PP1790 (Revised May 2025)

Pea Disease Diagnostic Series

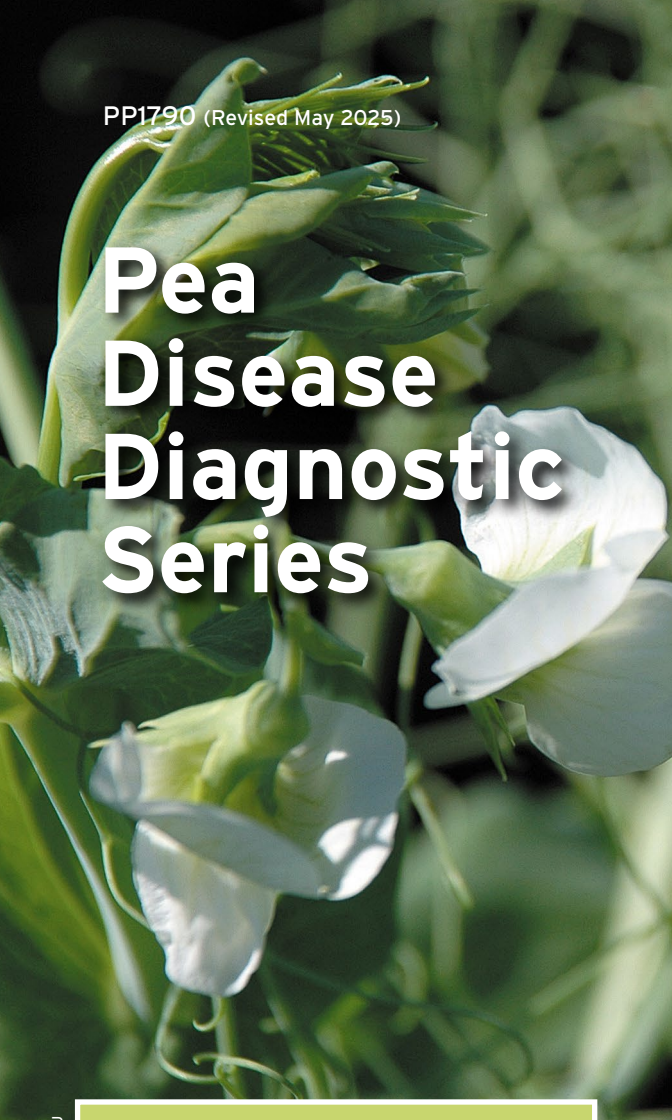

Photo: S. Markell, NDSU

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Index

Rots and Wilts

Spots and Lesions

Viruses

For more information on this and other topics, see www.ndsu.edu/agriculture

800-5-16; web-10-22; 394-5-25

PP1790-1
Pea Disease Diagnostic Series

Fusarium root rot

Fusarium avenaceum,
F. solani f. sp. *pisi* and other species

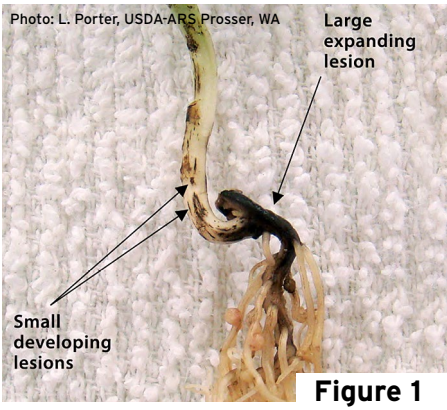

Figure 1

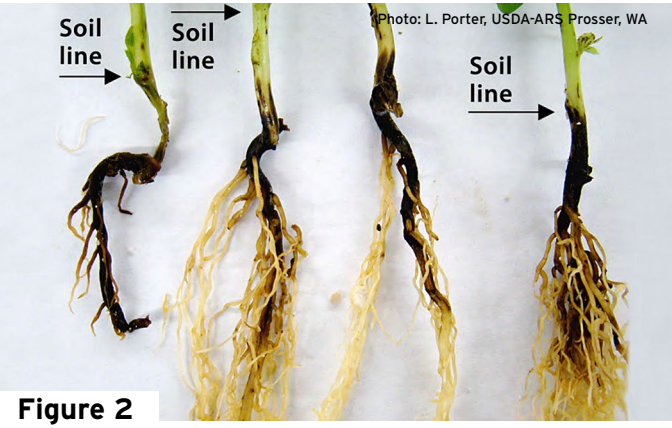

Figure 2

Figure 3

PP1790-1
Pea Disease Diagnostic Series

Fusarium root rot

Fusarium avenaceum
F. solani f. sp. *pisi* and other species

AUTHORS: Julie S. Pasche, Lyndon Porter and Kimberly Zitnick-Anderson

SYMPTOMS

- **Red to brown-black below-ground lesions**
- **Lateral root reduction and complete destruction in severe infections**
- **Below-ground red discolored vascular tissue is possible**
- **Above-ground stunting, yellowing and necrosis**

FIGURE 1 – Discrete lesions expanding from the point of seed attachment and coalescing into larger lesions

FIGURE 2 – Advanced lesions affecting large areas of roots and hypocotyls

FIGURE 3 – Infected plants yellowing from the base upward

FACTORS FAVORING DEVELOPMENT

- Temperatures from 73 to 83 F and wet soils
- Soil compaction and plant stress
- Contaminated seed or plant debris

IMPORTANT FACTS

- Alternative hosts include dry beans, soybean, chickpea and lentil
- Often seen in a complex with other root rots
- Above-ground symptoms often not seen until flowering
- Can be confused with other root rots and abiotic stress (water damage, etc.)

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PP1790-2
Pea Disease Diagnostic Series

Aphanomyces root rot

Aphanomyces euteiches

Figure 1

Figure 2

Figure 3

Aphanomyces root rot

Aphanomyces euteiches

AUTHOR: Lyndon Porter

SYMPTOMS

- **Caramel-brown root and below-ground stem**
- **Outer root and below-ground stem tissue will slough off, exposing the vascular tissue**
- **Lower leaves turn yellow; the plant may be stunted, wilt and/or die prematurely**

FIGURE 1 – Caramel-brown infected roots (R) and healthy roots (L)

FIGURE 2 – Infected roots and yellowing lower leaves

FIGURE 3 – Outer root tissue sloughing off and exposing inner vascular tissue

FACTORS FAVORING DEVELOPMENT

- Cool and wet spring conditions
- Low-lying areas
- Short rotations with peas or lentils

IMPORTANT FACTS

- Thick-walled spores can survive in soil for 20 years or more
- Lentils are a host, but chickpeas and faba beans are not
- Crop rotations of six or more years with nonhost can help reduce disease
- Can be confused with other root rots and abiotic stress (water damage, etc.)

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PP1790-3
Pea Disease Diagnostic Series

Pythium seed and seedling rot

Globisporangium ultimum and
other *Globisporangium*/*Pythium* species

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 1

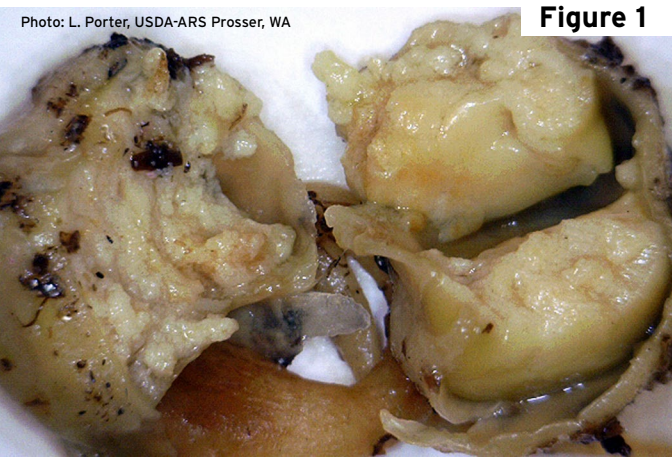

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 2

Figure 3

Photo: L. Porter, USDA-ARS Prosser, WA

Pythium seed and seedling rot

Globisporangium ultimum and
other *Globisporangium*/*Pythium* species

AUTHOR: Lyndon Porter

SYMPTOMS

- **Rotted seeds often are coated with soil that is difficult to remove, even with washing**
- **Rotted tissue appears light brown**
- **Stunted plants, poor vigor and pinching-off of secondary roots**

FIGURE 1 – Light brown internal seed rot

FIGURE 2 – Rotted seed coated with soil

FIGURE 3 – Emerged plants with reduced vigor

FACTORS FAVORING DEVELOPMENT

- Conditions that delay emergence, including planting into cool soils, poor seed vigor and compacted soils

IMPORTANT FACTS

- Common seed rot pathogen across the U.S.
- Manage by maximizing speed of emergence by planting as shallow as possible in warm soils with high-quality seed
- Fungicide seed treatments effective on *Pythium* should be used
- Can be confused with water damage and other root rots

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PP1790-4
Pea Disease Diagnostic Series

Rhizoctonia seed, seedling and root rot

Rhizoctonia solani AG 2-1, 4, 5 and 8

Figure 1

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 2

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 3

Photo: K. Chang, Alberta Agriculture and Forestry

PP1790-4
Pea Disease Diagnostic Series

Rhizoctonia seed, seedling and root rot

Rhizoctonia solani AG 2-1, 4, 5 and 8

AUTHORS: Timothy Paulitz, Dipak Sharma-Poudyal, Lyndon Porter, Weidong Chen and Lindsey du Toit

SYMPTOMS

- **Seeds may rot in soil, resulting in poor emergence**
- **Seedlings have reddish-brown, sunken lesions on roots and base of stem**
- **Pinching-off of tips of the main tap root and secondary roots**
- **Plants become stunted and yellow**

FIGURE 1 – Sunken brown lesions on below-ground stem tissue

FIGURE 2 – Browning of the roots and pinching-off of root tips

FIGURE 3 – Peas infected with Rhizoctonia

FACTORS FAVORING DEVELOPMENT

- Wet, cool soils
- Seed with poor germination

IMPORTANT FACTS

- Pathogen can survive in soil and plant debris
- Rotation is largely ineffective and resistant cultivars are not available
- Fungicide seed treatments are recommended
- Can be confused with other root rots, water damage

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PP1790-5
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Fusarium wilt

Fusarium oxysporum f. sp. *pisi*

Figure 1

Figure 2

Figure 3

Figure 4

PP1790-5
Pea Disease Diagnostic Series

Fusarium wilt

Fusarium oxysporum f. sp. *pisi*

AUTHOR: Stephen Guy

SYMPTOMS

- **Leaves curl and yellow progressively from the base of the plant upward, sometimes more severe on one side of the plant**
- **Root vascular tissue is shades of yellow, orange or red, extending into the base of stem**
- **Field distribution is scattered plants or concentrated patches**
- **Plants may wilt**

FIGURE 1 – Yellowing and curling of leaves

FIGURE 2 – Curling and yellowing of lower leaves on one side of the plant only

FIGURE 3 – Orange-red vascular discoloration extending into the stem

FIGURE 4 – Severe vascular discoloration

FACTORS FAVORING DEVELOPMENT

- Previous history of disease in the field
- Frequent cropping of susceptible varieties
- Late planting

IMPORTANT FACTS

- Can survive in soil for 10 years or more
- The fungus penetrates root tips and blocks vascular tissue
- Pathogen has more than one race and resistant varieties may not be effective against all races
- Can be confused with Aphanomyces and Fusarium root rots and abiotic stress

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PP1790-6
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Ascochyta blight

Ascochyta pisi, Didymella pinodes, D. pinodella

Figure 1

Figure 2

Figure 3

Figure 4

Ascochyta blight

Ascochyta pisi, Didymella pinodes, D. pinodella

AUTHOR: Michael Wunsch

SYMPTOMS

- **Leaf lesions are dark, irregular flecks and/or circular to oval lesions, with a concentric ring pattern**
- **Purplish stem lesions develop at nodes, elongate and may girdle stem**
- **Pod lesions are small, irregular to circular and brown to purplish black**
- **Seed may be discolored**

FIGURE 1 – Oval lesions with concentric rings

FIGURE 2 – Irregular flecks on leaf, extending to petioles and stems

FIGURE 3 – Small, irregular pod lesions

FIGURE 4 – Stem lesions

FACTORS FAVORING DEVELOPMENT

- Cool, wet weather
- Short rotational intervals between pea crops

IMPORTANT FACTS

- Primarily residue-borne but can be seedborne
- Crop rotation reduces but does not eliminate pathogen inoculum
- The host range of the causal pathogens is limited to field peas
- Can be confused with bacterial blight or Septoria blight

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PP1790-7
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Bacterial blight and brown spot

Pseudomonas syringae pv. *pisi*
and *P. syringae* pv. *syringae*

Figure 1

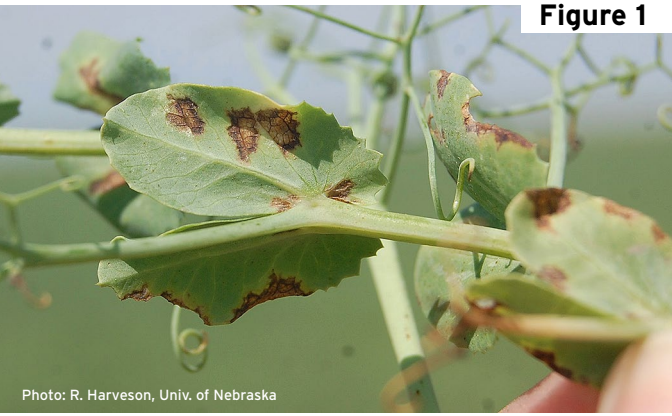

Photo: R. Harveson, Univ. of Nebraska

Figure 2

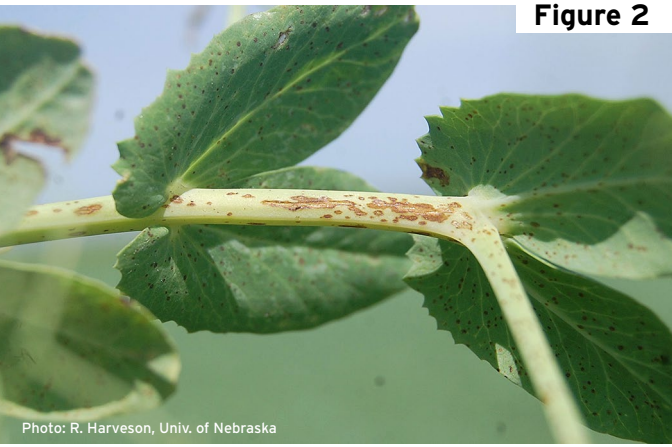

Photo: R. Harveson, Univ. of Nebraska

Photo: R. Harveson, Univ. of Nebraska

Figure 3

PP1790-7
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Bacterial blight and brown spot

Pseudomonas syringae pv. *pisi*
and *P. syringae* pv. *syringae*

AUTHOR: Robert M. Harveson

SYMPTOMS

- **Symptoms occur on all above-ground plant parts**
- **Lesions initially are water-soaked and later turn necrotic**
- **Lesions are vein-delimited, angular in shape and translucent**
- **Bacterial ooze may be seen under conditions of high humidity**

FIGURE 1 – Angular leaf lesions delimited by veins

FIGURE 2 – Watery stem lesions forming in linear patterns as disease progresses

FIGURE 3 – Bacterial ooze emerging from pod lesions

FACTORS FAVORING DEVELOPMENT

- Warm temperatures
- High humidity or leaf moisture

IMPORTANT FACTS

- Pathogens are seedborne
- Spread can occur with any type of mechanical contact on wet leaves or by splashing water
- Planting clean seed and use of disease resistant cultivars are the most effective management tools
- Can be confused with fungal leaf spots

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PP1790-8
Pea Disease Diagnostic Series

Powdery mildew

Erysiphe pisi and *E. trifoliorum*

Figure 1

Figure 2

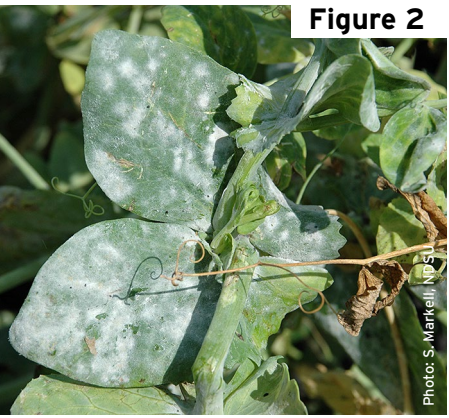

Figure 3

Figure 4

PP1790-8
Pea Disease Diagnostic Series

Powdery mildew

Erysiphe pisi and *E. trifoliorum*

AUTHORS: Renuka N. Attanayake, Weidong Chen and Michael Wunsch

SYMPTOMS

- **White powdery tufts of fungal growth**
- **New fungal growth can be rubbed off easily**
- **Fungal growth will expand and may cause plant tissue to become chlorotic**
- **Late in the season, small black spherical fungal structures may appear**
- **Infection on pods can cause a gray-brown discoloration of the seeds**

FIGURE 1 – Small tufts of fungal growth

FIGURE 2 – Progression of fungal growth

FIGURE 3 – Fungal growth rubbed off right side of leaf

FIGURE 4 – Sever infection late in the season; note black fungal structures

FACTORS FAVORING DEVELOPMENT

- Temperatures of 59 to 77 F are optimal
- Heavy dew or fog
- Late planting

IMPORTANT FACTS

- Pathogen can be soil-borne, seed-borne and wind-dispersed
- Management tools include resistant cultivars, crop rotation and foliar fungicides
- Most prevalent late in the season

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PP1790-9
Pea Disease Diagnostic Series

Rust

Uromyces viciae-fabae

Photo: S. Markell, NDSU

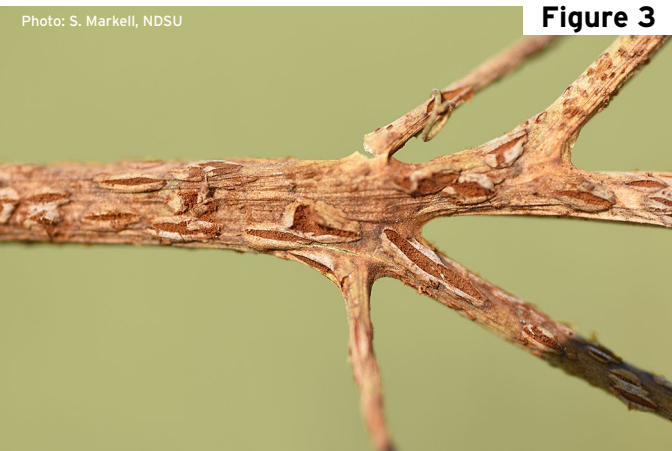
Figure 1

Photo: S. Markell, NDSU

Figure 2

Photo: S. Markell, NDSU

Figure 3



Rust

Uromyces viciae-fabae

AUTHORS: Sam Markell and Julie Pasche

SYMPTOMS

- **Affects all above-ground plant parts**
- **Pustules erupt from tissue, causing holes and large lacerations**
- **Pustules are filled with dusty cinnamon-brown spore that easily rub off**
- **Severe infection causes yellowing, premature senescence and yield loss**

FIGURE 1 – Pustules filled with dusty brown spores on leaf

FIGURE 2 – Pustules lacerating branch

FIGURE 3 – Severe infection causing premature senescence and plant death

FACTORS FAVORING DEVELOPMENT

- Heavy dew or fog

IMPORTANT FACTS

- Disease observed annually in northern Great Plains but rarely widespread
- Epidemics can progress quickly once disease is established
- Foliar fungicides can help manage disease
- Also can infect lentils and garden peas

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PP1790-10
Pea Disease Diagnostic Series

Septoria leaf spot

Septoria pisi

Photo: S. Markell, NDSU

Figure 1

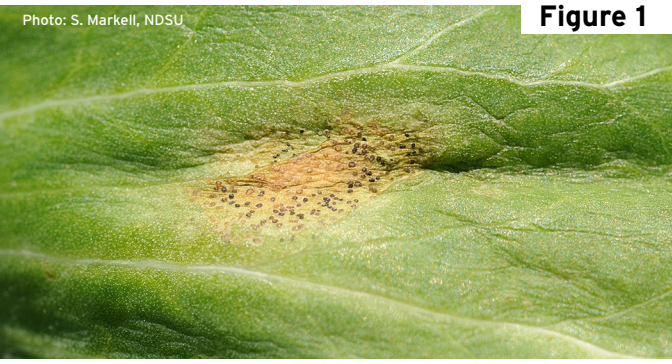

Photo: S. Markell, NDSU

Figure 2

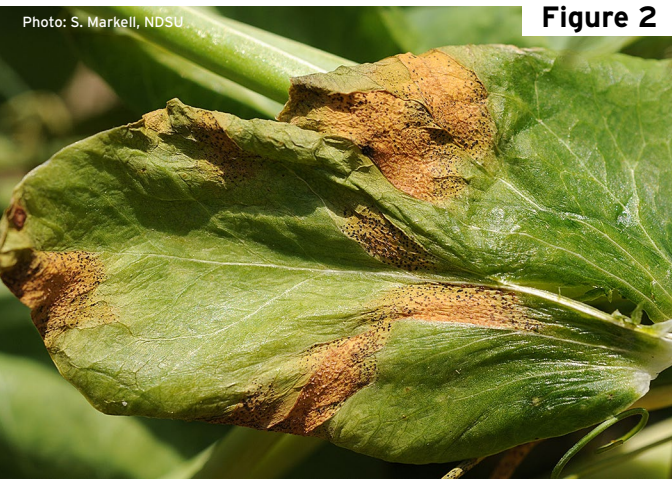

Photo: S. Markell, NDSU

Figure 3

Septoria leaf spot

Septoria pisi

AUTHORS: Mary Burrows and Sam Markell

SYMPTOMS

- **Symptoms occur on all plant parts**
- **Necrotic lesions with small black fungal structures (pycnidia)**
- **Often occur late in the season**

FIGURE 1 – Young leaf lesion with black fungal structures (pycnidia)

FIGURE 2 – Oblong lesions with pycnidia

FIGURE 3 – Necrotic lesion with pycnidia on branch

FACTORS FAVORING DEVELOPMENT

- Warm temperatures (70 to 80 F)
- High humidity or heavy dews

IMPORTANT FACTS

- The pathogen survives on crop stubble or infected seed; spores are wind-dispersed
- Planting clean seed, rotation and foliar fungicides are the most effective management tools
- No variety resistance is known
- Can be confused with Ascochyta blight and bacterial blight. Note that *Septoria* pycnidia are distributed randomly and *Ascochyta* pycnidia are distributed in a circular, target pattern. Bacterial blight does not have pycnidia.

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PP1790-11
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Sclerotinia white mold

Sclerotinia sclerotiorum

Figure 1

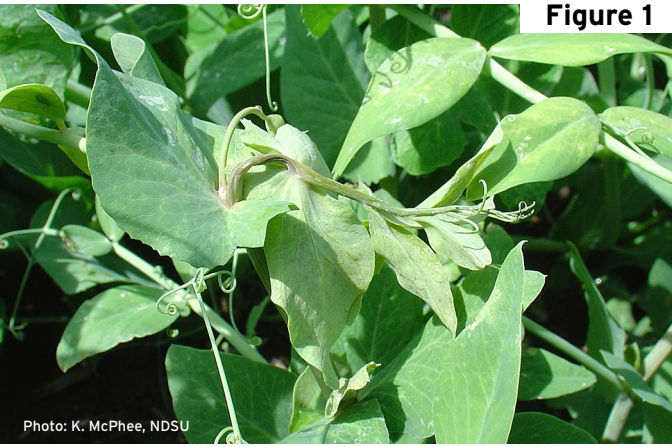


Figure 2

Figure 3

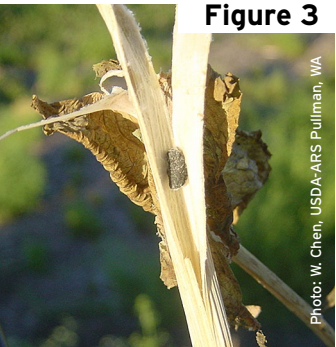
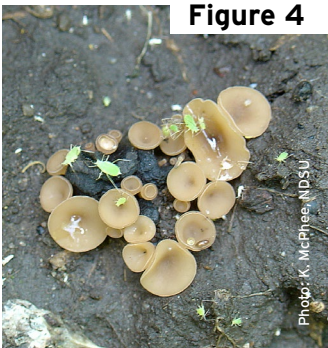


Figure 4



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Pea Disease Diagnostic Series

Sclerotinia white mold

Sclerotinia sclerotiorum

AUTHORS: Weidong Chen, Lyndon Porter and Kevin McPhee

SYMPTOMS

- **Lesions occur on stems, leaves and pods**
- **Lesions initially are water-soaked but appear bleached and necrotic as they age**
- **White, puffy fungal growth (white mold) may appear on lesions**
- **Mouse-dropping-sized black sclerotia may form on and in infected tissue**

FIGURE 1 – Water-soaked lesion on an infected plant

FIGURE 2 – Necrotic lesions and white fungal tissue on stems and pods

FIGURE 3 – A black sclerotium in a pea stem

FIGURE 4 – Apothecia (mushrooms) developed from sclerotia

FACTORS FAVORING DEVELOPMENT

- Cool and moist conditions
- Lush vegetative growth
- Heavy canopy

IMPORTANT FACTS

- Sclerotia can survive for many years in soil
- Pathogen infects most broadleaf crops
- Plant-to-plant spread can occur by physical contact
- Management tools include clean seed, fungicide applications, rotation to cereal crops and irrigation management

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PP1790-12
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Alfalfa mosaic

Alfamovirus AMV

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 1

Alfalfa mosaic

Alfamovirus AMV

AUTHORS: Lyndon Porter

SYMPTOMS

- **Yellow mottling of foliar tissue (not always prominent)**
- **Purple or brown streaks in leaf veins**
- **Dead tissue on leaf or stem**

FIGURE 1 – Yellow mottling of foliar tissue

FACTORS FAVORING DEVELOPMENT

- Presence of pea and green peach aphids, which transmit the virus
- Proximity to alfalfa fields

IMPORTANT FACTS

- Pea, green peach, foxglove, bean and potato aphids transmit the virus
- No resistant cultivars are available
- Insecticides may reduce secondary spread of virus by killing vectors (aphids)
- Can be confused with pea streak virus

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PP1790-13
Pea Disease Diagnostic Series

Bean leafroll or pea leafroll

Luteovirus phaseoli

Figure 1

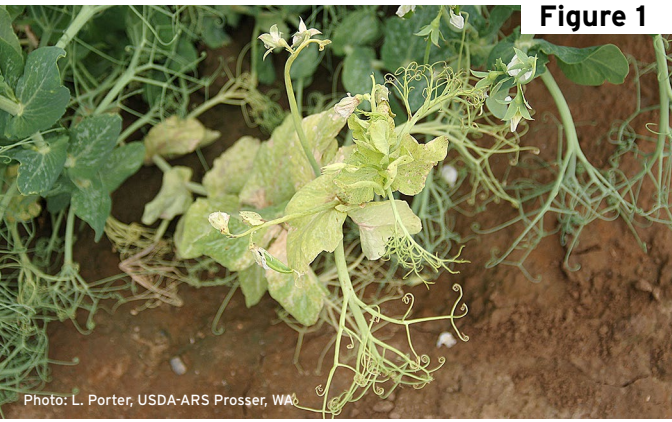

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 2

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 3

Photo: L. Porter, USDA-ARS Prosser, WA

Bean leafroll or pea leafroll

Luteovirus phaseoli

AUTHORS: Lyndon Porter

SYMPTOMS

- **Plants are yellow and stunted**
- **New tissue is distorted and twisted while old growth may be normal**
- **Leaflets curl downward and are brittle**

FIGURE 1 – Yellow, distorted and twisted leaves

FIGURE 2 – Down-curled leaves

FIGURE 3 – Yellow and distorted new growth; old growth is normal

FACTORS FAVORING DEVELOPMENT

- Presence of pea aphids transmitting the virus

IMPORTANT FACTS

- Virus is not seed-transmitted
- Often occurs with pea enation mosaic virus
- Later infections are less likely to have an impact on yield
- Cultivars with resistance may be available
- Can be confused with other viruses, root rots, herbicide damage or abiotic stress

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PP1790-14
Pea Disease Diagnostic Series

Pea enation mosaic

Enamovirus PEMV

Figure 1

Figure 2

Figure 3

Pea enation mosaic

Enamovirus PEMV

AUTHORS: Lyndon Porter

SYMPTOMS

- **Leaves may be brittle and have a mosaic of green and yellow rough bumps (enations), translucent spots or clear veins**
- **Pods may be distorted and fill poorly**

FIGURE 1 – Leaf with mosaic pattern and white/clear spots (windows)

FIGURE 2 – Misshapen pods

FIGURE 3 – Enations (bumps) on leaf

FACTORS FAVORING DEVELOPMENT

- Presence of pea aphids transmitting the virus

IMPORTANT FACTS

- Virus is not seed-transmitted
- Often occurs with bean leaf roll virus
- Early infections more severely impact yield than late infections
- Insecticides may reduce secondary spread of virus by killing vectors (aphids)
- Can be confused with other viruses, herbicide damage

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PP1790-15
Pea Disease Diagnostic Series

Pea seed-borne mosaic

Potyvirus pisumsemenportati

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 1

Photo: A. Beck, NDSU

Figure 2

Photo: M. Wunsch, NDSU

Figure 3

Pea seed-borne mosaic

Potyvirus pisumsemenportati

AUTHORS: Lyndon Porter, Kevin McPhee and Julie Pasche

SYMPTOMS

- **Leaves may curl downward**
- **Plants are stunted with a rosette appearance on new growth**
- **Pods may be deformed and fill poorly**
- **Seed may be water-soaked, scarred or cracked**
- **Maturity of infected plants is delayed**

FIGURE 1 – Deformed growth

FIGURE 2 – Seed with water soaking and scarring symptoms

FIGURE 3 – Delayed maturity of infected plants

FACTORS FAVORING DEVELOPMENT

- Presence of pea, green peach or potato aphids, which can transmit the virus
- Infected seed

IMPORTANT FACTS

- Virus is readily seed-transmitted
- Virus infects many plants, including lentil, chickpea, alfalfa and vetch
- Manage by planting virus-free seed and resistant cultivars
- Insecticides may reduce secondary spread of virus by killing vectors (aphids)
- Can be confused with other viruses or herbicide damage

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PP1790-16
Pea Disease Diagnostic Series

Pea streak

Carlavirus pisi

Figure 1

Photo: L. Porter, USDA-ARS Prosser, WA

Photo: L. Porter, USDA-ARS Prosser, WA

Figure 2

Pea streak

Carlavirus pisi

AUTHORS: Lyndon Porter

SYMPTOMS

- **Purple to brown streaks on leaves, stems and pods**
- **Leaf-yellowing and dieback of growing tips**
- **Pods may appear blistered, deformed and fill poorly**
- **Streaks on pods differ in size and shape and often are sunken**

FIGURE 1 – Malformed pea pods with blistering

FIGURE 2 – Purple sunken streaks on infected plants

FACTORS FAVORING DEVELOPMENT

- Presence of pea or green peach aphid transmitting virus

IMPORTANT FACTS

- Virus is not seed-transmitted
- Virus also can infect alfalfa, red and white clover, and vetch
- Rarely associated with significant damage in pea fields
- Insecticides may reduce secondary spread of virus by killing vectors (aphids)
- Can be confused with other viruses, herbicide or abiotic damage

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PP1790-17
Pea Disease Diagnostic Series

Botrytis gray mold

Botrytis cinerea

Figure 1

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 2

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 3

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 4

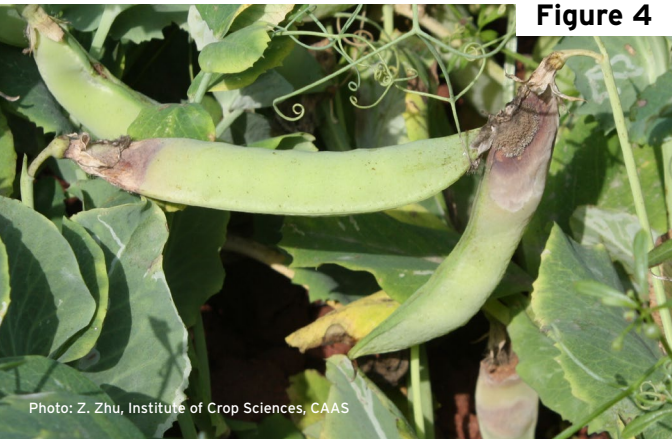

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

PP1790-17
Pea Disease Diagnostic Series

Botrytis gray mold

Botrytis cinerea

AUTHORS: Zhendong Zhu and Weidong Chen

SYMPTOMS

- **Symptoms occur on all above-ground plant parts**
- **Leaf lesions are water-soaked, grayish, irregular or circular lesions, with a concentric ring pattern**
- **Stem lesions are initially fuzzy, gray lesions, later turn tan and girdle stem**
- **Pod lesions are initially irregular or circular, water-soaked, later turn tan and sunken**
- **Gray, fluffy mycelium are produced on lesions under conditions of high humidity**

FIGURE 1 – Circular lesion with a concentric ring pattern on leaf

FIGURE 2 – Tan lesions covered with grayish mycelium on tendrils

FIGURE 3 – Tan lesions girdling stem

FIGURE 4 – Tan, sunken lesions covered with grayish mycelium on pods

FACTORS FAVORING DEVELOPMENT

- Cool and high humidity conditions

IMPORTANT FACTS

- Pathogen can survive in soil and plant debris or on growing plants
- Pathogen can be dispersed by splashing water, wind, or farm machinery
- Pathogen infests many plant species
- Resistant cultivars are not available
- Foliar fungicides can help manage disease

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PP1790-18
Pea Disease Diagnostic Series

Downy mildew

Peronospora viciae

Figure 1

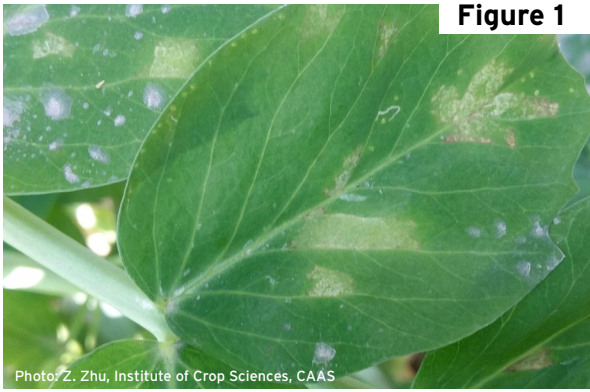

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 2

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 3

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Figure 4

Photo: Z. Zhu, Institute of Crop Sciences, CAAS

Downy mildew

Peronospora viciae

AUTHORS: Zhendong Zhu and Weidong Chen

SYMPTOMS

- **Symptoms may be systemic or local**
- **Systemically infected plants are stunted, distorted**
- **Irregular-shaped lesions on leaf undersurface that contain fluffy brown, pink or grey fungal tissue, while on the top side, plant tissue is turned greenish-yellow to brown**
- **Infected pods may be deformed and have yellow to brownish areas and superficial blistering**

FIGURE 1 – Irregular-shaped lesions forming on undersurface of leaves turns plant tissue on top surface greenish-yellow to brown

FIGURE 2 – Fluffy, mouse-grey fungal tissue on lower leaf surfaces

FIGURE 3 – Yellow to brownish areas and superficial blistering on infected pod

FIGURE 4 – Infection causing pod-cracking

FACTORS FAVORING DEVELOPMENT

- Cool and moist conditions
- Late planting

IMPORTANT FACTS

- Oospores can survive for 10-15 years in soil
- Pathogen can be soil-borne, seed-borne and wind-dispersed
- Management tools include resistant cultivars, crop rotation and foliar fungicides

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