: Ug99

- New genetic variant discovered in Uganda in 1999.
- Overcomes the resistance provided by Sr31 gene.
- Spread to Kenya, Ethiopia, Iran, Yemen.
- New variants continue to evolve and overcome resistance provided by other genes (Sr24, Sr36).

New challenges: Ug99 continued

Previous rust epidemics suggest a continued spread through Africa, the Middle East, and Asia…and North America in the next decade.

Rust spores blown into the air during harvest.

Image Citations: United States Department of Agriculture, Agricultural Research Service

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Why an issue? Global wheat picture

- More wheat is grown than any other crop.
- Most important food grain source.
- 675 million tons or 11,266,667 bushels in 2011.
- 108 million tons or 1.8 million bushels were imported into developing countries.
- Few of the current cultivars grown are resistant to Ug99!

Image Citation: Food and Agricultural Organization of the United Nations

Why an issue- U.S. wheat picture

- Important producer of wheat- fourth largest in the world.
- Third largest food crop in U.S. in acreage and gross farm receipts.
- 45 million acres harvested = 2 billion bushels each year.
- Over half of U.S. wheat crop is exported.
- 240,000 farms = $14 billion industry.

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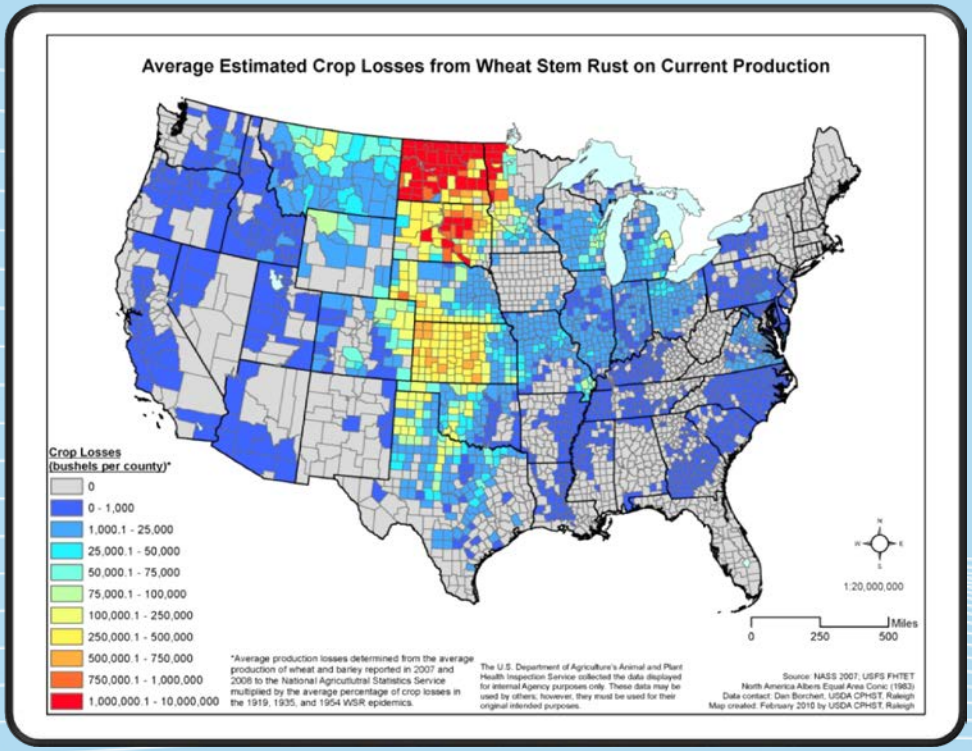
Current Estimate of Disease Risk

- Largest wheat production = greatest risk.
- The fungus will survive in the south and blow north.
- Stem rust is important everywhere!



Red indicates the greatest possible loss. Blue areas have the lowest risk. No risk in gray.

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What scientists are doing

- Monitoring stem rust disease around the world with the Global Cereal Rust Monitoring System.

- Screening varieties for resistance to Ug99 and other races of stem rust.

- Enhancing efforts to breed new resistance into high-yield cultivars.

Identifying and reporting rust

- Early detection is important!
- Recognize the threat, know the symptoms.
  - No symptoms until 7-15 days post-infection.
  - Early on, oval or elongate lesions that are reddish-brown in color.
  - Progresses to pustules that produce numerous black sooty spores.
  - Can result in lodging.

- **Report all instances of suspected rust to your local extension agent!**

Image Citations: Top – Boyd Padgett, Louisiana State University, Bottom - United States Department of Agriculture, Agricultural Research Service

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Recognize the threat: Identification of Rust Diseases

There are three cereal rusts of concern:

Leaf blades, leaf sheaths. Stem and heads, only rarely.

Stems, leaf sheaths, leaf blades, and head

Stems, leaf sheaths, leaf blades, and head.

Image Citation: ??

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Response to Suspected Wheat Stem Rust Infestation

For additional assistance identifying diseases of wheat or barley, contact your local NPDN lab or your local county extension office.

- Contact your state's NPDN lab:
  - http://www.npdn.org
- Contact your local count extension office:
  - http://nifa.usda.gov/Extension/index.html

They will instruct you on collecting samples for disease confirmation.

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Additional information resources

- To see how much wheat and barley is grown in your state:
  - USDA- National Agricultural Statistics Service, Quick Stats http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp

- Other sources of cereal rust information:
  - USDA Cereal Disease Lab, St. Paul, MN http://www.ars.usda.gov/main/site_main.htm?modecode=36-40-05-00
  - Borlaug Global Rust Initiative http://www.globalrust.org/traction

Questions?

- For more information, check out www.protectingusnow.org

- You can also contact:
  - Amanda Hodges, Ph.D., Associate Extension Scientist, Department of Entomology and Nematology, University of Florida, achodges@ufl.edu
  - Stephanie D. Stocks, M.S., Assistant-In Extension Scientist, Department of Entomology and Nematology, University of Florida, sstocks@ufl.edu

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Author and Publication Dates

- Erick De Wolf, Ph.D., Department of Plant Pathology, Kansas State University
- Jennifer Weeks, Ph.D., Department of Entomology and Nematology, University of Florida
- Marty Draper, Ph.D., USDA, National Institute of Food and Agriculture
- Keumchul Shin, M.S., DPM student, University of Florida

- Published June 2012
- Updated August 2013

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Editors

- Stephanie Stocks, M.S., Department of Entomology and Nematology, University of Florida
- Amanda Hodges, Ph.D., Department of Entomology and Nematology, University of Florida

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- Citation:
  - De Wolf, E., J. A. Weeks, M. Draper, and K. Shin. 2012. Wheat stem rust. Accessed (add the date) – www.protectingusnow.org.

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National Plant Board (NPB) and State Departments of Agriculture

National Plant Diagnostic Network (NPDN)

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