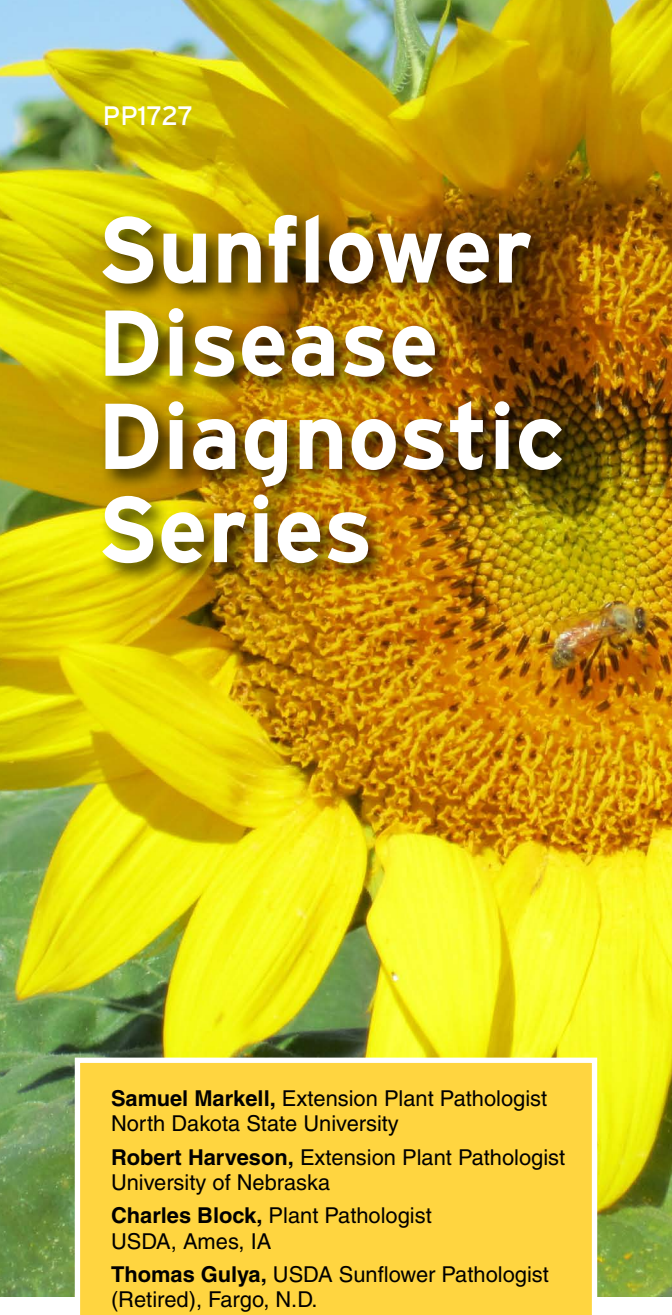

PP1727

Sunflower Disease Diagnostic Series

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USDA

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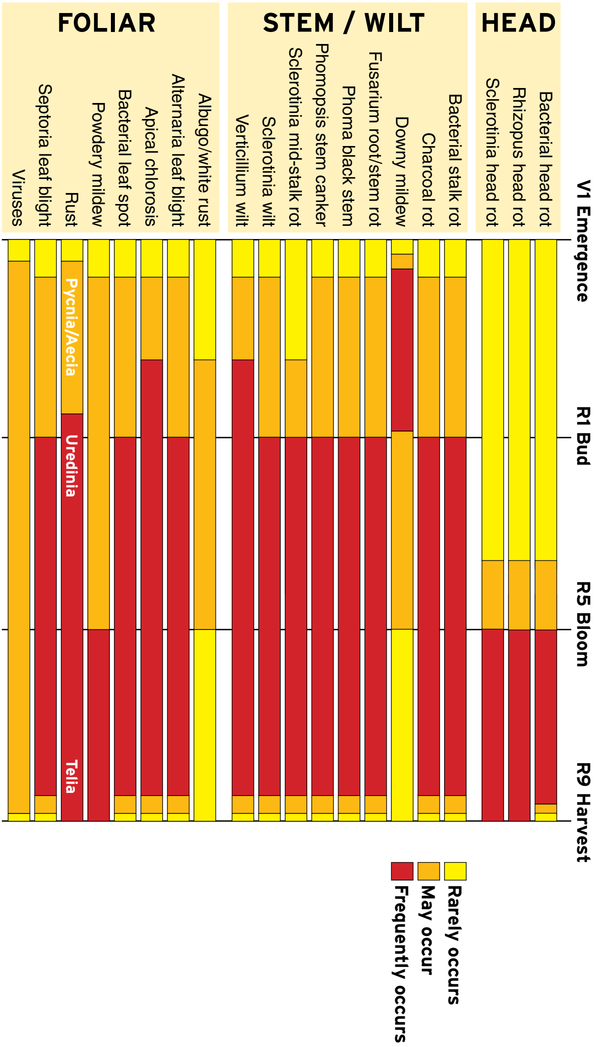
North Central IPM Center

Timeline for sign/symptom occurrence



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

500-8-14

PP1727-1
Sunflower Disease Diagnostic Series

Bacterial head rot

Pectobacterium carotovorum,
subsp. *carotovorum* and *P. atrosepticum*

Figure 1

Figure 2

Figure 3

PP1727-1
Sunflower Disease Diagnostic Series

Bacterial head rot

Pectobacterium carotovorum,
subsp. *carotovorum* and *P. atrosepticum*

AUTHORS: Bob Harveson, Sam Markell, Tom Gulya and Charlie Block

SYMPTOMS

- **Coalescing lesions develop watery, soft-rot symptoms that become dark brown as disease progresses**
- **Heads give off an odor of rotting potatoes, and slimy masses of bacterial growth are present within infected tissues**

FIGURE 1 – Watery lesions forming on heads as a result of infection through wounds

FIGURE 2 – Slimy masses of bacterial growth within infected head tissues

FIGURE 3 – Affected tissues dry out and turn black after a period of warm, dry weather

FACTORS FAVORING DEVELOPMENT

- Thunderstorms with hail; insect or bird damage to heads
- Warm temperatures with high humidity levels

IMPORTANT FACTS

- Mechanical injury (from insects, birds or hail) is required for infection
- Pathogen is found ubiquitously in soil and is spread by rain splashing and driving winds
- More common in the U.S southern Great Plains states
- Can be confused with other head rot diseases (Sclerotinia, Botrytis or Rhizopus)

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PP1727-2
Sunflower Disease Diagnostic Series

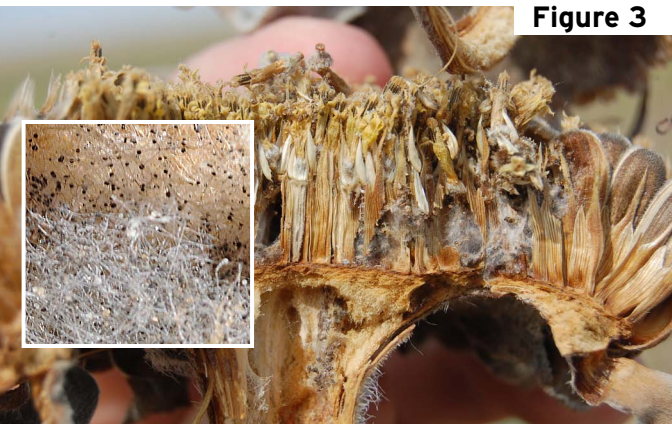
Rhizopus head rot

R. stolonifer, R. oryzae (syn. *R. arrhizus*) and *R. microsporus*

Figure 1

Figure 2

Figure 3



PP1727-2
Sunflower Disease Diagnostic Series

Rhizopus head rot

R. stolonifer, R. oryzae (syn. *R. arrhizus*) and *R. microsporus*

AUTHORS: Bob Harveson, Sam Markell, Charlie Block and Tom Gulya

SYMPTOMS

- **First appears on heads as dark spots of varying sizes as a result of wounding, followed by a watery, soft rot that later dries and turns dark brown**
- **Rhizopus is distinguished from other head rots by the presence of grayish, threadlike mycelial strands within infected heads; small black reproductive structures the size of a pinhead also may be present**

FIGURE 1 – Note wound from hail stone with subsequent development of watery, soft rot

FIGURE 2 – Rotted area of head drying, shriveling and beginning to shred

FIGURE 3 – Grayish fungal strands growing through head; reproductive structures (inset)

FACTORS FAVORING DEVELOPMENT

- Thunderstorms with hail; insect or bird damage on head
- Warm temperatures with high humidity levels

IMPORTANT FACTS

- Mechanical injury (from insects, birds or hail) is required for infection
- Pathogen is found ubiquitously in soil, and infective spores are released into the air easily
- More common in the U.S southern Great Plains states
- Can be confused with bacterial and/or Sclerotinia head rots

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PP1727-3
Sunflower Disease Diagnostic Series

Sclerotinia head rot

Sclerotinia sclerotiorum

Figure 1

Figure 2

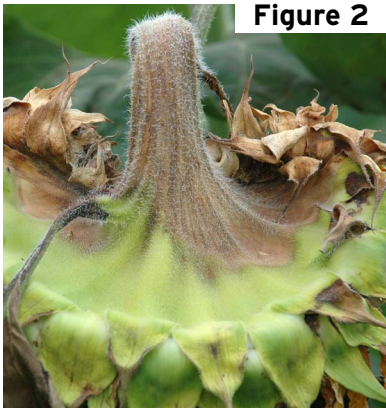

Figure 3

Figure 4

Sclerotinia head rot

Sclerotinia sclerotiorum

AUTHORS: Sam Markell, Tom Gulya, Charlie Block and Bob Harveson

SYMPTOMS

- **Lesions begin as large, soft (mushy), brown areas on the back of heads that turn tan-cream, typically odorless**
- **White mold (mycelium) and hard black structures (sclerotia) form inside head**
- **Heads will shred, and disintegration and/or decapitation may occur**

FIGURE 1 – Apothecia (grows from sclerotia and produces ascospores)

FIGURE 2 – Soft brown area on the back of head

FIGURE 3 – A shredded sunflower with sclerotia

FIGURE 4 – White mycelium and black sclerotia on the face of a skeletonized sunflower head

FACTORS FAVORING DEVELOPMENT

- Wet soils prior to bloom (facilitates apothecia production)
- Frequent wetness during or after bloom, including rain, fog, heavy dew
- Temperatures 85 F or below

IMPORTANT FACTS

- The same pathogen causes sclerotinia wilt and sclerotinia mid-stem rot
- The pathogen can survive for many years in the soil as sclerotia
- Management tools are limited
- Most common in the U.S. northern Great Plains
- Can be confused with Rhizopus head rot

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PP1727-4
Sunflower Disease Diagnostic Series

Bacterial stalk rot

Pectobacterium carotovorum,
subsp. *carotovorum* and *P. atrosepticum*

Figure 1

Figure 2

Figure 3

Bacterial stalk rot

Pectobacterium carotovorum,
subsp. *carotovorum* and *P. atrosepticum*

AUTHORS: Bob Harveson, Charlie Block, Sam Markell and Tom Gulya

SYMPTOMS

- **Infected stalks soften and dry up, becoming dark brown to black and may split open**
- **Plants often lodge under the weight of maturing heads**
- **A foam may appear on infected tissues as a result of bacterial-causing fermentation of sugars in plant**

FIGURE 1 – Affected tissues blacken and are often on petiole axils

FIGURE 2 – Infected stalk splitting longitudinally

FIGURE 3 – Development of a foam on stalk wounds due to bacterial infection

FACTORS FAVORING DEVELOPMENT

- Thunderstorms with hail
- Warm temperatures with high humidity levels

IMPORTANT FACTS

- Mechanical injury (from insects, birds or hail) is required for infection
- Pathogen is found ubiquitously in soil and is spread by rain splashing and driving winds
- More common in the U.S southern Great Plains states
- Can be confused with other stalk rots

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PP1727-5
Sunflower Disease Diagnostic Series

Charcoal rot

Macrophomina phaseolina

Figure 1

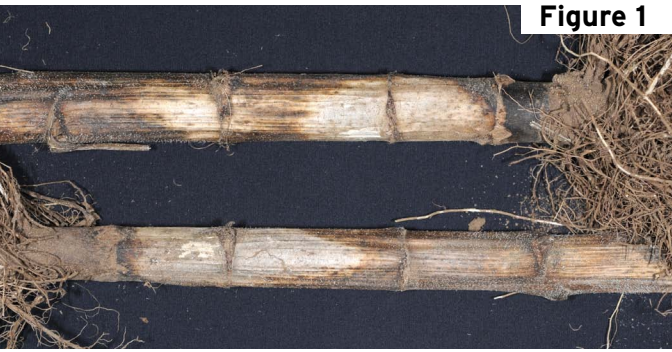

Figure 2

Figure 3

Figure 4

Charcoal rot

Macrophomina phaseolina

AUTHORS: Sam Markell, Charlie Block, Bob Harveson and Tom Gulya

SYMPTOMS

- **Gray to silver basal lesion starting at the soil line**
- **Premature senescence and plant death**
- **Abundant dusty black microsclerotia inside lower stem (visible with a hand lens)**
- **Vascular tissue compressed into layers**

FIGURE 1 – Gray lesion at the base of sunflower stalks

FIGURE 2 – Microsclerotia inside sunflower stem

FIGURE 3 – Stem with severe charcoal rot

FIGURE 4 – Field with charcoal rot

FACTORS FAVORING DEVELOPMENT

- Field history with charcoal rot, including soybeans, corn and other crops
- Wet weather in spring followed by hot, dry weather in reproductive growth stages
- Water stress (sandy soil, heat, drought, etc.)

IMPORTANT FACTS

- The same pathogen causes charcoal rot on soybeans, corn and other crops
- Infection begins early in the season but manifests in late reproductive stages if plants are stressed
- Most common in the U.S. southern and high Plains states
- Can be confused with Verticillium wilt and Sclerotinia wilt

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PP1727-6
Sunflower Disease Diagnostic Series

Downy mildew

Plasmopara halstedii

Figure 1

Figure 2

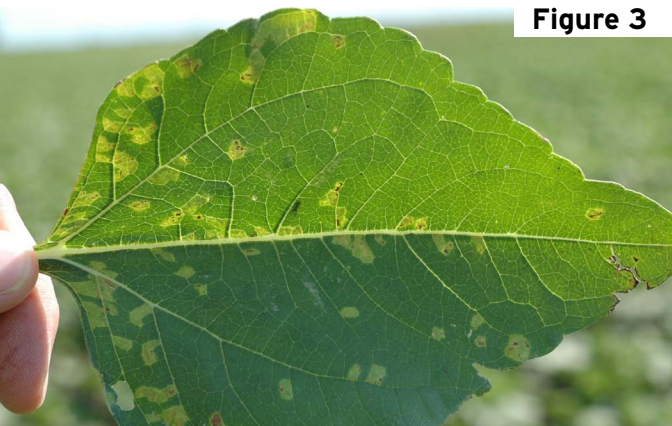

Figure 3

Downy mildew

Plasmopara halstedii

AUTHORS: Sam Markell, Bob Harveson, Charlie Block and Tom Gulya

SYMPTOMS

- **Stunting, leaf chlorosis, white sporulation on underside of leaf, plant death**
- **Horizontal heads when mature**
- **Secondary infection: discrete chlorotic leaf spots on upper leaf surface**

FIGURE 1 – Stunting and chlorosis (yellowing) from systemic infection: Healthy (left), infected (right)

FIGURE 2 – Underside (left) and upperside (right) of leaf with systemic infection

FIGURE 3 – Local lesions from secondary infection

FACTORS FAVORING DEVELOPMENT

- Cold soils and rainfall shortly after planting leading to waterlogged soil
- Cool nights with dew or rain (for local lesions via secondary infection)

IMPORTANT FACTS

- Secondary infections do NOT cause yield loss
- Pathogen is soil-borne and can survive many years in soil
- Disease is specific to sunflowers
- Fungicide seed treatments and resistant hybrids can be used for management
- Can be confused with herbicide damage

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PP1727-7
Sunflower Disease Diagnostic Series

Fusarium root and stem rots

Fusarium species

Figure 1

Figure 2

Figure 3

Fusarium root and stem rots

Fusarium species

AUTHORS: Sam Markell, Bob Harveson, Charlie Block and Tom Gulya

SYMPTOMS

- **Premature senescence**
- **Internal pink, orange, red or purple discoloration of pith**

FIGURE 1 – Pink discoloration caused by an unidentified *Fusarium* species

FIGURE 2 – Pink streaks caused by *Fusarium* spp., associated with black microsclerotia of *M. phaseolina* (Charcoal rot)

FIGURE 3 – Sunflowers infected with *Fusarium*

FACTORS FAVORING DEVELOPMENT

- Water stress (sandy soil, heat, drought, etc.)

IMPORTANT FACTS

- Many *Fusarium* species have been found to cause damage to sunflowers
- Many *Fusarium* species can cause disease and/or survive on crop hosts
- Economic damage is thought to be limited but can occur
- Frequently found with Charcoal rot
- Can be confused with other stalk/wilt diseases

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PP1727-8
Sunflower Disease Diagnostic Series

Phoma black stem

Phoma macdonaldii

Figure 1

Figure 2

Figure 3

Phoma black stem

Phoma macdonaldii

AUTHORS: Sam Markell, Bob Harveson, Tom Gulya and Charlie Block

SYMPTOMS

- **1- to 2-inch *black* lesion, usually superficial**
- **Lesions centered on petioles**
- **Multiple lesions may occur on the same stem**

FIGURE 1 – Phoma lesions centered on petioles

FIGURE 2 – A sunflower stalk with numerous Phoma lesions

FIGURE 3 – Phoma (bottom black lesion) and Phomopsis (upper brown lesion) occurring on the same stem

FACTORS FAVORING DEVELOPMENT

- Frequent rainstorms
- Insects (such as stem weevils) can facilitate infection
- Sunflower residue nearby or short rotation

IMPORTANT FACTS

- Rarely economically important
- Typically the most common stem disease in the northern Great Plains
- Infection begins on leaves and progresses into the stem
- Can be vectored by black sunflower stem weevils *(Apion)*
- Can be confused with Phomopsis stem canker

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PP1727-9
Sunflower Disease Diagnostic Series

Phomopsis stem canker

Diaporthe helianthi, D. gulyae

Figure 1

Figure 2

Figure 3

PP1727-9
Sunflower Disease Diagnostic Series

Phomopsis stem canker

Phomopsis helianthi, P. gulyae

AUTHORS: Sam Markell, Tom Gulya, Bob Harveson and Charlie Block

SYMPTOMS

- **Leaf bronzing**
- **Large (often greater than 6-inches) *brown* stem lesion that is centered on petiole**
- **Stem will become hollow and is easily punctured with thumb**
- **Premature senescence and/or widespread lodging may occur**

FIGURE 1 – Leaf bronzing

FIGURE 2 – Stem lesions at different stages of development

FIGURE 3 – Stem lesion and lodging

FACTORS FAVORING DEVELOPMENT

- Frequent rainstorms
- Infested sunflower residue nearby and short crop rotation

IMPORTANT FACTS

- Infection begins in leaves and spreads into the stem
- High disease pressure can devastate the crop
- Most common in the U.S. northern Great Plains
- Can be confused with Phoma black stem and Sclerotinia mid-stem rot

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PP1727-10
Sunflower Disease Diagnostic Series

Sclerotinia mid-stem rot

Sclerotinia sclerotiorum

Figure 1

Figure 2

Figure 3

Figure 4

PP1727-10
Sunflower Disease Diagnostic Series

Sclerotinia mid-stem rot

Sclerotinia sclerotiorum

AUTHORS: Sam Markell, Charlie Block, Tom Gulya and Bob Harveson

SYMPTOMS

- **Large (greater than 6-inch) *tan* to *manila* lesion on the stem, centered on petiole**
- **White mold (mycelium) and hard black structures (sclerotia) may be visible**
- **Stalk may shred at lesion, and plant eventually will lodge**

FIGURE 1 – Leaf lesion caused by *Sclerotinia* infected flower

FIGURE 2 – Sclerotinia lesion with white mycelium

FIGURE 3 – Shredded stalk resulting in lodging

FIGURE 4 – Abundant small black sclerotia in a shredded stem

FACTORS FAVORING DEVELOPMENT

- Wet soils before bloom (facilitates apothecia production)
- Temperatures 85 F or below
- Prolonged wet canopies (rain, fog, dew, etc.)

IMPORTANT FACTS

- The same pathogen causes Sclerotinia head rot and Sclerotinia wilt
- Infection begins on leaf when ascospores colonize senescent leaf tissue, florets or pollen
- Most common in the U.S. northern Great Plains states
- Can be confused with Phomopsis stem canker

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PP1727-11
Sunflower Disease Diagnostic Series

Sclerotinia wilt/ Basal stalk rot

Sclerotinia sclerotiorum

Figure 1

Figure 2

Figure 3

Figure 4

PP1727-11
Sunflower Disease Diagnostic Series

Sclerotina wilt/ Basal stalk rot

Sclerotinia sclerotiorum

AUTHORS: Sam Markell, Bob Harveson, Charlie Block and Tom Gulya

SYMPTOMS

- **Tan to manila basal lesion at soil line**
- **White mold (mycelia) and black sclerotia on basal lesion**
- **Whole-plant wilt, basal shredding and lodging may occur**

FIGURE 1 – Tan to manila basal lesion; note white mycelium

FIGURE 2 – Lodging and shredding (left plant only) caused by Sclerotinia wilt

FIGURE 3 – Sclerotia and mycelium on infected sunflower

FIGURE 4 – Wilted sunflower plant

FACTORS FAVORING DEVELOPMENT

- Field history with Sclerotinia diseases
- Tight crop rotation with broadleaf crops

IMPORTANT FACTS

- The same pathogen causes Sclerotinia white mold on other broadleaf crops
- Unlike Sclerotinia head and mid-stalk rot, fungus invades through roots
- Sclerotia can survive for many years in the soil
- Most common in the U.S. northern Plains states
- Can be confused with Verticillium wilt and Charcoal rot

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PP1727-12
Sunflower Disease Diagnostic Series

Verticillium wilt

Verticllium dahliae

Figure 1

Figure 2

Figure 3

Figure 4

Verticillium wilt

Verticllium dahliae

AUTHORS: Sam Markell, Tom Gulya, Charlie Block and Bob Harveson

SYMPTOMS

- **Interveinal chlorosis and necrosis starting at lowest leaves and progessing upwards**
- **Damaged vascular tissue; initially, a brown ring may be present**
- **Wilting occurring at bloom, usually in patches or rows**
- **Pith shrunken and black at maturity**

FIGURE 1 – Sunflower with Verticillium wilt. Note leaf chlorosis progressing upward.

FIGURE 2 – Leaf symptoms

FIGURE 3 – Vascular browning

FIGURE 4 – External Verticillium lesion on lower stem (L) and shrunken and blackened pith (R)

FACTORS FAVORING DEVELOPMENT

- Water stress (sandy soil, heat, drought, etc.)
- Field history with Verticillium wilt

IMPORTANT FACTS

- The same pathogen causes Verticillium wilt on other crops (potatoes, etc.)
- Can be economically devastating with high disease pressure
- Leaf symptoms can be confused with Phomopsis stem canker
- Can be confused with Charcoal rot and Sclerotinia wilt

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PP1727-13
Sunflower Disease Diagnostic Series

Albugo/White rust

Figure 1

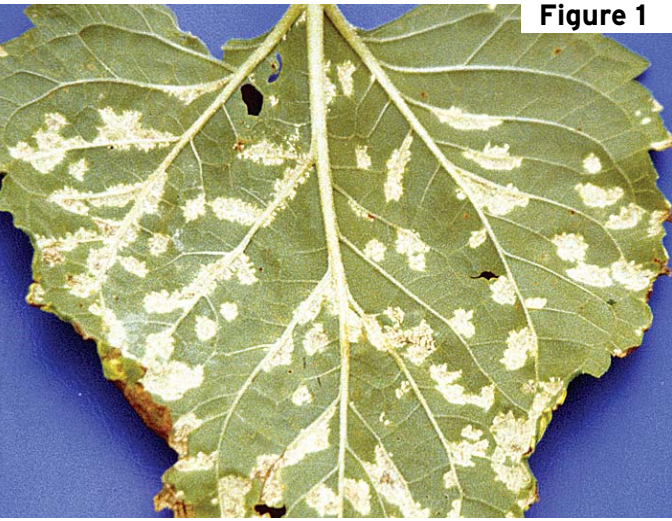

Figure 2

Figure 3

Albugo/White rust

AUTHORS: Sam Markell, Tom Gulya, Bob Harveson and Charlie Block

SYMPTOMS

- **Raised chlorotic pustules up to 3/8 inch in diameter on upper side of leaf**
- **Spores on underside of leaf opposite of chlorotic pustules**
- **Lesions on stem, petiole and head are dark and bruiselike**

FIGURE 1 – White sporulation on underside of leaf

FIGURE 2 – Chlorotic lesion on upper surface of leaf

FIGURE 3 – Dark, bruiselike lesion on the stem

FACTORS FAVORING DEVELOPMENT

- Cool nights (50 to 60 F) and warm days (70 to 80 F)
- Rain splash

IMPORTANT FACTS

- Disease is very rare in the U.S.
- When found, it often is observed in single horizontal layer of leaves across a canopy
- Can be confused with downy mildew local lesions and powdery mildew

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PP1727-14
Sunflower Disease Diagnostic Series

Alternaria leaf blight

Alternariaster helianthi, Alternaria zinniae

Figure 1

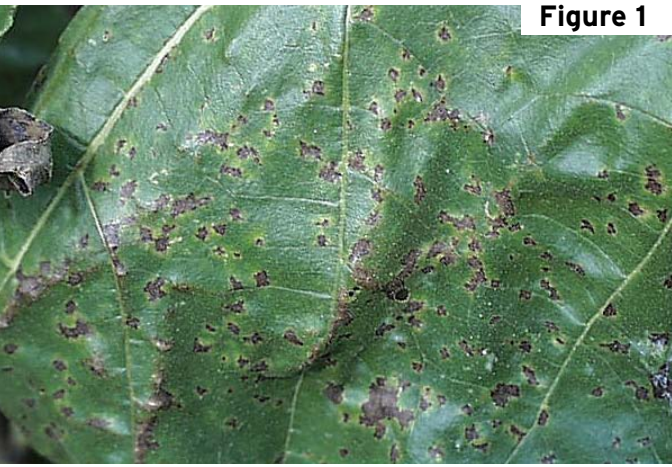


Figure 2

Figure 3

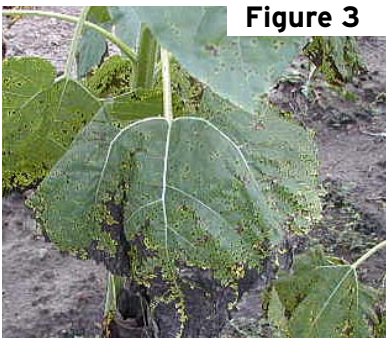
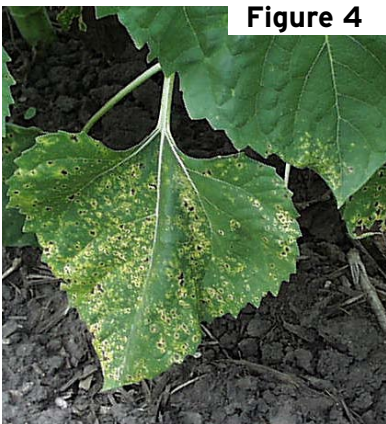


Figure 4



Alternaria leaf blight

Alternariaster helianthi, Alternaria zinniae

AUTHORS: Charlie Block, Sam Markell, Bob Harveson and Tom Gulya

SYMPTOMS

- **Young leaf spots are small, dark, angular**
- **Leaf spots usually are found between major leaf veins, along leaf margins and tips and will coalesce**
- **Extensive yellowing (chlorosis) occurs, followed by browning and leaf death**
- **Defoliation occurs from the ground up**
- **Stem lesions are dark, narrow, elliptical and about ½ to 1½ inches long**

FIGURE 1 – Characteristic necrotic and chlorotic leaf blight lesions
FIGURE 2 – Stem lesions
FIGURE 3 – Lesion coalescence and necrosis near leaf tips
FIGURE 4 – Yellow leaf spots with little necrosis on resistant cultivar

FACTORS FAVORING DEVELOPMENT

- Rainfall shortly after planting
- Warm, humid weather

IMPORTANT FACTS

- Disease development is highly dependent on rain and dew
- Plants at flowering and seed filling stages more susceptible than young plants
- Fungus survives on plant residue
- Crop rotation and tillage of residue to encourage decomposition to help manage disease
- Can be confused with Septoria leaf blight, bacterial leaf spot

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PP1727-15
Sunflower Disease Diagnostic Series

Apical chlorosis

Pseudomonas syringae pv. *tagetis*

Figure 1

Figure 2

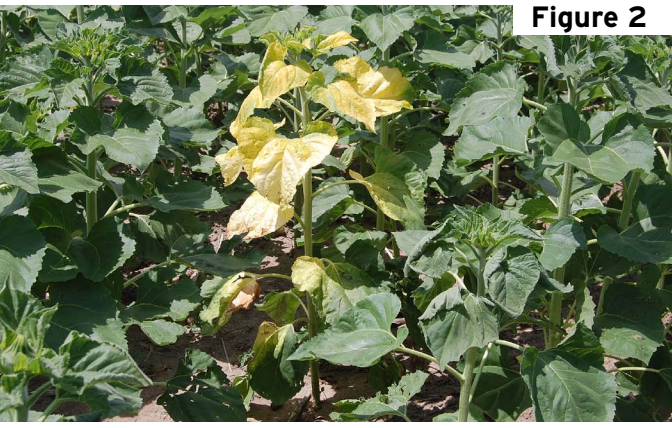

Figure 3

Apical chlorosis

Pseudomonas syringae pv. *tagetis*

AUTHORS: Bob Harveson, Tom Gulya, Sam Markell and Charlie Block

SYMPTOMS

- **Distinctive bright yellow to nearly white chlorosis of newest leaves**
- **New leaves will be unaffected in warm weather**
- **May occur on isolated plants, patches or in rows**
- **Stunting if plants infected at a young stage**

FIGURE 1 – Young plant infected systemically; note bright yellow chlorosis and stunting

FIGURE 2 – Plant nearing bud formation (R1) exhibiting systemic chlorosis symptoms

FIGURE 3 – Distribution of apical chlorosis corresponding to low areas of water accumulation in field

FACTORS FAVORING DEVELOPMENT

- Wet, cool conditions
- Water-logged soils

IMPORTANT FACTS

- Can be observed on plants of all growth stages, but most common on young plants (pre-bloom)
- Damage is minimal unless young plants are infected
- Chlorotic symptoms due to a toxin produced by the pathogen
- Related to bacterial leaf spot pathogen
- Can be confused with fertility problems, downy mildew and/or viruses

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PP1727-16
Sunflower Disease Diagnostic Series

Bacterial leaf spot

Pseudomonas syringae pv. *helianthi*

Figure 1

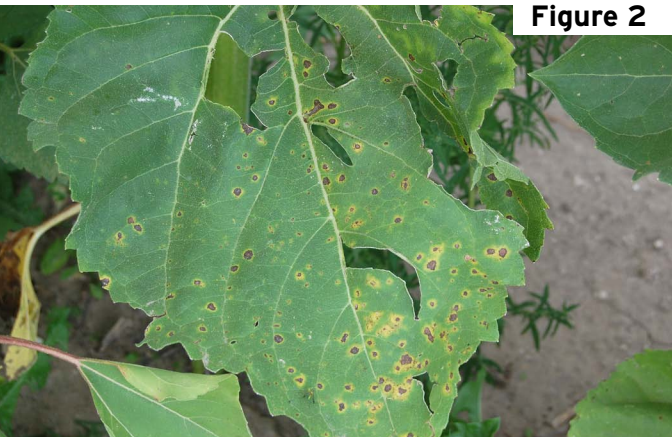

Figure 2

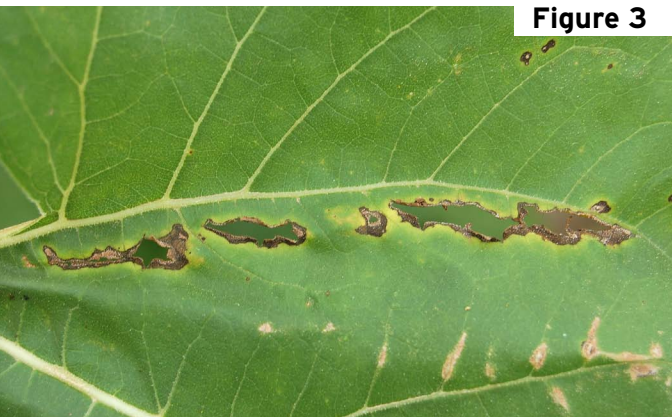

Figure 3

Bacterial leaf spot

Pseudomonas syringae pv. *helianthi*

AUTHORS: Bob Harveson, Sam Markell, Tom Gulya and Charlie Block

SYMPTOMS

- **Angular, necrotic spots of varying size**
- **Leaf spots form linear lesions that crack and fall out**
- **Necrotic spots may be surrounded with yellow haloes**

FIGURE 1 – Multiple leaf spots surrounded by yellow halos

FIGURE 2 – Small necrotic leaf spots on lower leaves

FIGURE 3 – Coalescing of spots to form linear lesions

FACTORS FAVORING DEVELOPMENT

- Wounds created by hail, sandblasting and other forms of mechanical damage
- Warm temperatures with high humidity levels

IMPORTANT FACTS

- Often is restricted to lower leaves and, thus, not generally economically damaging
- Can be seed-borne and soil-borne; spread by splashing rains and high winds
- Related to apical chlorosis pathogen
- Can be confused with Alternaria leaf blight and Septoria leaf blight

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PP1727-17
Sunflower Disease Diagnostic Series

Powdery mildew

Erysiphe cichoracearum

Figure 1

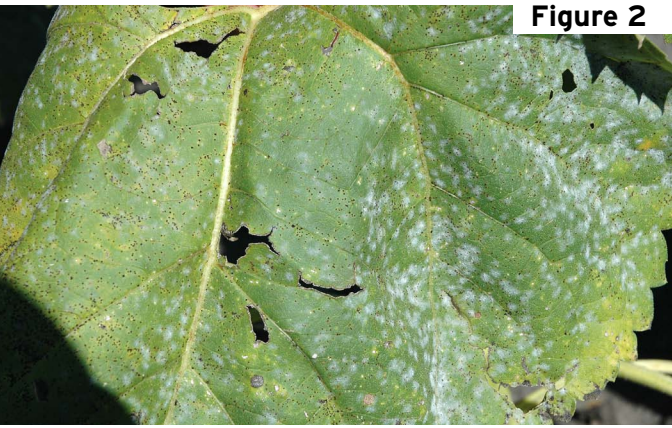

Figure 2

Figure 3

Powdery mildew

Erysiphe cichoracearum

AUTHORS: Sam Markell, Tom Gulya, Bob Harveson and Charlie Block

SYMPTOMS

- **White spots of fungal mycelium on upper leaf surface, can be rubbed off easily**
- **White mycelium will eventually cover the entire leaf**
- **Black specks (cleistothecia) may develop late in season**

FIGURE 1 – Discrete spots of white mycelium forming on a seedling

FIGURE 2 – White spots forming on mature leaf (brown spots are rust)

FIGURE 3 – Sunflower leaf completely covered in mycelium

FACTORS FAVORING DEVELOPMENT

- High humidity
- Plant maturity and leaf senescence

IMPORTANT FACTS

- Usually doesn't appear until after full bloom (R5)
- Symptoms are often more severe on lower leaves
- White fluffy growth on the ***top*** of leaves and late onset of disease help distinguish from downy mildew
- Can be confused with local lesions of downy mildew

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PP1727-18
Sunflower Disease Diagnostic Series

Rust

Puccinia helianthi

Figure 1

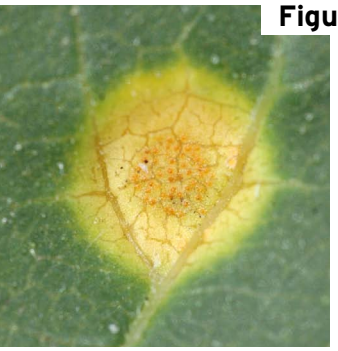

Figure 2

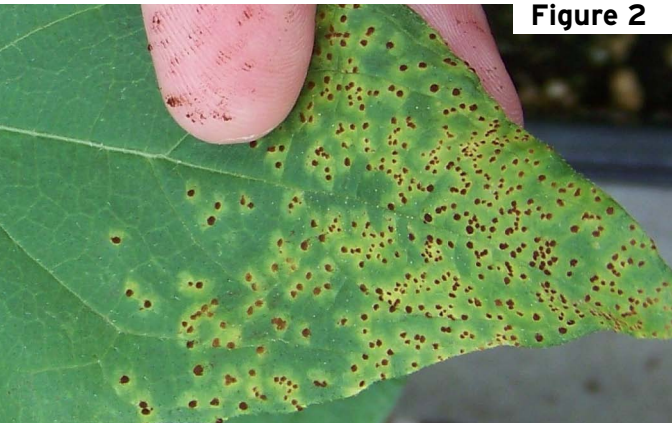

Figure 3

Rust

Puccinia helianthi

AUTHORS: Sam Markell, Bob Harveson, Charlie Block and Tom Gulya

SYMPTOMS

- **Pycnia = yellow/orange bump on topside of leaf (early season)**
- **Aecia = cluster of orange cups opposite pycnia (early season)**
- **Uredia = dusty cinnamon-brown pustule (throughout season), spores can be easily rubbed off, yellow halo common**
- **Telia = hard black pustule (crop maturity)**

FIGURE 1 – Pycnia (L) on upper side of leaf and Aecia (R) opposite pycnia on underside of leaf

FIGURE 2 – Uredinia surrounded by yellow halos; note spores on finger

FIGURE 3 – Pustules on stem and petiole (L) and bracts (R)

FACTORS FAVORING DEVELOPMENT

- Frequent leaf wetness; dew, fog, light rain, etc.
- Temperatures between 55 and 85 F
- Proximity to wild, volunteer or sunflower residue that has or had rust

IMPORTANT FACTS

- Sunflower rust is specific to sunflowers (cultivated and wild)
- Economic losses can be devastating in epidemics
- Fungicide threshold = 1 percent severity on upper leaves at or before bloom (R5)
- Found in all U.S. Great Plains states
- Can be confused with soil splashed on lower leaves or other foliar diseases

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PP1727-19
Sunflower Disease Diagnostic Series

Septoria leaf blight

Septoria helianthi

Figure 1

Figure 2

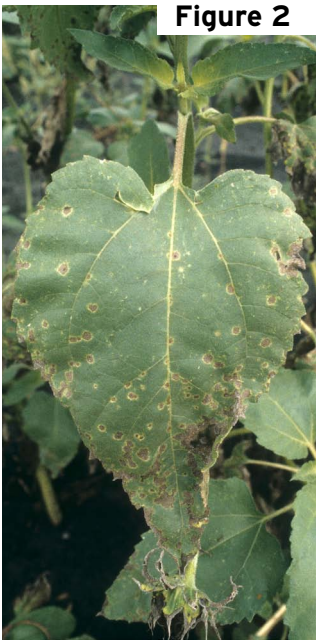
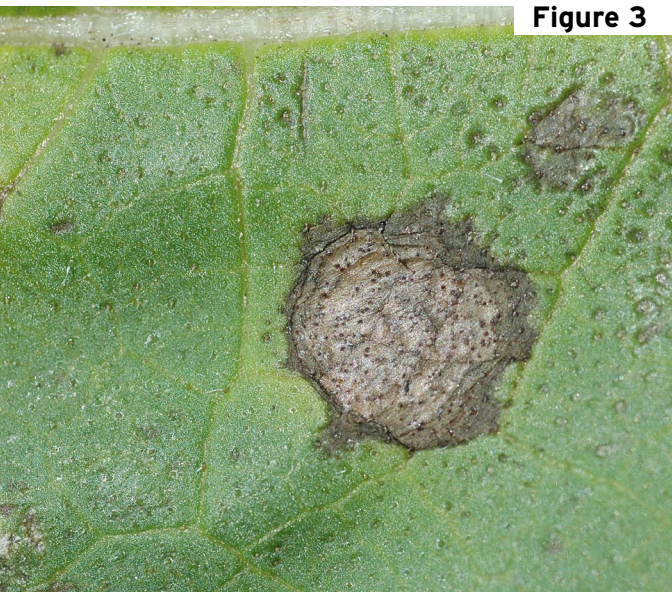


Figure 3



PP1727-19
Sunflower Disease Diagnostic Series

Septoria leaf blight

Septoria helianthi

AUTHORS: Charlie Block, Bob Harveson, Sam Markell and Tom Gulya

SYMPTOMS

- **Circular leaf spots up to ¾ inch in diameter, with dark margins and tan to gray centers**
- **Leaf spots often, but not always, surrounded by a narrow yellow halo**
- **Fungus survives on plant residue; infection spreads from bottom leaves upward**
- **Mature leaf spots become dotted with black specks, or pycnidia, on the upper leaf surface**

FIGURE 1 – Young developing lesions

FIGURE 2 – Mature lesions of Septoria leaf spot

FIGURE 3 – Pycnidia visible as black specks inside large, round lesions (with hand lens)

FACTORS FAVORING DEVELOPMENT

- Cool temperatures and rain in the spring and fall
- Symptoms develop most rapidly after flowering, but finding leaf spots on seedlings is common
- Frequent wetness during or after bloom, including rain, fog and heavy dew

IMPORTANT FACTS

- Disease tends to go dormant during hot, dry weather
- Seldom a problem in drier sunflower-production areas
- Can be confused with Alternaria leaf blight and bacterial leaf spot. Larger rounded lesions with pycnidia help distinguish Septoria leaf spot from Alternaria leaf spot.

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PP1727-20
Sunflower Disease Diagnostic Series

Virus Diseases

Nebraska mottle/ringspot virus?
Sunflower mosaic virus

Figure 1

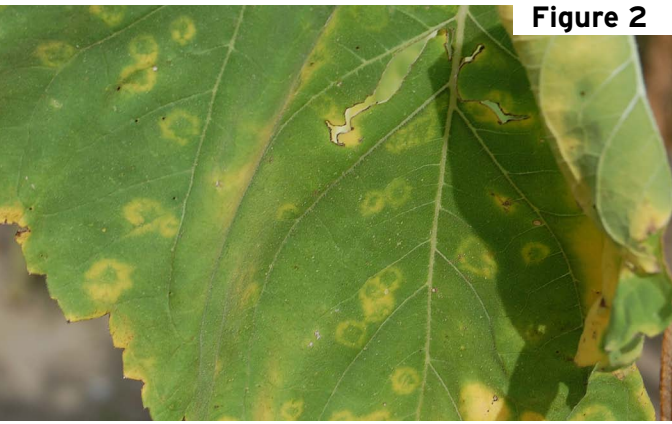

Figure 2

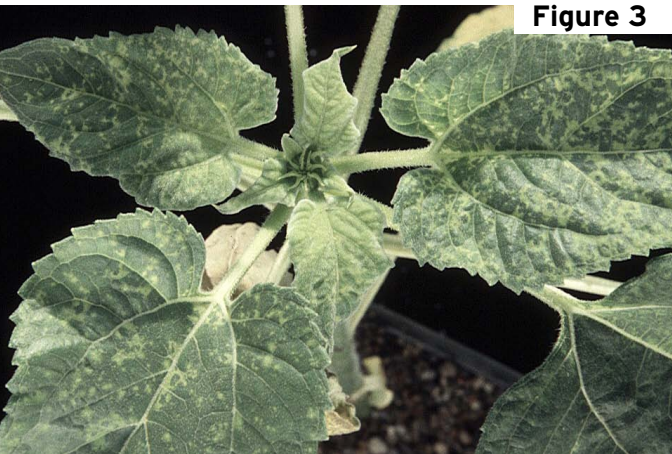

Figure 3

Virus Diseases

Nebraska mottle/ringspot virus? (NMRV?)
Sunflower mosaic virus (SMV)

AUTHORS: Tom Gulya, Bob Harveson, Sam Markell and Charlie Block

SYMPTOMS

NMRV?

- **Begins as small, yellow spots on new foliage**
- **Chlorotic ringspots may develop as plants mature**

SMV

- **Leaf mosaic symptoms**

FIGURE 1 – Greenhouse-inoculated seedlings showing small, yellow spots (NMRV?)

FIGURE 2 – Late-season field-infected plant showing chlorotic ringspot symptoms (NMRV?)

FIGURE 3 – Typical sunflower mosaic virus symptoms (SMV)

FACTORS FAVORING DEVELOPMENT

- Unknown

IMPORTANT FACTS

- Viruses are not typically an economic problem due to low incidence
- Identity of virus pathogen and potential vectors are unknown in many viruses
- Sunflower mosaic virus can be seedborne and vectored by aphids

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