

### Disease Facts

- Caused by the soil-borne fungus *Phytophthora sojae* (also known as *Phytophthora megasperma* f. sp. *glycinea*)
- Pathogen has many races, and multiple races occur in each field
- Disease is favored by extended wet field conditions
- May attack soybeans at any time during the growing season
- Displays seed rot, seedling blight and root/stem rot phases
- Above-ground symptoms may not be evident for several weeks after initial infection



Soybean plants in foreground wilting due to *Phytophthora*

### Conditions Favoring Disease Development

- Associated with wet soil conditions
  - Commonly occurs on heavy, poorly-drained or compacted soils
  - May occur on any soil saturated for an extended period of time
- The ideal temperature for infection is 60 to 80° F
- Successive years of soybeans on the same fields may increase damage potential
- Application of high levels of potash, manure or municipal sludge immediately before planting may increase disease severity

### Disease Cycle

- Disease-causing fungus is a water mold, or Oomycete, characterized by oospores and zoospores
- Oospores act as survival mechanism of the fungus
  - May persist in soybean residue and soil for years
- Zoospores are produced when oospores germinate in the presence of a soybean crop
  - Zoospores also produced from infected soybean tissue during the growing season
  - Swim through films of water to the root
  - Fungus infects root and grows into and among the root cells of the plant
- Disease survives in soybean residue and in the soil



Plants wilting among healthy plants is often a symptom of *Phytophthora*

### Impact on Crop

- The *Phytophthora* fungus can kill plants at all stages of growth
- Stand reduction may result in replanting or yield loss
- Replanting is common when early infection results in severe seed rot and damping off of seedlings
- In some cases, infected stands survive but are less productive than healthy stands
- Yield reductions can range from as little as 5% to more than 50% depending on severity



## Phytophthora Symptoms

**Seed Rot Phase** – may begin at imbibition

- Infected seeds become dark brown and soft to mushy
- Complete deterioration of the seed may occur

**Seedling Blight Phase** – occurs at emergence or soon after

- “Damping off” – rapid decay, wilting and plant death
- Symptoms include a dark brown to black discoloration of the stem, usually beginning at the soil line
- Diseased tissues quickly become soft and water-soaked, and wilting and plant death may soon follow

**Root and Stem Rot Phase** -- symptoms begin in the root

- Brown, discolored tap root and secondary roots and less root mass
- Nodulation is often minimal, leading to chlorotic, N-deficient plants
- Affected plants may be stunted, so fields have an uneven appearance

**Root and Stem Rot Phase** – symptoms may spread to the stem

- Brown discoloration develops at the soil line
- Dark-brown to red-brown lesion may progress up the stem (key diagnostic feature of the stem rot phase)
- Diseased tissues quickly become soft and water-soaked, and wilting and plant death may soon follow, especially during stress periods



Note dark-brown lesion extending upward from soil line

## Management

**Variety Selection** – most effective means of managing Phytophthora

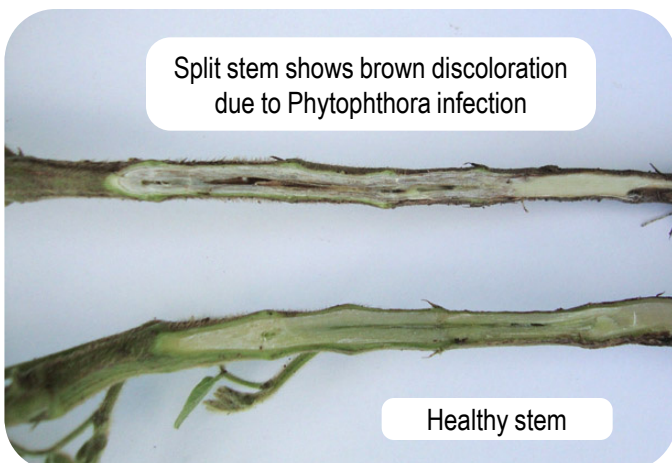
- Pioneer researchers are developing varieties with resistance genes and field tolerance to Phytophthora
  - Rps 1C and Rps 1K are the most common race-specific resistance genes used today
  - Race-specific resistance is most effective during the seed and seedling growth stages
  - Field tolerance is effective against all races of Phytophthora, more enduring than race-specific genes
  - Field tolerance is not as effective in the seed and seedling growth stages
  - Varieties containing both genetic resistance and field tolerance have two mechanisms of protection
- Pioneer rates its varieties for tolerance and provides ratings to customers -- ratings range from 4 to 6 (9=tolerant)

**Field Drainage and Soil Structure** – improve field drainage and remediate compaction and hardpan layers if possible

**Planting Date** – on heavy soils or in no-till systems, early planting may not be an option

**Seed Treatments** – use seed-applied fungicides in fields with a history of Phytophthora damage

- Pioneer Premium Seed Treatment (PPST) contains metalaxyl, which has specific activity against early season Phytophthora and Pythium diseases
  - Provides protection for up to three weeks
  - Especially useful when cool, wet soil conditions develop after planting



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