

Cover Crops and Their Potential Diseases To Consider



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Talk outline

- Cover Crop Basics
- Cover Crops for New Mexico
- Plant Disease Basics
- Potential Diseases within Cover Crops

What is a cover crop?

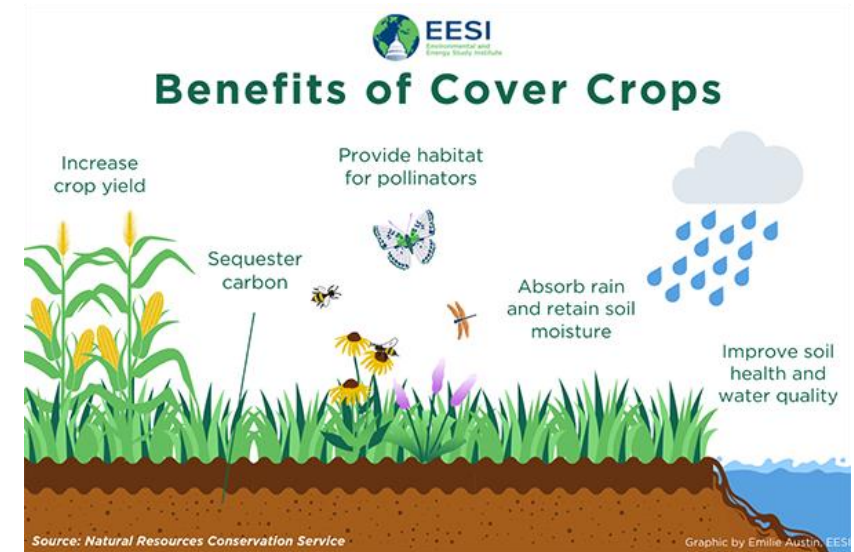
- Plants grown between cash crop cycles
- Intercropped with cash crops to cover bare ground
- Planted in the absence of a “normal” crop
- Grown primarily to add organic matter and nutrients to the soil
- **Not harvested or partially harvested!**



Verdesian Life Sciences

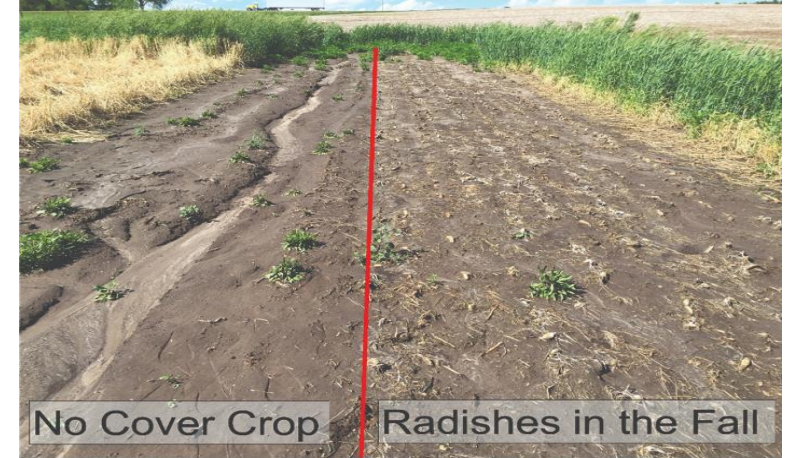
What is the purpose of a cover crop?

- Provide protection to the soil from water and wind erosion
- Biomass for increasing the soil organic matter
- Break soil compaction
- Supply nitrogen and nutrients to the soil
- Can help suppress weeds and plant diseases



How can cover crops help with erosion control?

- Surface covers reduce the ability of wind and water to move the soil by shielding the soil's surface
- Cover crops bind the soil together and hold it in place
- Cover crops slow the wind velocity or runoff velocity
- Improves the soil's capacity to absorb water



University of Nebraska



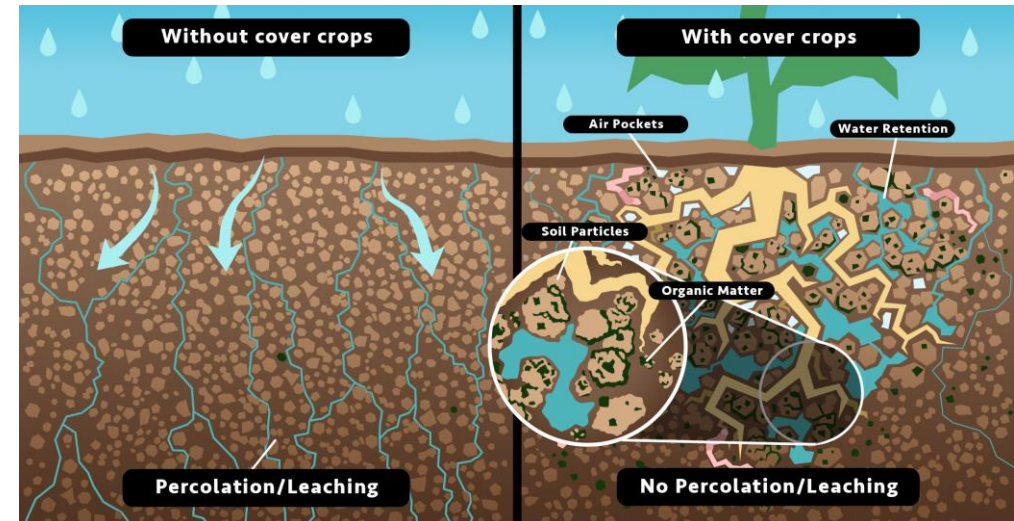
Farm Progress

Cover crops and organic matter

- Adding organic matter improves the nutrient supply of the soil
- Increases soil biological activities
- Improves soil structure
- Improves water holding capacity



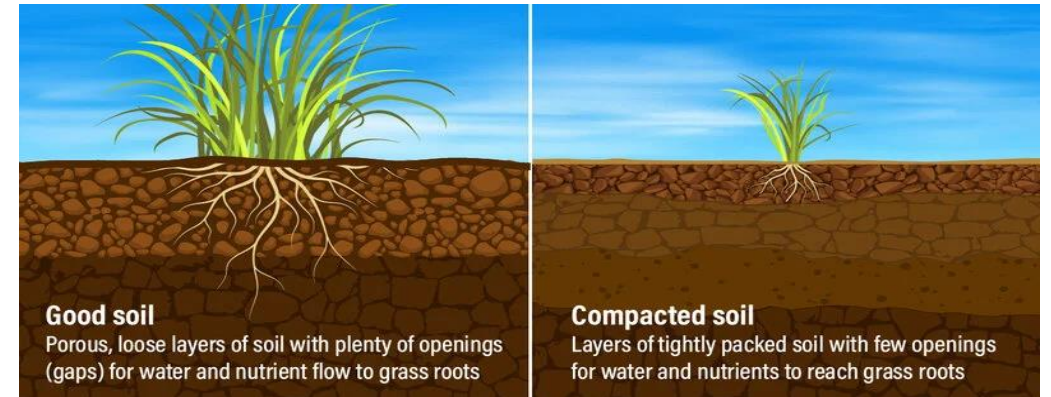
University of Maryland Extension



ARID-New Mexico State University

Cover crops and soil compaction alleviation

- Compaction occurs when the soil is too dense
- Can affect root growth and water movement in the soil
 - Affect plant growth, health and production



J. Rodriguez

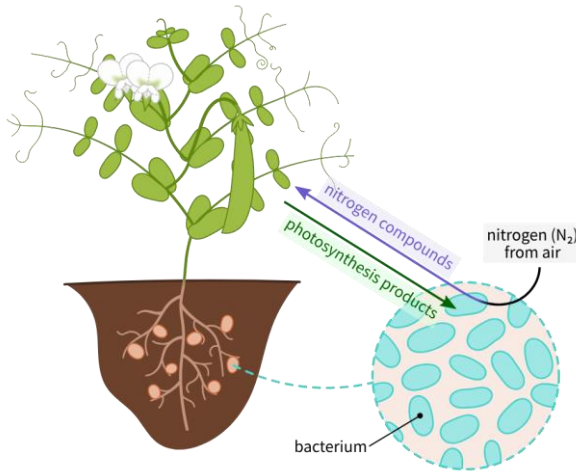


Prarie Farm Report

Cover crops and nitrogen fixation



Biological nitrogen fixation in legumes (legumehub.edu)



- Examples of legumes are alfalfa, clovers, beans
- Bacteria that make nitrate in roots with plants are called Rhizobium
- Nitrogen comes from the soil and air
- It is a relationship of give and take
- Plants supply bacteria with simple sugars and bacteria give nitrates to plants
- Can fix up to 270 lbs/ac N in a year
- Legumes can be planted as cover crops and worked back into the soil to supply nitrogen for the following cash crop

Cover crops and nutrient supply

- As cover crops grow, they are taking up nutrients
- These nutrients will be released when plants are terminated

Legumes	Tissue N (lb/ac)	Tissue P (lb/ac)	Tissue K (lb/ac)
Cowpea_IC	282	36	278
Cowpea_CA	253	26	240
Cowpea_CC36	190	26	246
Lablab	160	23	162
Guar_DU	128	20	145
Tepary bean	107	12	102
Bush bean	90	8	57
Lima bean	87	9	69
Mung bean	57	11	83

Dr. John Idowu,
NMSU

Weed and disease suppression

- Thick cover crop stands can prevent most germinated weed seeds from completing their life cycle and reproducing (smother effect).
- Rye residues had 80-95% early broadleaf weed control
- Increase the number of beneficial insects feeding on weed seeds
- Some cover crops release allelochemical (natural toxins) to inhibit or slow the growth of other plants
- Brassicas (forage radish, mustard) contains glucosinolates that can suppress nematodes and plant pathogens



Dr. John Idowu

Classification of cover crops

- Cover crops are classified based on:
 - i. The way the cover crop is used (catch crop, green manure, living mulches, etc.)
 - ii. The type of crop planted (grasses, legumes, brassica etc.)
 - iii. When they are planted (summer, winter) – **most common**

Winter cover crops

- Planted in late summer or fall
- Provide ground cover during the late fall/winter/early spring
- **Winter covers must be cold-tolerant crops**
- Critical to plant on time before the temperature becomes too low
- Winter hardy crops: triticale (hybrid of wheat and rye), hairy vetch, and cereal rye
- Cool season legumes: several clovers, vetches, medics, and field peas



Triticale



Clover

Summer (warm season) cover crops

- Normally planted in summer as green manure
- Can provide an opportunity for crop rotation
- Improve poor soils
- Provide nitrogen for the following winter cash crop
- Many species can be used for this purpose
- Examples of summer legumes
 - Cowpeas, Sweetclover, Sesbania, Guar, etc.



Cowpea



Sesbania

Deciding what cover crop works for you...

- **What is your goal?**
 - Increasing nitrogen, organic matter
 - Decreasing erosion, compact soils?
- **What cover crop options are available?**
- **When is the seeding time?**
 - Spring / fall
- **What are the management practices?**
 - No-till, conventional, organic, etc.
- **Are there other important details to know?**



Performance in Relation to Set Goals

Popular and Useful Choices of Cover Crops for New Mexico

Crop	Over-winter ability	Biomass amount	Soil structure improvement	Comments
Annual Ryegrass	NO	**	***	Overall, an easy crop to establish
Perennial Ryegrass	***	**	**	Faster establishment than other perennials. Extensive root system
Winter Rye	***	***	**	Can grow at low pH and at cool temperatures
Winter Wheat	***	***	**	Requires fertile soil; avoid wet or low pH soil.
Sweet Clover	***	***	**	Better with high pH than other clovers
White Clover	***	*	**	Good for low pH soil, treat with inoculants
Tall Fescue	***	*	**	Persistent, may become weed-like.
Buckwheat	NO	**	*	Do not allow to mature, or reseeding will occur

*** = Relatively High;

** = Moderate;

* = Relatively Low

Cool Season Cover Crops

Late Sept – Nov (Fall planted) in some cases early spring

- Triticale/wheat/barley/rye
- Annual ryegrass
- Clover
- Vetch
- Austrian winter peas
- Forage radish (Tillage radish)



Triticale/wheat/barley/rye

Plant late September – November

General seeding rate: 80-120 lbs. / acre

- Excellent biomass
- Good weed suppression
- Interplant with peas, vetch, and clovers
- Don't let them go to seed!



Triticale (hybrid between wheat and rye)

- Upright growth habit: 3–5 feet
- Heat and drought tolerance
- Shade tolerance
- Flood tolerance
- Low fertility tolerance
- It is best to terminate when plants are small
- Mowing after heading can terminate
- Terminate at least two weeks before planting
- Triticale can become a weed if not completely terminated



Austrian Winter Pea

- Seeding rate: 50-80 lbs./ac
- Planting date: Sept. – Nov.
- Climbing or prostrate growth (2 – 4 ft)
- Fixes nitrogen quickly (90 – 150 lbs. N/ac)
- Soil builder, erosion fighter, weed fighter
- Can produce excellent biomass
- Good for grazing
- Beneficial insect habitat
- Can work very well in mixed cover crops (can be mixed with grasses, other legumes, or brassicas)



Annual Ryegrass

(also called Italian Ryegrass)

Plant late Aug. – Oct.

Seeding rate: 20-30 lbs. / acre

- Can produce quick cover in 4-6 weeks
- Weed suppression
- Interplant with legumes
- May need mowing if too fast for legume
- Tolerates shading (can grow in standing crop)
- Difficult to control if it goes to seed



Clovers

Plant in late Sept. – Oct.

Seeding rate: depends on type

- Nitrogen fixation
- Beneficial insect habitat
- Many can be used as forage
- Possible to interplant with winter cereal
- Difficult to establish on cracking clay soils



New Zealand White Clover
Los Lunas, NM

Hairy Vetch

Plant late Sept. – Nov.

Seeding rate: 20-25 lbs. / acre

- Very good nitrogen fixation
- Beneficial insect habitat
- Can be mixed with winter cereals
- Cold tolerant
- Good biomass



Forage Radish

Plant late Sept. – Nov.

Seeding rate: 8 – 12 lbs. / acre

- Can break soil compaction layer
- Suppresses harmful nematodes
- Excellent biomass
- Can serve as a catch crop (fast-growing plant between two cash crops)
- Good for erosion control



Radish holes after winterkill

Photo credit: Joel Gruver, Western Illinois University.
<https://eorganic.org/node/4182>

Warm Season Cover Crops:

- **Generally planted: March – July**
- Cowpeas
- Lablab
- Pigeon Pea
- Buckwheat
- Pearl Millet
- Sorghum – Sudan
- Sesbania



Cowpeas

Plant March-July

Seeding rate: 40-50 lbs. / acre

- Fixes nitrogen (150 lbs. N / ac.)
- Excellent weed suppression
- Easy to manage
- Can grow in poor soils
- Sandy & clay soils
- Can reduce nematode populations in the soil



Lablab (Hyacinth bean)

Plant March – July

Seeding rate: 20 lbs. / acre

- Fixes nitrogen
- Excellent weed suppression
- Easy to manage
- Alkaline clay soils
- Drought tolerant
- Beware if you have nematodes



Buckwheat

Plant March-July

Seeding rate: 50 - 60 lbs. / acre

- Rapid growth
- Sandy or clay soils
- Excellent forage for poultry
- **Toxic to horses**
- Will not establish well if soilborne disease pressure is high
- Buckwheat can harbor insect pests including Lygus bugs, root lesion nematodes



Sorghum - Sudan

Plant March-May

Seeding rate: 30-40 lbs. / acre

- Excellent biomass
- Excellent forage/hay
- Improves soil structure
- Drought tolerant
- Very good weed suppression
- Can regrow after mowing



Sesbania (*Sesbania exaltata*)

Plant March-July

Seeding rate: 40-50 lbs. / acre

- Very high biomass 12.7 t/ac
- Good nitrogen fixation
- Excellent weed suppression
- Excellent forage
- Easy to manage
- Sandy & clay soils





Cover Crop cocktail/mixes

Cover Crop Cocktails/Mixes

- Insurance against cover crop failure – if one species fail, others in the mix may survive
 - For example, in LC, Dr. Idowu planted 4 species (triticale, barley, Austrian winter pea, radish) and 2 of them (barley and radish) failed because of irrigation problems. We still had a strong performance of two species (triticale and AWP)
- Multiple benefits from different species in the mix – you can achieve multiple goals i.e., organic matter addition, compaction alleviation, and nitrogen addition to the soil
- Enhancement of microbial diversity – different microbes associate with different crops

Cover Crop Chart

Google: USDA Cover Crop Chart

GROWTH CYCLE			PLANT ARCHITECTURE		RELATIVE WATER USE	
A	=	Annual	Y	=	Upright	● = Low
B	=	Biennial	*	=	Upright-Spreading	● ● = Medium
P	=	Perennial	≡	=	Prostrate	● ● ● = High

COOL				WARM							
--GRASS--		BROADLEAF								--GRASS--	
LEGUME											
A <u>ANNUAL FESCUE</u>										A <u>BROWNTOP MILLET</u>	
A <u>BARLEY</u>										A <u>AMARANTH</u>	A <u>FOXTAIL MILLET</u>
A <u>OAT</u>	A/B <u>CAMELINA</u>	A/P <u>MUSTARD</u>	A <u>BALANSA CLOVER</u>	A <u>CHICKPEA</u>	A/P <u>MEDIC</u>	A <u>COWPEA</u>	A <u>CLUSTER BEAN</u>	A <u>BUCKWHEAT</u>		A <u>PEARL MILLET</u>	
A <u>WHEAT</u>	A <u>PHACELIA</u>	A/B <u>CANOLA</u>	A <u>BERSEEM CLOVER</u>	A <u>PEA</u>	A <u>LUPIN</u>	A/P <u>LABLAB</u>	A/P <u>JACK BEAN</u>	A <u>QUINOA</u>		A <u>PROSO MILLET</u>	
A/B <u>ANNUAL RYEGRASS</u>	A <u>FLAX</u>	A <u>RADISH</u>	A <u>CRIMSON CLOVER</u>	A <u>LENTIL</u>	A <u>FABA BEAN</u>	A/P <u>FENUGREEK</u>	A <u>VELVET BEAN</u>	P <u>CHICORY</u>		A <u>GRAIN SORGHUM</u>	
A <u>CEREAL RYE</u>	A <u>KALE</u>	B <u>TURNIP</u>	B/P <u>RED CLOVER</u>	A/P <u>LESPEDEZA</u>	A/B <u>SWEET CLOVER</u>	A/P <u>PIGEONPEA</u>	A <u>MUNG BEAN</u>	A <u>CUCURBITA</u>		A <u>SUDAN GRASS</u>	
A <u>TRITICALE</u>	A <u>SPINACH</u>	B <u>BEET</u>	P <u>WHITE CLOVER</u>	P <u>BIRDSFOOT TREFOIL</u>	P <u>ALFALFA</u>	A <u>PARTRIDGE PEA</u>	A <u>SOYBEAN</u>	A <u>SAFFLOWER</u>		A <u>TEFF</u>	
P <u>SALINE TOLERANT</u>	A/B <u>CHARD</u>	A/B <u>CARROT</u>	P <u>KURA CLOVER</u>	A/B <u>VETCH</u>	P <u>SAINFOIN</u>	A <u>SUNNHEMP</u>	A/P <u>PEANUT</u>	A <u>SUNFLOWER</u>		A <u>CORN</u>	

Cover crop limitations

- Management of cover crops is key to success
- Cost of seed and application needs to be justified
- Water consumption of cover crop growth may reduce soil moisture and harm the following cash crop
- May reduce soil temperature and cause slow growth in cooler regions
- Does nutrient value exceed the cost of cover crop production
- **May harbor certain insects and disease that affect surrounding plants and vegetation**

Plant Disease Basics

Causal Agents

Biotic factor (living)	Abiotic factor (non-living)
• Fungi • Bacteria • Viruses • Nematodes • Parasitic plants • Insects • Weeds • <i>Can spread from plant to plant (patches/smaller area)</i>	• Temperature extremes • Moisture extremes • Soil problems • Nutrient deficiency or toxicity • Wind • Pesticide toxicity • Improper cultural practices • <i>Do not spread (larger area distribution, uniform)</i>

The Plant Disease Triangle

Pathogen

Fungi
Bacteria
Viruses
Nematodes
Phytoplasmas

Host

Susceptible:
Crop
Cultivar

Disease

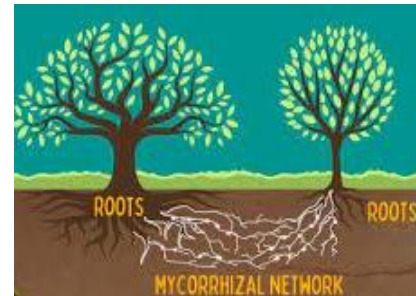
Favorable Environment

Air/soil temperature
Soil fertility
Soil type

Soil pH
Soil moisture
Rainfall/humidity

Disease Management

- The key to disease management is **PREVENTION!**
 - Well managed plants = healthy plants
- Most effective management programs incorporate **all** strategies known to reduce disease severity – “**Integrated Disease Management**”
 - **Physical (pruning, etc.), cultural (irrigation, etc.), biological and chemical**



- **Accurate identification of the disease (pathogen) or disorder is essential for successful management**

NMSU Plant Diagnostic Clinic

- Team effort
- **Test! Don't Guess!**
 - The NMSU Plant Diagnostic Clinic is here for you!!!
 - Co-Director/Weed Specialist: Dr. Leslie Beck
 - Co-Director/Plant Pathologist: Dr. Phillip Lujan
 - Plant Diagnostician: Dr. Srijana Dura
 - Entomologist: Drs. Joanie King & Jane Pierce
 - Horticulturist: Dr. Marisa Thompson
 - Nematologist: Jacki Beacham



NMSU Plant Diagnostic Clinic

- Services provided:
 - **Integrated** plant diagnostic clinic
 - Diseases
 - Abiotic issues
 - Arthropod identification and damage
 - Plant and weed identification
 - Permitted to receive unknowns (diseases/abiotic/nematodes/insects) from within the contiguous 48 states

Plant Diseases in Cover Crops

Triticale (hybrid between wheat and rye)

- Susceptible to a few fungal and viral diseases
 - Fungal: **Fusarium head blight**, Powdery mildew, Ergot, Rusts and Phytophthora
 - Viral: **Triticum Mosaic Virus**



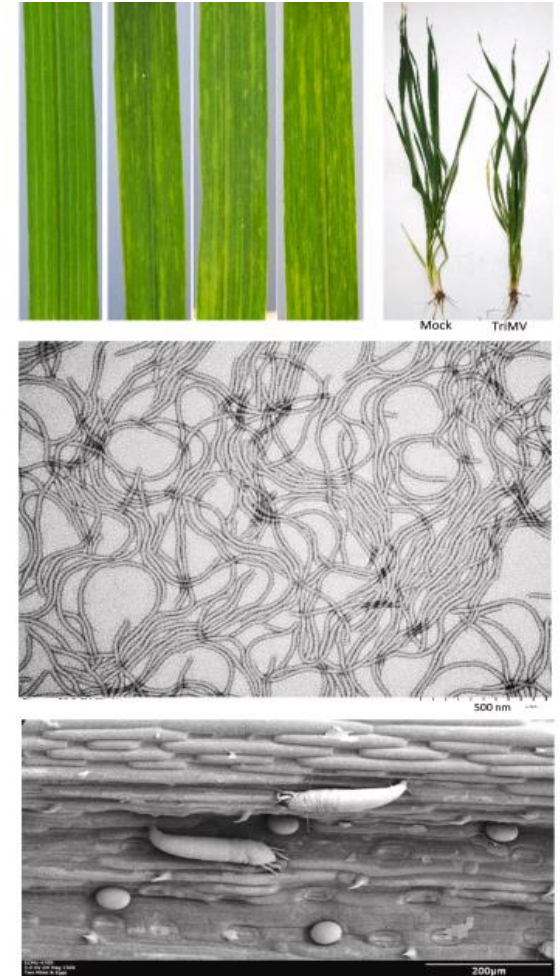
Triticale (hybrid between wheat and rye)

- Fusarium head blight
 - Caused by *Fusarium* spp. with *graminearum* being the predominant species
 - Favorable conditions for infection:
 - Warm and wet with high humidity
 - Symptoms:
 - Bleached spikelets, shrunken kernels and fungal growth on affected heads
 - Management:
 - Resistant varieties, crop rotation (don't plant after corn), fungicides (initial flowering)



Triticale (hybrid between wheat and rye)

- Triticum Mosaic Virus (TriMV)
 - Transmitted by the wheat curl mites
 - Co-infection often occurs with wheat streak mosaic virus (WSMV)
 - Symptoms:
 - Yellowing and streaking, mottling, and stunting
 - Management:
 - Controlling volunteer wheat (mites preferred host)
 - Removal of infected plants



Tatineni et. al., 2025

Austrian Winter Pea

- Susceptible to a few fungal, nematode and viral diseases
 - Fungal: **Powdery mildew**, Sclerotinia and Fusarium wilt
 - Nematode: **Root-knot nematode**
 - Viral: Bean Yellow Mosaic Virus



Austrian Winter Pea

- Powdery mildew
 - Caused by the fungus, *Erysiphe pisi*
 - Favorable conditions for infection:
 - Warm, dry weather with a cool, dewy morning
 - Symptoms and signs:
 - White, powdery fungal growth on leaves, stems and pods, yellowing and leaf drop
 - Management:
 - Resistant varieties, air circulation, field sanitation, crop rotation and fungicides



Austrian Winter Pea

- Root-knot nematode
 - Caused by the nematode, *Meloidogyne* spp.
 - Symptoms:
 - Above-ground: stunted growth, yellowing leaves, wilt, reduced yield
 - Below-ground: galls or knots on the roots
 - Management:
 - Resistant varieties, crop rotation, organic matter (improve soil health and drainage), tilling, solarization, and sanitation



Annual Ryegrass

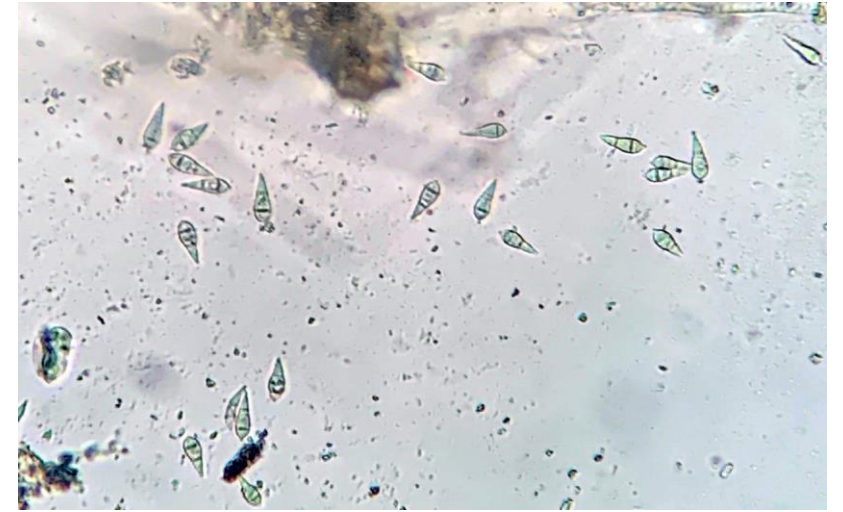
(also called Italian Ryegrass)

- Susceptible to mostly fungal diseases such as **Gray Leaf Spot**, Rusts, **Anthracnose** and Powdery mildew



Annual Ryegrass

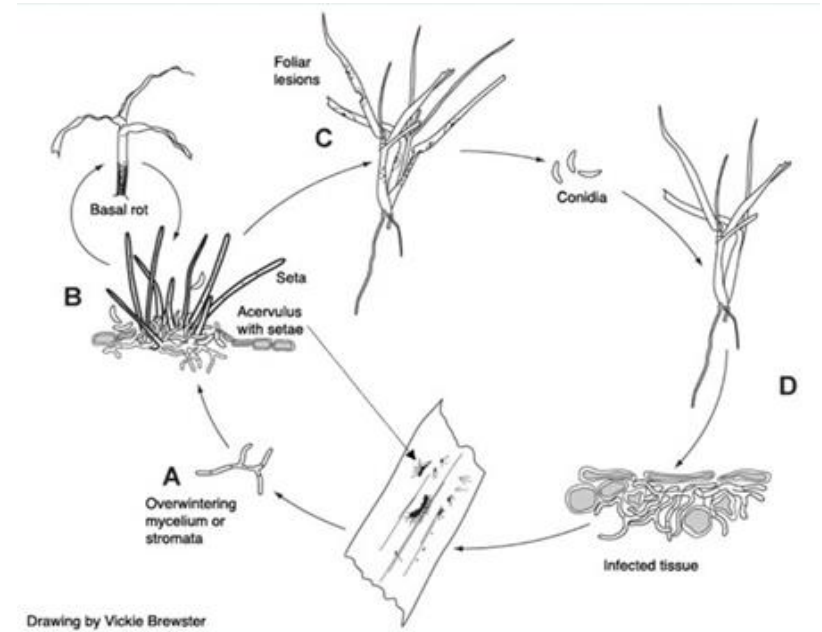
- Gray Leaf Spot
 - Caused by the fungus, *Pyricularia grisea*
 - Favorable conditions for infection:
 - High temperatures (82-90F), leaf wetness, nitrogen fertility, plant stress
 - Symptoms:
 - Blue-gray cast, yellow appearance, leaves can become matted and greasy, leaf lesions, patches and leaf death
 - Management:
 - Cultural practices such as irrigation (water deeply but infrequently), avoid excessive or quick release fertilizer, air circulation; fungicides available



Annual Ryegrass

- Anthracnose

- Caused by the fungus, *Colletotrichum cereale* (graminicola)
- Favorable conditions for infection:
 - Warm (70-90F) and wet conditions, particularly at night, stressed grass (soil compaction or nutrient issues (low potassium or phosphorus or excess nitrogen))
- Symptoms:
 - Foliar blight: yellow to brown lesions on older leaves
 - Basal rot: develops in late summer to fall, infected leaves turn yellow, with a darkened crown at the base of the plant
- Management:
 - Cultural practices such as irrigation (water deeply but infrequently), avoid excessive or quick release fertilizer, air circulation; fungicides available



Clover

Susceptible to viruses and fungal diseases

Viruses: **Alfalfa mosaic**, Red clover mosaic

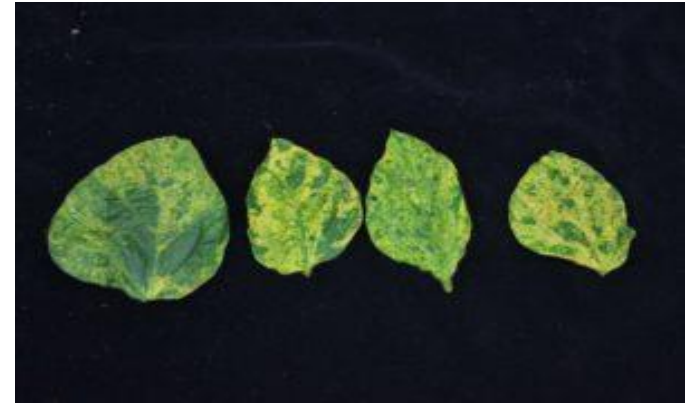
Fungal: Clover rot, Aphanomyces root rot,
Fusarium root rot



New Zealand White Clover
Los Lunas, NM

Clover

- Alfalfa mosaic virus
 - Transmitted by aphids, infected seeds or mechanical spread
 - Symptoms:
 - Leaf mosaic, necrosis, stunting, deformed plants and plant death
 - Management:
 - Use certified virus-free seed, weed control (aphids), resistant varieties, remove infected plants



Clover

- Fusarium root rot
 - Caused by the fungus, *Fusarium* spp.
 - Favorable conditions for infection:
 - Plant stress and insect damage
 - Symptoms:
 - Stunted growth, wilting, root and crown discoloration
 - Management:
 - Promote plant vigor, crop rotation, insect control (root-feeding insects such as root borer), plant good certified seed



Hairy Vetch

Susceptible to fungal diseases and nematode pests

Fungal: Anthracnose, Rusts, Powdery Mildew and **Sclerotinia Stem Rot**

Nematode: Root-knot nematode



Hairy Vetch

- Sclerotinia Stem Rot
 - Caused by the fungus, *Sclerotinia sclerotiorum*
 - Favorable conditions for infection:
 - Cool, wet conditions
 - Symptoms and signs:
 - Wilting, white mycelium on stems, lesions, rot and black sclerotia
 - Management:
 - Air circulation, sanitation, irrigation management and crop rotation; fungicides available



Forage Radish

Susceptible to fungal, bacterial or viral diseases

Fungal: Alternaria leaf blight, cercospora leaf spot, Fusarium wilt, **Verticillium wilt**

Bacterial: **Bacterial soft rot**

Viral: Mosaic virus



Forage Radish

- Verticillium wilt
 - Caused by the fungus, *Verticillium dahliae*
 - Favorable conditions for infection:
 - Between 64-90F and can be spread through soil, wind and water
 - Symptoms:
 - Yellowing of lower leaves, stunting of plant, dark-brown discoloration around and in the vascular system, wilting
 - Management:
 - Crop rotation, destroy infected material



Forage Radish

- Bacterial soft rot
 - Caused by the bacteria, *Pectobacterium* sp. / *Pseudomonas* sp.
 - Favorable conditions for infection:
 - Prolonged moisture from excessive rain or irrigation and mild/humid temperatures
 - Symptoms:
 - Water-soaked tissue, rotted tissue, foul odor and wilting
 - Management:
 - Sanitation, manage humidity, optimize plant health, plant resistant cultivars



Cowpeas

Susceptible to fungal, bacterial and viral diseases

Fungal: Powdery mildew, **Cercospora**,
Fusarium root rot, Southern Blight

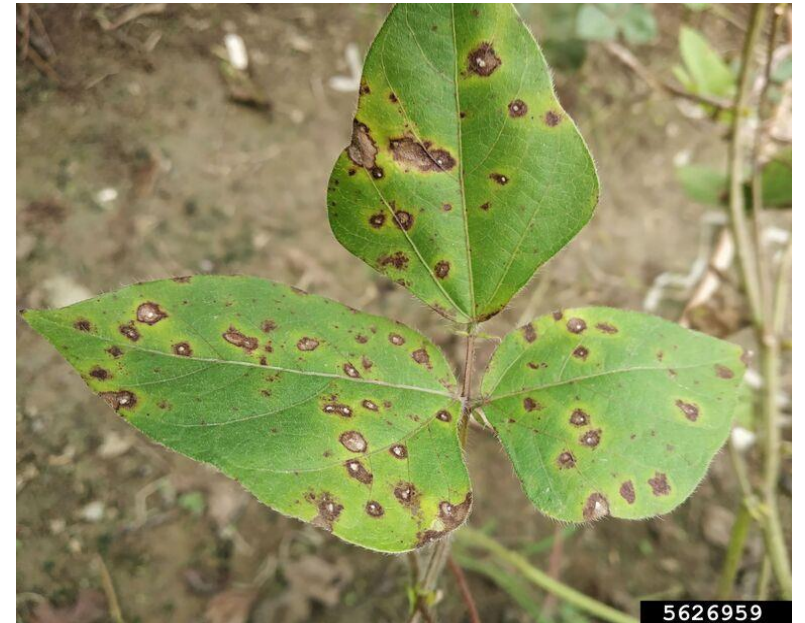
Bacterial: Bacterial blight and Bacterial
wilt

Viral: **Cowpea mosaic**



Cowpeas

- Cercospora leaf spot
 - Caused by the fungus, *Cercospora canescens*
 - Spread by wind and rain-blown spores
 - Symptoms:
 - Leaf spots that expand to become reddish-brown with a yellow halo, powdery appearance, and leaf defoliation
 - Management:
 - Resistant varieties, sanitation, crop rotation, avoid overhead irrigation; fungicides available (mancozeb or copper containing fungicides)



Cowpeas

- Cowpea mosaic virus
 - Transmitted by leaf-feeding beetles (Chrysomelidae), seed or mechanical
 - Symptoms:
 - Leaf mosaic (light and dark green patterns), leaf necrosis, stem and pod discoloration, leaf area reduction, stunting
 - Management:
 - Plant certified seeds, manage beetle populations and maintaining good field sanitation



Lablab (Hyacinth bean)

Susceptible to fungal, bacterial and viral diseases

Fungal: Anthracnose, Powdery mildew, Root Rot

Bacterial: Bacterial Wilt and Bacterial Leaf Spot

Viral: **Lablab Bean Mosaic Virus/Dolichos Yellow Mosaic Virus (DYMV)**



Lablab (Hyacinth bean)

- Lablab Bean Mosaic Virus/Dolichos Yellow Mosaic Virus (DYMV)
 - Transmitted by the whitefly vector, *Bemisia tabaci*
 - Symptoms:
 - Yellow mosaic patches, stunted growth and reduced yields
 - Management:
 - Whitefly management, planting resistant varieties and removal of infected plants



Buckwheat

Susceptible to fungal and viral diseases and nematode pests

Fungal: Stem Rot, Powdery Mildew,
Rhizoctonia Root Rot

Viral: **Curly Top**

Nematode: Root Lesion Nematodes



Buckwheat

- Rhizoctonia Root Rot
 - Caused by the fungus, *Rhizoctonia solani*
 - Favorable conditions for infection:
 - Disease is favored by intermediate soil moisture and most active in warm soil temperatures
 - Symptoms:
 - Root and stem lesions, root girdling, yellowing leaves, stunting and wilting
 - Management:
 - Fungicide-treated seed, crop rotation, improve soil drainage, do not over-fertilize



Buckwheat

- Curly Top Virus
 - Transmitted by the beet leafhopper
 - Symptoms:
 - Stunting, leaf chlorosis, small/shriveled leaves, plant necrosis, plant death
 - Management:
 - Sanitation (manage weeds), remove infected plants, shading (leafhoppers prefer sunny areas)



Sorghum - Sudan

Susceptible to fungal and bacterial diseases

Fungal: Anthracnose, Rust, and Leaf Blight

Bacterial: **Bacterial Leaf Stripe**



Sorghum - Sudan

- Bacterial leaf stripe
 - Caused by the bacteria, *Burkholderia andropogonis*
 - Favorable conditions for infection:
 - High humidity, prolonged leaf wetness, presence of infected residue from previous crops
 - Symptoms:
 - Elongated, narrow, yellow to brown lesions, wavy or irregular margin of the lesions
 - Management:
 - Resistant hybrids, crop rotation, sanitation, seed treatment



Sesbania (*Sesbania exaltata*)

Susceptible to fungal, viral and nematode pests

Fungal: Collar and Stem Rot, Leaf Spot

Viral: **Sesbania Mosaic Virus** and Cowpea Mild Mottle Virus

Nematode: Root-knot nematode



Sesbania (*Sesbania exaltata*)

- Sesbania Mosaic Virus
 - Transmitted by mechanical or sap
 - Symptoms:
 - Mosaic symptoms, stunted growth, reduced photosynthesis and leaf deformation
 - Management:
 - Prevention (no cure), use certified seed, careful handling and destroy infected plants



The Plant Disease Triangle

Pathogen

Fungi
Bacteria
Viruses
Nematodes
Phytoplasmas

Host

Susceptible:
Crop
Cultivar

Disease

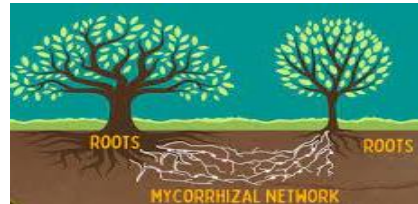
Favorable Environment

Air/soil temperature
Soil fertility
Soil type

Soil pH
Soil moisture
Rainfall/humidity

Disease Management

- The key to disease management is **PREVENTION!**
 - Well managed plants = healthy plants
- Most effective management programs incorporate **all strategies** known to reduce disease severity – “**Integrated Disease Management**”
 - **Physical** (pruning, etc.), **cultural** (irrigation, planting area, etc.), **biological** and **chemical**



- **But first! Accurate identification of the disease (pathogen) or disorder is essential for successful management**

Questions about the presentation or plant disease problems/sampling suggestions?

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