An Introduction to Plant Pathology and Identification of Wheat Diseases

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What is Plant Pathology?

- Study of microorganisms and the environmental factors that cause disease in plants
- Disease – any malfunctioning of host cells that results from continuous irritation by a pathogenic agent or environmental factor
  - Non-infectious
  - Infectious
### Diseases

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<th>Non-infectious (abiotic)</th>
<th>Infectious (biotic)</th>
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<td>Abnormal temps, soil moisture, or light levels</td>
<td>Leaf spots</td>
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<td>Storm damage</td>
<td>Cankers</td>
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<td>Lack of oxygen</td>
<td>Galls</td>
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<td>Air pollution</td>
<td>Wilts</td>
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<td>Nutrient deficiencies/toxicities</td>
<td>Root and stem rots</td>
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<td>Soil pH extremes</td>
<td>Leaf and shoot blights</td>
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<td>Soil salinity extremes</td>
<td>Fruit spots and rots</td>
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<td>Pesticide toxicities</td>
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Plant Disease Triangle

- Any disease has the potential to cause problems on crops in any area
- Disease development on any crop is a result of complex interactions over time between host, pathogen, and environment
Pathogens and Plant Diseases

- Fungi – 8,000 species of fungi cause 100,000 diseases
- Bacteria – 200+species
- Viruses – 500+species
- Nematodes – 500+species
Plant Diseases – Rules of Thumb

• Bacterial diseases, fungal leaf spots, and foliar blights, in general, are more severe and likely to occur during humid weather or irrigated conditions

• Nematodes and many fungal root rots are more problematic in warm, moist soils

• Non-irrigated crop production or arid climates tend to be more favorable for other root and stalk rots

• Viruses are usually dependent upon their vectors
Specific Diseases and Conditions Favoring Their Development

• Dryland production:
  – Root and crown rot – residue borne
  – Mosaic diseases

• Irrigated production:
  – Scab – residue borne
  – Take-all – residue borne
  – Rust – 3 different diseases/pathogens
  – Tan Spot – residue borne
  – Black chaff – residue borne
Root and Crown Rot of Wheat

- Disease complex consisting of *Bipolaris sorokiniana* and/or *Fusarium* spp.
- Both are unspecialized, opportunistic pathogens associated with stress conditions
- Drought and warm temperatures predispose plants to this complex
- Common root rot – *Bipolaris*
- Dry-land (Fusarium) foot rot - *Fusarium*
Root and Crown Rot Symptoms

- Brown to black lesions and necrosis on sub-crown internodes (*Bipolaris*)
- Roots, crown, lower nodes, and internodes become brown and necrotic (*Fusarium*)
- If crowns become severely damaged, plants don’t recover in spring and/or produce fewer crown roots and tillers
Root and Crown Rot
Sub-Crown Internode Symptoms
Root and Crown Rot
Stem and Crown Symptoms
R&C Rot – Field Symptoms
Management Options
Root and Crown Rot of Wheat

- Shallow seeding
- Late fall planting
- Balanced fertility program
- Crop rotation
- Resistant cultivars (to both pathogens and drought stress)
Wheat Viruses

- WSBV – transmitted by soilborne fungus
- BYDV – transmitted by aphids
- Wheat streak mosaic, Triticum mosaic, and High Plains virus are all vectored by the wheat curl mite
- Triticum mosaic is a new virus discovered in 2006 in Kansas and formally recognized in 2007
Wheat streak mosaic
Box Butte County
Virus Management

• Destroy volunteer wheat
• Control grassy weeds
• Don’t plant too early
• Resistance
Additional Diseases Associated with Root and Crown Rot

- Head scab, corn stalk rots, and dryland foot rot
  - All caused by *Fusarium graminearum*
- Part of the root and crown rot complex
- Strongly correlated with plant stresses and adverse environmental conditions for the crop
- Under optimal conditions, can move from roots and crowns to heads
Fusarium head blight (scab) of wheat

Cause:

- Caused by the fungus *Fusarium graminearum*

Sexual fruiting structures on corn stubble

Sexual spores

Asexual spores
Symptoms

- Sudden appearance of white heads in the field
- Heads partially bleached
- Salmon to pink spore masses on bleached heads
Symptoms

Early infection can spread from the head to the stem, which becomes discolored below the head.
Fusarium Head Blight (Scab)

Disease Favored by:
- Excess moisture before and during flowering
- Planting into corn, wheat and sorghum stubble

Effects:
- Low yield and test weight
- *Fusarium*-damaged kernels (scabby grain) results in low germination and seedling blights
- Contamination of grain by deoxynivalenol (DON) – vomitoxin
Management

- Resistant/tolerant varieties
- Avoid planting wheat following corn, wheat, or sorghum
- Do not over-irrigate after full heading
Take-all

- Caused by *Gauemannomyces graminis* var. *tritici*
- Favored by alkaline, and N and P – deficient, poorly drained soils
- Also favored by continuous cropping
- More severe in wet years and irrigated conditions
Root Rot
Take-All Management

- Rotate out of cereals
- Control volunteer cereals
- Control grass weeds
- Plant into firm, well drained soil
- Maintain a balanced fertilizer program
Black Stem Rust

- Last major epidemic in 1954
- Durable resistance gene (SR31)
- New race in Africa called TTKS (Ug99) defeats SR31 (and SR24)
- 80% of wheat lines susceptible to TTKS
Rust Management

- Resistance
- Control grass weeds
- Control alternate hosts
Tan Spot

• Caused by *Pyrenophora tritici-repentis*
• Yield losses not extensive unless it damage occurs on flag leaf at heading
• Infection requires wet period of 6-48 hrs
• Overwinters on wheat stubble, thus disease problems are not an issue unless planting into residue
Tan Spot – Wheat

Overwintering structures in stubble

Lesions after spring infection
Symptoms After Planting in Infected Wheat Residue
Bacterial leaf blight/ black chaff
Management of Bacterial Blight/Black Chaff

- Certified, pathogen-free seed
- Irrigation management
- Avoid highly susceptible varieties
- Rotate out of cereals
Thank You – Questions?