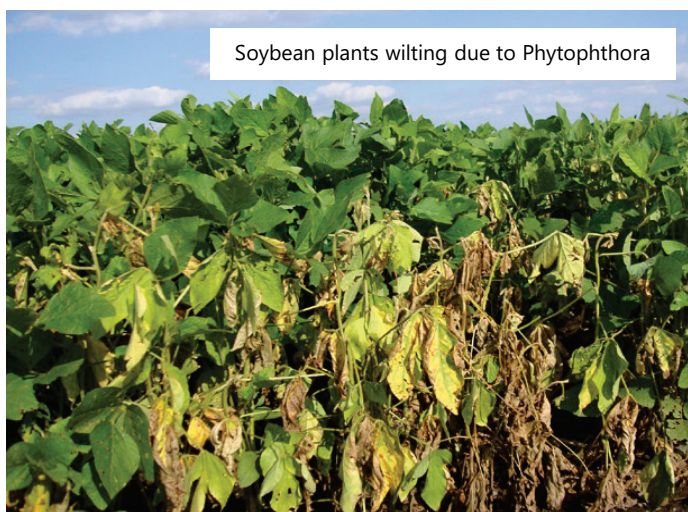


## Phytophthora Root and Stem Rot

### 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.



### 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 (15 to 27° C).
- 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.



Wilted plants surrounded by 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 taproot 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 and Seed Treatments** – most effective means of managing Phytophthora.
  - Corteva Agriscience researchers are developing varieties with resistance genes and field tolerance to Phytophthora.
  - Corteva Agriscience uses molecular breeding to develop varieties with race-specific resistance genes such as Rps 1C, Rps 1K, and Rps 3a.
  - Race-specific resistance provides complete resistance to specific races throughout the growing season.
  - Field tolerance provides partial protection against all races of Phytophthora.
  - Field tolerance is not as effective in the seed and seedling growth stages, but provides benefit in-season.
  - Varieties containing race-specific resistance and favorable field tolerance coupled with DuPont™ Lumisena™ fungicide seed treatment is the ideal combination because they provide multiple mechanisms to protect against Phytophthora.
  - Pioneer® brand soybean varieties are rated for tolerance and these ratings are provided to customers – ratings range from 2-9 (9=tolerant) with a majority of varieties scoring between 4 and 6.
- **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.

