

Common Diseases of Forage Crops: *Scouting and IPM*

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Many diseases attack forage crops

- Requirements for disease control:
 - Identification
 - Knowledge of the cause and its life cycle
 - Effect of environment
 - Control procedures available

Proper diagnosis of plant diseases and knowledge of the disease's cause and life cycle are important to gain before an appropriate control strategy can be considered.

“Control Procedures” *are determined by:*

1. Economic factors

- *Costs associated with control*

*ie: seed treatment, early harvest, extended rotation period,
cost of seed for improved varieties, etc*

2. Environmental factors

- Weather forecast

If control procedures are indicated, they must take into account both economic and environmental factors. There are always costs associated with disease control in any crop. Generally, spraying with fungicides or other disease control products is not economically viable in perennial forages. More common disease control costs include seed treatment, early harvest, increased costs for improved disease-resistant seed. An extended crop rotation period may include more subtle costs over time. Environmental factors can influence control choices also. If a wet spell has resulted in increased disease pressure, then a forecast for dry weather will very likely slow the development of disease. On the other hand, a forecast for weather favorable for disease development could trigger a decision to move ahead with a control strategy.

*How are your forage crops
doing?*

*What problems might be
arising?*

To make good decisions, a producer has to have current, first-hand knowledge of the condition of forage fields on the farm.

-- CLICK -- One look isn't enough. A season-long monitoring program will let you know what problems may be developing.

Regular field walks

- Especially when environmental conditions favor disease development
 - Cool, wet weather
 - High humidity
- Weekly scouting from planting (or end of winter dormancy) through 1 week beyond final harvest is desirable

Regular field scouting for diseases, in combination with other crop observations like presence of insect damage, nutrient and environmental issues is needed. Attention to disease problems should be even more careful when weather conditions favor disease development. Season-long scouting, from break of dormancy (or seeding time) through the season until 1 week beyond harvest is desirable.

Basic tools for field diagnosis:

(No product endorsements intended)

1. Hand lens

- at least 10X magnification
- \$10 - \$30



2. Pocket knife

- Sharp!
- \$10 - \$50



3. Camera

- Digital
- Hi quality preferred



\$100



\$500+

To successfully diagnose plant disease problems, a few simple tools are useful, including a good hand lens, a sharp knife and a camera capable of taking acceptable close-up digital photos. You can spend a little, or a lot....just like anything else.

Tools (cont.)

4. GPS unit

- In addition to traditional location description
- \$150 – 700



5. Soil probe, shovel or trowel (+ clean bucket, ziploc bags and marking pen)

- For collecting soil samples for lab analysis, or digging up intact root systems



\$70



\$15-30



\$5-15

A GPS unit will allow for pinpointing the location of diseased plants or problem areas. Visiting the same location in following years can help manage more persistent disease problems. Your notes should also include a traditional description based on nearby road intersections and convenient landmarks, or something similar.

A suitable tool for collecting soil samples and digging up plant roots is also needed. Be sure they are kept clean.

Something's wrong with your plant

....*what to do?*

1. Keen observation needed
2. Ask yourself (or others) many questions
3. Many causes possible – not all related to diseases or insects
 - Plant nutrition
 - Soil texture
 - Weather conditions
 - Quality of light
 - Environmental conditions
 - Cultural conditions
 - Animals (including humans)

When a plant problem is first noticed and disease may be the cause, it is important not to jump to conclusions. Careful observation of the affected plants, the surrounding plants and the general environment is needed. There are many possible causes for the problem and many questions to answer.

Could plant symptoms be caused by a plant nutrient problem?

Could drainage or compaction issues caused by soil texture be a factor?

How might recent or seasonal weather events be involved in the problem?

Could light quality, such as nearby woodlines, be involved?

Environmental conditions such as drought, excessive moisture or temperature are often very important factors.

Cultural conditions including tillage, planting, cultivation and chemical practices should also be considered.

What types of animals could be damaging your crop?

Checklist of potential forage establishment problems:

1. Seed failed to germinate

- Dry seedbed
- Non-viable seed
- Hard or dormant seed
- Unfavorable temperature
- Herbicide residue
- Waterlogged soil

2. Seed germinated but did not emerge

- *Planted too deep*
- *Soil crusted at surface*
- *Poor seedling vigor*
- *Insects or diseases*
- *Extreme temperature – too hot or too cold*

3. Seed emerged but did not survive

- Soil too acid or low fertility
- Insects or diseases
- Drought
- Weed competition
- No legume nodulation
- Winterkill
- Grazing too early – pulled up plant

Source: Potash and Phosphate Institute – Forage Crop Pocket Guide

During the establishment year, forage plants, especially legumes, are vulnerable to diseases. But there are many other reasons why seedlings don't do well. Before germination, diseases don't appear on this list generated by the Potash and Phosphate Institute. -- CLICK -- During germination, seedlings are vulnerable to fungal diseases that cause rot and damping off. -- CLICK -- After emergence, diseases continue to be a threat under conditions favorable for the pathogen.

Disease control strategies *integrate*:

1. Resistant or tolerant varieties
2. Crop management
3. Seed treatment (*to control seedling diseases*)

Compared to many other field crops, options for controlling diseases in forages are limited. The primary points are to select fields carefully with regard to soil type and drainage, and select disease resistant forage varieties. Crop management, including timing of harvest, and field sanitation, including harvesting 'cleanest' fields last and cleaning machinery between fields, can help minimize disease. Application of disease control sprays on established forage fields is very rare indeed and not economically practical for Michigan farmers.

Common perennial forage crops in MI

1. Legumes

- Alfalfa
- Clovers
- Birdsfoot Trefoil

2. Grasses

- Orchardgrass
- Timothy
- Smooth bromegrass
- Tall fescue
- Perennial ryegrass
- Others:
 - *Quackgrass*
 - *Kentucky bluegrass*
 - *Reed canarygrass*
 - *Festulolium*

This 'short' list represents most of the common perennial forage crops grown in Michigan.

Ways to think about disease problems



There are different ways to categorize forage diseases based on how they impact plants....

Categorize by pathogens that:

1. Attack plants below ground
2. Attack plants above ground

.....OR

Forage diseases can be categorized based on where they attack the plant. This makes quite a lot of sense with forage crops, especially the legumes, since root diseases are important in stand longevity.

Categorize by pathogens that:

1. Attack roots
2. Attack stems
3. Attack leaves

(or a combination)

(Typically, seedling and root diseases are most damaging on alfalfa and other legume forages. Leaf and stem diseases are most damaging on grass species.)

.....OR

Another way to categorize forage diseases is to get specific about what part of the plant the pathogen affects. In some cases, a pathogen attacks more than one plant part. For example, spring black stem of alfalfa affects both leaves and stems. Generally speaking, forage legumes including alfalfa are more commonly damaged by seedling and root diseases while grasses are more commonly damaged by leaf and stem diseases.

Categorize by pathogens that:

1. Attack specific forage species...for example:

- Alfalfa
- Clover
- Birdsfoot trefoil
- Timothy
- Orchardgrass
- Smooth brome grass
- ...etc

Finally, forage crop diseases can be categorized by which forage species they attack.

Alfalfa diseases

★ = included in MSU Extension publication "Insect, Nematode and Disease Control in Michigan Field Crops", E1582

Seedling

- Phytophthora root rot ★
- Aphanomyces ★
- Pythium
- Rhizoctonia

Stem

- Anthracnose ★
- Rhizoctonia stem canker
- Summer black stem & leaf spot
- Spring black stem
- Sclerotinia crown & stem rot

Root

- Phytophthora root rot ★
- Aphanomyces ★
- Brown root rot
- Bacterial wilt ★

Leaf

- Common leaf spot
- Downy mildew
- Stemphylium leaf spot
- Lepto leaf spot
- Verticillium wilt ★

Alfalfa is often considered the most important perennial forage crop in Michigan. It has certainly been the subject of more research and development efforts by industry and universities than any other forage legume. The red stars indicated diseases included in MSU Extension publication E1582 "Insect, Nematode and Disease Control in Michigan Field Crops"

This list includes most of the diseases that impact alfalfa grown in Michigan. Of all these diseases, the five identified for inclusion in MSU's alfalfa disease control recommendation publication 'Insect, Nematode and Disease Control in Michigan Field Crops', E1582 are indicated with a red star.

Alfalfa diseases

Table 4-11. Probability and occurrence of alfalfa diseases in stands of different ages

Disease	— Harvest (established stand) —				Year				
	1st	2nd	3rd	4th	seeding	1st	2nd	3rd	4th
Anthracnose ★	— ^a	++	+++	++	++	+++	+++	+++	+++
Aphanomyces root rot ★	++	+++	+++	+++	+++	++	++	++	++
Bacterial wilt ★	+	+	+++	+++	—	+	++	+++	+++
Common leaf spot	++	+++	+++	+++	+++	+++	+++	+++	+++
Downy mildew	+++	+	+	+++	+++	++	++	++	++
Fusarium crown root rot	+++	+++	+++	+++	—	+	++	++	+++
Fusarium wilt	+	++	+++	+++	—	+	++	+++	+++
Phytophthora root rot ★	++	+++	+++	+++	+++	++	++	++	++
Pythium root rot	—	—	—	—	+++	+	+	+	+
Spring black stem	+++	++	—	+++	++	+++	+++	+++	+++
Summer black stem	—	++	+++	+	+++	+++	+++	+++	+++
Verticillium wilt ★	+++	+	++	+++	—	+	++	+++	+++

^aProbability of occurrence and/or severity: — = none, + = low, ++ = moderate, +++ = high

Pest Management in Wisconsin Field Crops 2012, A3646, Eileen Cullen et al
 (★ = also included in MSU Extension publication E1582 "Insect, Nematode and Disease Control in Michigan Field Crops")

This chart, produced by University of Wisconsin researchers, indicated when alfalfa diseases are more likely, both during an individual growing season and across the first 5 years including seeding year.

Alfalfa seedling diseases

Table 4-11. Probability and occurrence of alfalfa diseases in stands of different ages

Disease	— Harvest (established stand) —				Year				
	1st	2nd	3rd	4th	seeding	1st	2nd	3rd	4th
Anthracnose ★	— ^a	++	+++	++	++	+++	+++	+++	+++
Aphanomyces root rot ★	++	+++	+++	+++	+++	++	++	++	++
Bacterial wilt ★	+	+	+++	+++	—	+	++	+++	+++
Common leaf spot	++	+++	+++	+++	+++	+++	+++	+++	+++
Downy mildew	+++	+	+	+++	+++	++	++	++	++
Fusarium crown root rot	+++	+++	+++	+++	—	+	++	++	+++
Fusarium wilt	+	++	+++	+++	—	+	++	+++	+++
Phytophthora root rot ★	++	+++	+++	+++	+++	++	++	++	++
Pythium root rot	—	—	—	—	+++	+	+	+	+
Spring black stem	+++	++	—	+++	++	+++	+++	+++	+++
Summer black stem	—	++	+++	+	+++	+++	+++	+++	+++
Verticillium wilt ★	+++	+	++	+++	—	+	++	+++	+++

^aProbability of occurrence and/or severity: — = none, + = low, ++ = moderate, +++ = high

Pest Management in Wisconsin Field Crops 2012, A3646, Eileen Cullen et al
 (★ = also included in MSU Extension publication E1582 "Insect, Nematode and Disease Control in Michigan Field Crops")

Important alfalfa seedling diseases are highlighted on this chart including Aphanomyces, Phytophthora and Pythium root rots. Notice that Aphanomyces and Phytophthora are most problematic during the seeding year, and are worse in later cuttings after the seeding is established. Pythium is primarily a seed rot, damping off, and seedling blight problem.

Aphanomyces root rot on alfalfa

- Pathogen: fungus – *Aphanomyces euteiches*
 - *Similar to Phytophthora root rot, but slower and more chronic*
 - *New 'race 2' strain side-steps long-time resistance*
 - *Causes 'damping off' of seedlings, especially in wet soil conditions*
 - *Causes stunting, yellow plants in established stands*

Self-explanatory. *Aphanomyces* is often found in combination with *phytophthora*.

Aphanomyces root rot on alfalfa



Aphanomyces root rot on seedling
Photo: APS press



Aphanomyces symptoms – right
Healthy plant – left
Photo: APS press

Aphanomyces root rot causes stunted, unthrifty seedlings. Secondary roots die back, reducing the seedlings ability to extract water and nutrients from soil.

Phytophthora root rot on alfalfa

- Pathogen: fungus – *Phytophthora medicaginis*
 - *Serious disease causing loss of stand on heavier or poorly drained soils*
 - *Seedlings up to 2 months most vulnerable*
 - *Resistant variety is first line of defense*
 - *Seed treatments can improve stand development*

Self-explanatory



Phytophthora seed and seedling blight
Photo: U of Illinois Crop Sciences

Resistant varieties, seed treatment, improved drainage,

These photos show alfalfa seeds affected by *Phytophthora* during germination and emergence. The healthy seedling on the right is to compare with the diseased ones on the left.

Alfalfa root diseases

Table 4-1 1. Probability and occurrence of alfalfa diseases in stands of different ages

Disease	— Harvest (established stand) —				Year				
	1st	2nd	3rd	4th	seeding	1st	2nd	3rd	4th
Anthracnose ★	— ^a	++	+++	++	++	+++	+++	+++	+++
Aphanomyces root rot ★	++	+++	+++	+++	+++	++	++	++	++
Bacterial wilt ★	+	+	+++	+++	—	+	++	+++	+++
Common leaf spot	++	+++	+++	+++	+++	+++	+++	+++	+++
Downy mildew	+++	+	+	+++	+++	++	++	++	++
Fusarium crown root rot	+++	+++	+++	+++	—	+	++	++	+++
Fusarium wilt	+	++	+++	+++	—	+	++	+++	+++
Phytophthora root rot ★	++	+++	+++	+++	+++	++	++	++	++
Pythium root rot	—	—	—	—	+++	+	+	+	+
Spring black stem	+++	++	—	+++	++	+++	+++	+++	+++
Summer black stem	—	++	+++	+	+++	+++	+++	+++	+++
Verticillium wilt ★	+++	+	++	+++	—	+	++	+++	+++

^aProbability of occurrence and/or severity: — = none, + = low, ++ = moderate, +++ = high

Pest Management in Wisconsin Field Crops 2012, A3646, Eileen Cullen et al
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The main alfalfa root rot diseases affecting established alfalfa plants include Aphanomyces and Phytophthora. Infections build up over the growing season, so are worse in later cuttings.

Alfalfa plants showing symptoms of
Aphanomyces root rot.



Left: race 1 resistant cultivar WAPH-1
Center: susceptible cultivar Saranac
Right: race 1 and 2 resistant WAPH-5. (T.J. Hughes)

As mentioned, the newly emerging “race 2” of Aphanomyces is not controlled by existing genetic resistance to race “1”

Plant stunted by PRR on left. Photo: L.H. Rhodes, Ohio State U.

Black lesions pruning off taproot. Photo: British Col. Ministry of Ag

Lateral 'taproots' form after loss of main taproot to PRR. Photo: L.H. Rhodes, OSU

PRR in lower area (rear) where drainage is poor. Photo: L.H. Rhodes, OSU

Phytophthora root rot in alfalfa

Root rot diseases are much more prevalent in poorly drained soils. These photos show symptoms of Phytophthora root rot on established alfalfa.

Alfalfa stem diseases

Table 4-1 1. Probability and occurrence of alfalfa diseases in stands of different ages

Disease	— Harvest (established stand) —				Year				
	1st	2nd	3rd	4th	seeding	1st	2nd	3rd	4th
Anthracnose ★	— ^a	++	+++	++	++	+++	+++	+++	+++
Aphanomyces root rot ★	++	+++	+++	+++	+++	++	++	++	++
Bacterial wilt ★	+	+	+++	+++	—	+	++	+++	+++
Common leaf spot	++	+++	+++	+++	+++	+++	+++	+++	+++
Downy mildew	+++	+	+	+++	+++	++	++	++	++
Fusarium crown root rot	+++	+++	+++	+++	—	+	++	++	+++
Fusarium wilt	+	++	+++	+++	—	+	++	+++	+++
Phytophthora root rot ★	++	+++	+++	+++	+++	++	++	++	++
Pythium root rot	—	—	—	—	+++	+	+	+	+
Spring black stem	+++	++	—	+++	++	+++	+++	+++	+++
Summer black stem	—	++	+++	+	+++	+++	+++	+++	+++
Verticillium wilt ★	+++	+	++	+++	—	+	++	+++	+++

^aProbability of occurrence and/or severity: — = none, + = low, ++ = moderate, +++ = high

Pest Management in Wisconsin Field Crops 2012, A3646, Eileen Cullen et al

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This chart highlights alfalfa stem diseases. Anthracnose is of major concern in Michigan, although spring black stem and summer black stem are also present. Anthracnose is most prevalent during mid-summer weather in established stands. Spring black stem is worst in cool weather, spring and fall. Summer black stem is most prevalent during mid-summer.

Anthracnose on alfalfa

- Stem disease
 - Pathogen: fungus – *Colletotrichum trifolii*
 - *Straw-colored lesions on stems, may girdle*
 - *Favored by warm, humid conditions*
 - *Newer varieties have high resistance*
 - *Control measures:*
 - *Select resistant variety*
 - *Keep harvest equipment clean from year to year*
 - *Harvest younger stands first*
 - *Rotate out of alfalfa for one year*

Self-explanatory

Anthracnose on alfalfa



Diamond-shaped lesion



'Shepherd's crook



Plants with anthracnose scattered among healthy plants



Anthracnose – right
Fusarium - left

*Photos from OSU Extension
"Alfalfa Anthracnose", AC-15-
96, L.H. Rhodes and
R.M. Sulc*



Alfalfa stand thinned by
anthracnose

These photos provide an idea of visual symptoms of anthracnose on alfalfa.

Spring black stem on alfalfa

- Stem disease
 - Pathogen: fungus – *Phoma medicaginis* var. *medicaginis*
 - *Leaf and stem lesions begin as small black spots*
 - *Usually confined to lower stem, worse in favorable conditions*
 - *Stunts plants, but can kill by spreading to crown*
 - *Favored by cool, wet weather, affects mostly 1st cutting*

Self-explanatory



Photos: Oklahoma St Univ.
Entomology & Plant Pathology

Spring Black Stem of Alfalfa

These photos provide an idea of what spring black stem of alfalfa looks like.

Summer black stem on alfalfa

- Stem disease
 - Pathogen: fungus – *Cercospora medicaginis*
 - *Leaf lesions begin as small brown spots*
 - *Starts with lower leaves, progresses upward*
 - *Bad cases cause early defoliation*
 - *Disease can girdle petioles and stems*
 - *Favored by warm, moist weather, usually affects later cuttings*
 - *Stunts plants, but can kill by spreading to crown*

Self-explanatory



Photo: S. Wegula, Univ of
Nebraska, Lincoln

Summer Black Stem of Alfalfa

Summer black stem is primarily a defoliation problem. However, severe cases can result in stem lesions girdling stems and eventually killing plants.

Alfalfa leaf diseases

Table 4-1 1. Probability and occurrence of alfalfa diseases in stands of different ages

Disease	— Harvest (established stand) —				Year				
	1st	2nd	3rd	4th	seeding	1st	2nd	3rd	4th
Anthracnose ★	— ^a	++	+++	++	++	+++	+++	+++	+++
Aphanomyces root rot ★	++	+++	+++	+++	+++	++	++	++	++
Bacterial wilt ★	+	+	+++	+++	—	+	++	+++	+++
Common leaf spot	++	+++	+++	+++	+++	+++	+++	+++	+++
Downy mildew	+++	+	+	+++	+++	++	++	++	++
Fusarium crown root rot	+++	+++	+++	+++	—	+	++	++	+++
Fusarium wilt	+	++	+++	+++	—	+	++	+++	+++
Phytophthora root rot ★	++	+++	+++	+++	+++	++	++	++	++
Pythium root rot	—	—	—	—	+++	+	+	+	+
Spring black stem	+++	++	—	+++	++	+++	+++	+++	+++
Summer black stem	—	++	+++	+	+++	+++	+++	+++	+++
Verticillium wilt ★	+++	+	++	+++	—	+	++	+++	+++

^aProbability of occurrence and/or severity: — = none, + = low, ++ = moderate, +++ = high

Pest Management in Wisconsin Field Crops 2012, A3646, Eileen Cullen et al

(★ = also included in MSU Extension publication E1582 "Insect, Nematode and Disease Control in Michigan Field Crops")

Alfalfa leaf diseases are highlighted. Common leaf spot is worst in warm, humid conditions and can cause defoliation. Downy mildew is worst in cool periods at the beginning and end of the growing season.



Common Leaf Spot of Alfalfa

Pseudopeziza medicaginis

Favored by cool, moderate, wet, weather.

Generally a problem on 2nd cutting and later

Can cause early defoliation, yield and quality loss

This photo shows common leaf spot on alfalfa.



Downy Mildew of Alfalfa

Peronospora trifoliorum

- Favored by cool, wet, weather in early and late growing season.
- Generally a problem on 2nd cutting and later
- Can cause early defoliation, yield and quality loss
- Can disappear when weather is warmer and dry, then reappear as cool, wet conditions return

This photo shows downy mildew of alfalfa.

Alfalfa Scouting

1. Weed scouting
2. Insect scouting
3. *Disease scouting*
 - *Included in general field scouting effort*
 - *Use of scouting calendar helpful*

Disease scouting in alfalfa and other forages should not be considered a 'stand-alone' task. Rather, it should be incorporated into general scouting and crop monitoring activities. Access to a scouting calendar will be helpful. An alfalfa scouting calendar will include periods during the growing season when specific diseases are most likely.

Tips on scouting alfalfa

1. Diseases often confined to lower leaves and have little effect on yield or quality
2. Occasionally, epidemics of leaf diseases will cause premature loss of leaves and affect yield
3. Alfalfa diseases may have symptoms similar to other problems
 - PLH
 - Nutritional deficiencies
 - Frost
 - Herbicide injury

Self-explanatory

Tips on scouting alfalfa

4. Include disease scouting throughout season
5. Disease may become more obvious during periods of crop stress
6. Estimate the percentage of disease throughout the field
7. Record information concerning:
 - *Particular problem area*
 - *Location*
 - *Size of area affected*
 - *Drainage pattern*
 - *Etc.*

Self-explanatory

Sample alfalfa disease scouting calendar

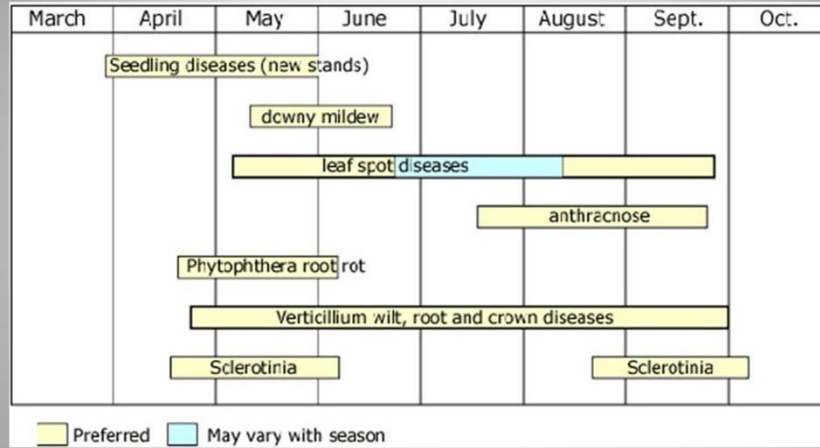
Disease	Harvest				Seeding	Year			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
Pythium Rot	3	1	1	1	3	0	0	0	0
Phytophthora Root Rot ★	2	3	3	3	3	2	2	2	2
Anthracnose ★	0	1	3	3	2	3	3	3	3
Verticillium Wilt ★	3	1	2	3	0	1	2	3	3
Bacterial Wilt ★	1	1	3	3	0	1	2	3	3
Fusarium Wilt	1	2	3	3	0	1	2	3	3
Spring Black Stem	3	2	0	1	1	3	3	3	3
Summer Black Stem	0	2	3	2	1	3	3	3	3
Common Leaf Spot	2	3	3	3	3	3	3	3	3
Downy Mildew	3	1	1	3	3	2	2	2	2
Fusarium Crown Rot	3	2	2	3	0	1	2	2	3

Probability of occurrence and/or severity.
0 = none
1 = low
2 = moderate
3 = high

From: University of Wisconsin Extension IPM manual

Here is a sample of an alfalfa disease scouting calendar from Wisconsin Extension. The red stars indicate alfalfa diseases included in MSU Extension disease control guide.

Another sample alfalfa disease scouting calendar



From: Cornell University Alfalfa IPM Disease Scouting Calendar

This alfalfa disease scouting calendar from Cornell uses a different, simpler format.

Alfalfa IPM Scouting Form

Grower: _____ **Scout:** _____ **Date:** _____
Weather: _____ **Temp:** _____ partly sunny cloudy rainy calm light wind strong wind

Field Name: _____ **Time:** in: _____ out: _____
Plant Develop.: Ht. (in.) _____ Growth Stage: _____ %Bud: _____ %Bloom: _____
Soil Condition: wet moist dry loose light crust hard crust

Pest	Count	Unit	Threshold	Status	MAP

COMMENTS: _____

Common Abbreviations: PLT=plant; CRWN=crown; SWP=Sweep; AW=Alfalfa Weevil, PLH=Potato Leafhopper;
 PRR=Phytophthora Root Rot; VERT=Verticillium Wilt

From: Cornell alfalfa scouting manual

This is a sample of an alfalfa scouting form. Farmers or crop consultants should include similar information in their scouting records.

Clover diseases

Crown and root rots

- Mainly caused by *Fusarium sp.*
- Leaf spots including stemphylium, Pseudopeziza, sooty blotch, Cercospora

Northern anthracnose

- Caused by fungus – *Kabatiella caulivora*
- Worst in cool, wet weather
- Lesions on stems and petioles cause leaves to wilt and appear scorched

Powdery mildew

- *Erysiphe plygoni*
- Dry weather, warm days, cool nights
- Dusty, white mildew grows on leaves
- Overwinters on plant material
- Spread by wind

Viruses

- Green and yellow mosaic pattern on leaves
- Bean yellow mosaic most common

Clovers, including red clover, ladino, white, alsike and kura clovers are included in perennial forage fields in Michigan, with red clover predominating. Clovers are suitable for soils that are not adequately drained or limed or where soils cannot be practically improved for alfalfa. Red clover is a short-lived perennial, with stands usually declining after 2 years. Newer varieties, including Arlington and Marathon have improved diseases resistance and are sometimes referred to as '3-year' red clovers. The principal disease problems for clovers are crown and root rots caused by *Fusarium*, and defoliation caused by northern anthracnose.



Red clover with crown rot
Photo: Oregon State Univ. Extension

Cultural control:

- Maintain adequate P and K.
- Maintain optimal soil pH
- Follow recommended harvesting schedule

This photo shows a crown rot in red clover. Crown rots are the main cause of decline in red clover stands.



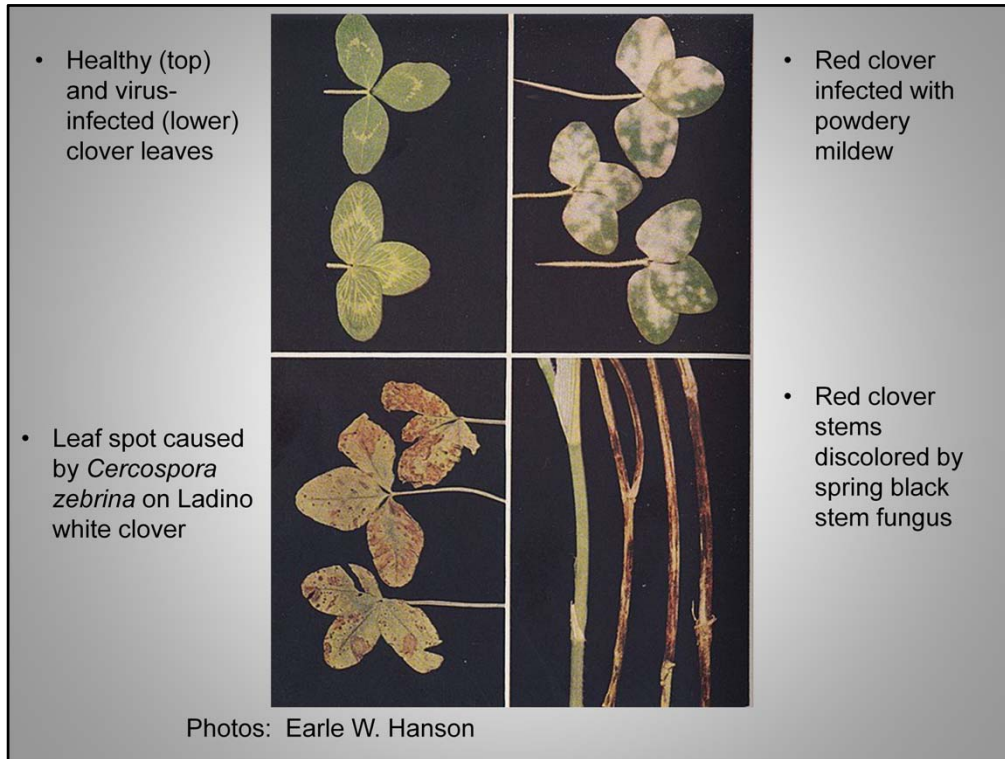
Northern anthracnose on red clover
Photo: MGRI



Northern anthracnose on red clover
Photo: Eugene A. Hollowell

- Most common on red, crimson, alsike and white sweet clovers in cool, wet weather

Northern anthracnose defoliation can be severe in periods of cool, wet weather.



These diseases are less important problems in clover.

Birdsfoot Trefoil diseases

Crown and root rots

- Caused by *Fusarium* sp., *Rhizoctonia* sp., *Mycoleptodiscus* sp., *Coprinus psychromorbidus*, etc

Stemphylium leaf spot and stem canker

- May become severe
- Early harvest aids in leaf retention and reduction of disease inoculum

Fusarium wilt

Fusarium oxysporum

Fighting disease in BFT...

- Use disease resistant variety
- Pardee – disease resistant but not winter hardy
- Dawn – improved disease resistance, not quite as hardy as Norcen
- Avoid rapid and complete defoliation – leave some leafy stems
- Allow reseeding
- Avoid stockpiling past early bloom
- Avoid excessive shading by grasses
- Allow plants to rest in fall (Sept – mid Oct)

Although **birdsfoot trefoil** is more persistent than red clover, this is due to the emergence of new plants from self-seeding, not longevity of original plants in a seeding. Diseases that cause problems in birdsfoot trefoil include **crown and root rots** caused by *Fusarium* spp. and other fungal pathogens, **Stemphylium leaf spot**, **stem cankers** and **Fusarium wilt**. There are a limited number of birdsfoot trefoil varieties available, and disease resistance remains a challenge. Pardee, a variety developed in Pennsylvania, has greatly improved disease resistance, but lacks adequate winter hardiness for Michigan conditions. To manage disease in birdsfoot trefoil, avoid rapid and complete defoliation (leave some leafy stems at harvest), allow reseeding, avoid stockpiling past early bloom, avoid excessive shading by grasses, and allow plants to rest in fall (September – mid October).



Stemphylium Leaf Spot (Target Spot) on BFT.
Photo: Ag and Rural Dvpt., Alberta, CA

Harvest early to reduce leaf losses.



Winter Crown Rot caused by
Coprinus psycromorbidus
Photo: Ron Howard, Ag and Rural
Dvpt., Alberta, CA

Favored by snow mold, late springs.
No preventative measures

Early harvest can help minimize leaf losses in birdsfoot trefoil stands with heavy *Stemphylium* leaf spot infection. Winter crown rot can be a problem in areas that experience snow cover late into spring.



Typical progression of symptoms (left to right) of Fusarium wilt in birdsfoot trefoil plants. Photo: Bergstrom, Wunsch, Cornell University

Rapid wilting, root discoloration, plant death in seeding year. Principal factor in decline of trefoil seed industry in Lake Champlain Valley of New York and Vermont in the '70's and early 80's.

Genetic resistance is the solution. Pardee variety developed at Cornell, but lacks adequate winter hardiness for northern areas.

Fusarium wilt in birdsfoot trefoil can be a serious problem. These photos show the progression of symptoms in young plants.

Perennial forage grass diseases

- Leaf rust
- Stem rust
- Leaf spot
- Root rot
- Ergot

These diseases are typical of perennial forage grass disease problems.

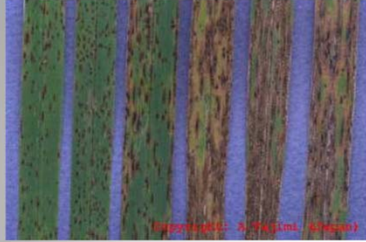
Stem rust of Timothy



Stem rust on timothy
Puccinia graminis

Rust diseases can attack most forage grass species

Brown stripe of Orchardgrass



Slide: Erik L.
Stomberg, Virginia
Polytechnic Inst.

1. *Scolecetrichum graminis*
2. Overwinters as masses of mycelia in living leaves and crop debris
3. Produce spores in spring
4. Rain splashed and wind-blown rain
5. Ceases during hot, dry summer
6. Resumes in wet fall conditions

Brown stripe is a fungal disease of orchardgrass.

Rusts of forage grasses

- Round, bright orange pustules that rupture the leaf tissues (leaf rust)
- Oblong, reddish-brown pustules that rupture stem tissue

The rust diseases of grasses typically produce round, bright orange pustules that rupture leaf or stem tissues.

Leaf spots of forage grasses

- Do not rupture plant tissues
- Usually characterized by brown-black spots bordered by a yellow “halo”

Leaf spots, on the other hand, do not rupture leaf or stem tissues. They also have a different appearance than rusts, with dark spots usually bordered by a yellow ‘halo’.

Root rots of forage grasses

- Cause brown-black roots that are reduced in number and size

Root rots of grasses reduce plant vigor and productiveness. Careful examination of plant roots may reveal discolored and small root systems.

Ergot of forage grasses

- *Claviceps purpurea*
- Seen most commonly on cereal rye
- Fungus infects developing grains
- Ergot bodies (hard masses of fungal mycelium) replace seeds – up to 10X larger
- Open-pollinated grasses susceptible



Brome grass infected with ergot
Photo: Government of Saskatchewan
Agriculture

Ergot is a fungal disease that results in seeds being replaced with fungal mycelium. It is most commonly seen in Michigan on cereal rye, but can infect many other grass species.

Controlling grass diseases

- Ergot – cutting early, clipping wild grasses along edges
- Rust and leaf spot – cutting early, plant resistant or tolerant varieties

Grass diseases, if severe enough, can be managed by cutting early to reduce losses and for ergot, clipping wild, grassy areas around field edges to reduce sources of disease 'carry-over'. The most effective method of avoiding losses to grass diseases is to select varieties with genetic resistance.

Questions/Discussion?

MICHIGAN STATE UNIVERSITY | Extension



An ergot body that has germinated to produce drumstick-like structures that will release spores. (Photo courtesy Robin Morrall)

Self-explanatory