

Growing Healthy Soil

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Overview

- How does soil type impact management
- How can you improve soil structure
- What is a cover crop
- How can you use cover crops on your farm?



SOIL BASICS



Soils: more than “just dirt”

- Hold up plants
- Provide air and water to plants
- Supply nutrients
 - Plants need sufficient quantity but not too much
- Provide habitat for soil organisms



How do you
describe
good soil?

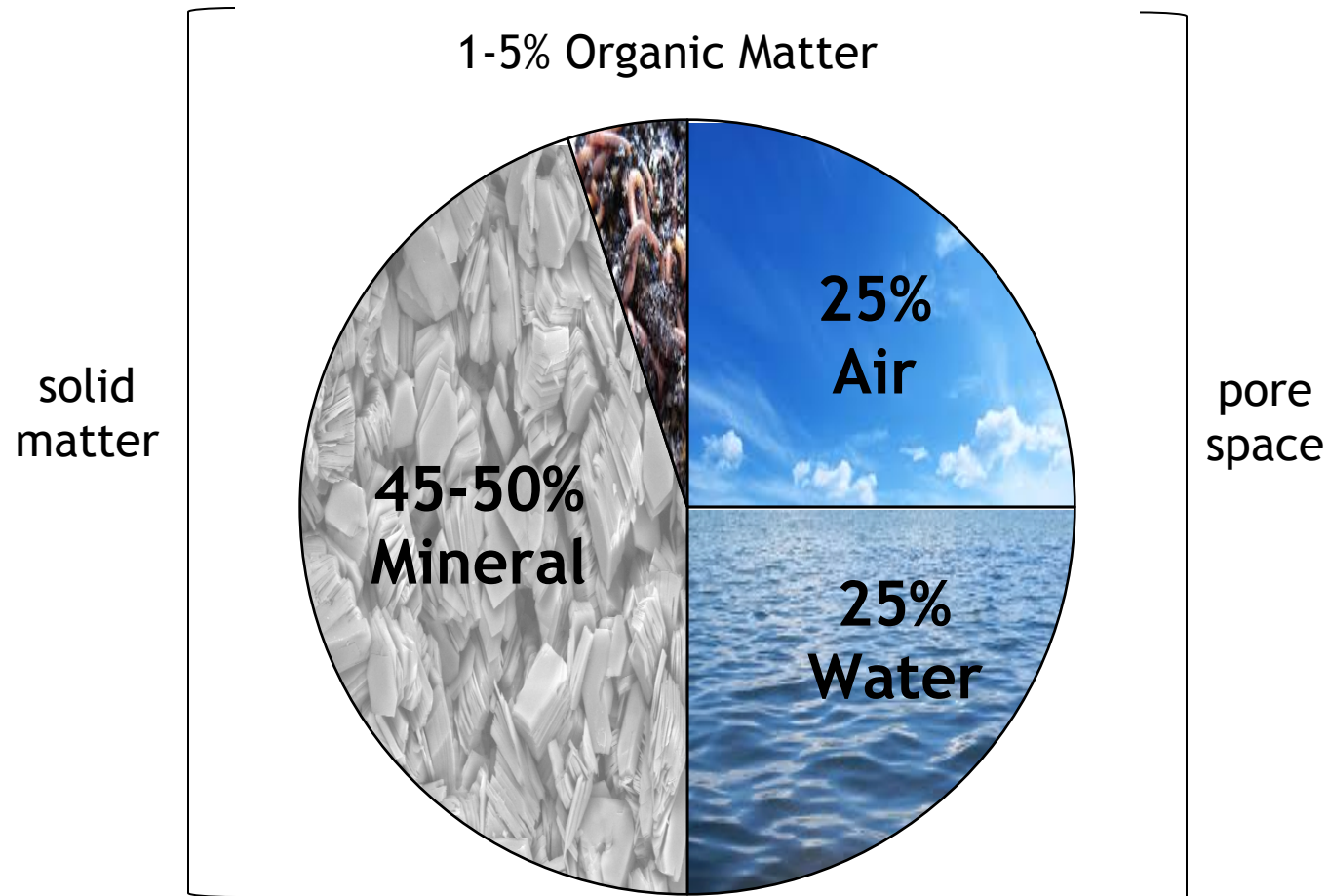


Characteristics of ideal soil

- Fertile
- Deep
- Well drained/aerated
- High in organic matter
- Friable
(soil is easily worked)



What is soil?



Solid matter: Mineral and organic components

- Broken down rock particles
 - Clay particles hold nutrients
 - Particle size determines pore space, drainage, etc
- Organic matter (containing carbon)
 - Decomposed plant and animal matter
 - Ideal soil is about 5% organic matter
 - Source of food for soil microorganisms
 - Source of nutrients for plants
 - Holds minerals against loss due to leaching



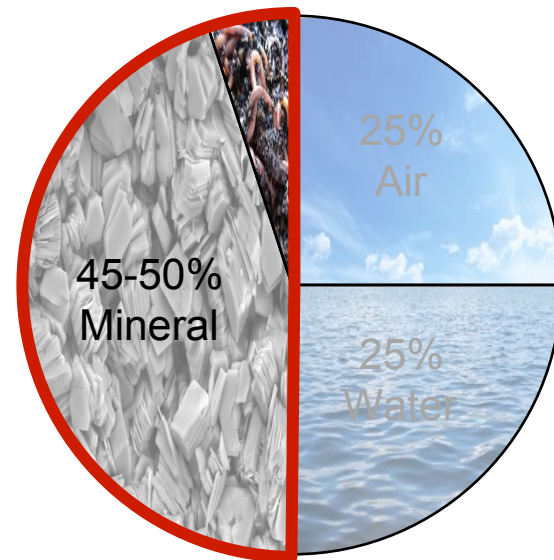
The not-solid stuff: Pore Space

- Air (~25% of total soil volume)
 - Oxygen supports soil life
 - Roots
 - Microbes
 - Air can be displaced by water
- Water (~25% of total soil volume)
 - Carries nutrients to plants

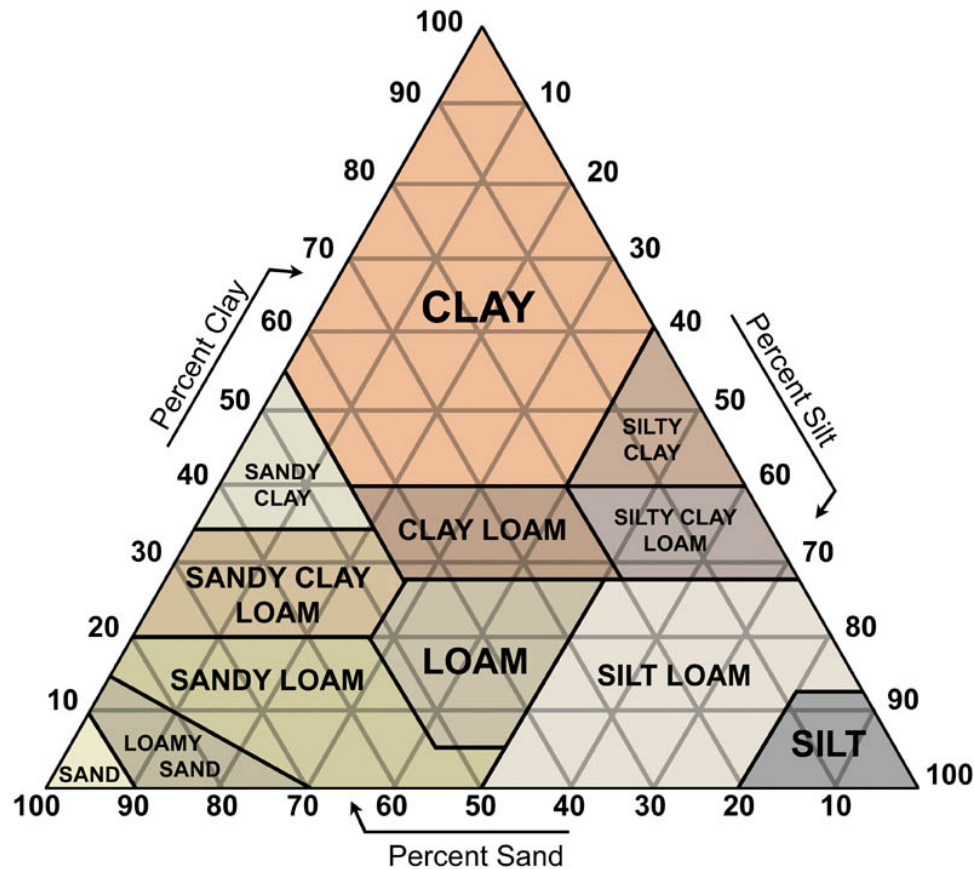


Soil Texture

- Can NOT be changed
- Determined by mineral composition (the solid stuff)
 - Particle size (sand, silt, clay)
 - What particles are made of
- Why is texture important?
 - The texture will determine how much air is in soil and how well water flows through the soil
 - Determines how easily the soil is worked and under what conditions



Soils are a mix of sand, silt and clay



Soil texture: Sand



0.2 mm - 2 mm

- Feels gritty if rubbed between your fingers
- Larger gaps (water flows through more easily)
- Warms up and dries early in spring
- Low in organic matter
- Low in nutrients



Soil texture: Silt

0.002 to 0.05 mm

- About as thick as a strand of hair!
- Feels like flour
- Don't till more than necessary, or this good soil will get washed away!



Soil texture: Clay

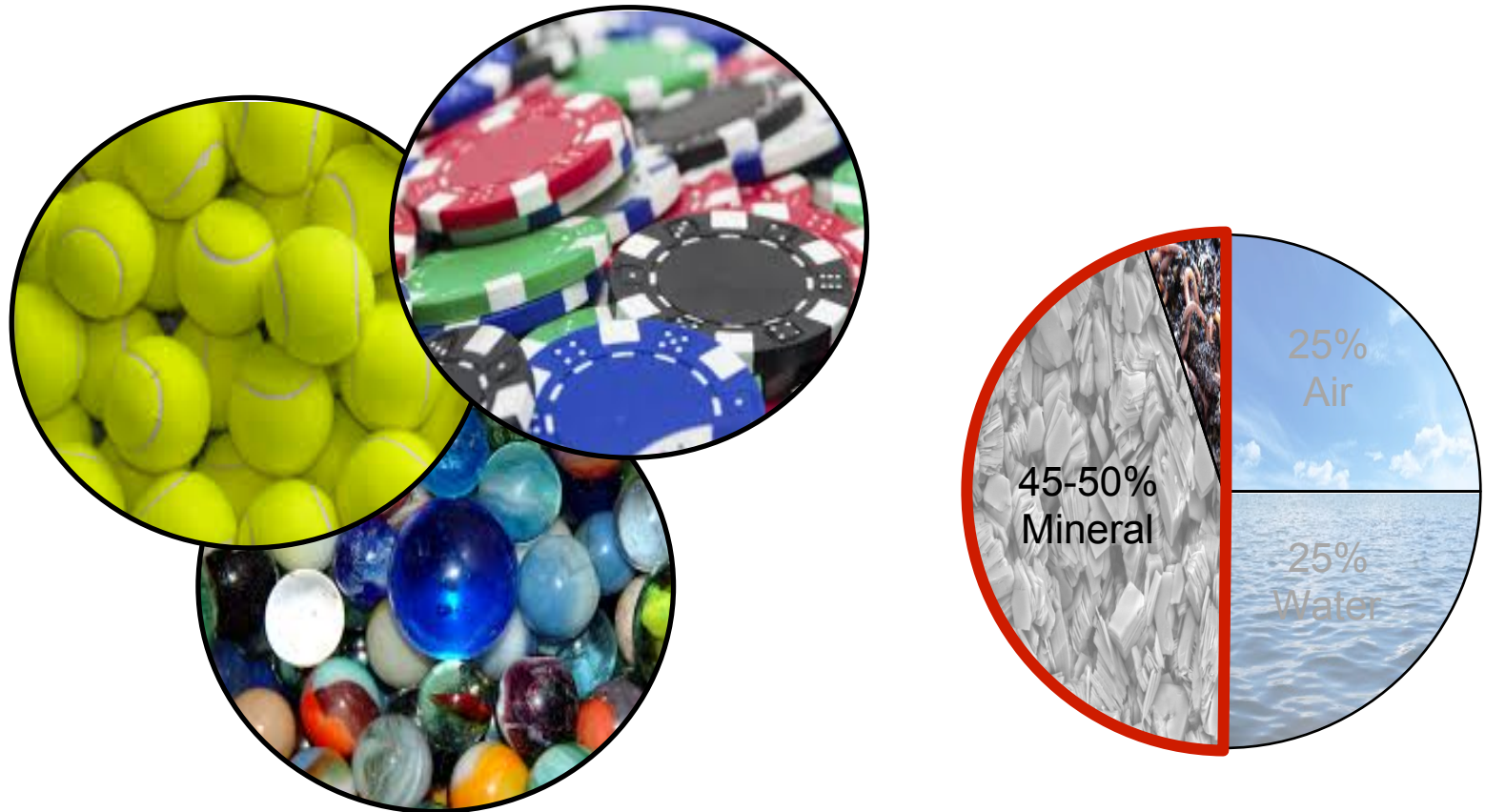


Smaller than 0.002 mm

- Small gaps
- Root growth is poor due to small spaces between soil particles
- Feels sticky when wet
- Does not drain easily and is difficult to work
- Dries slowly in spring
- Usually high in nutrients



Soil Texture



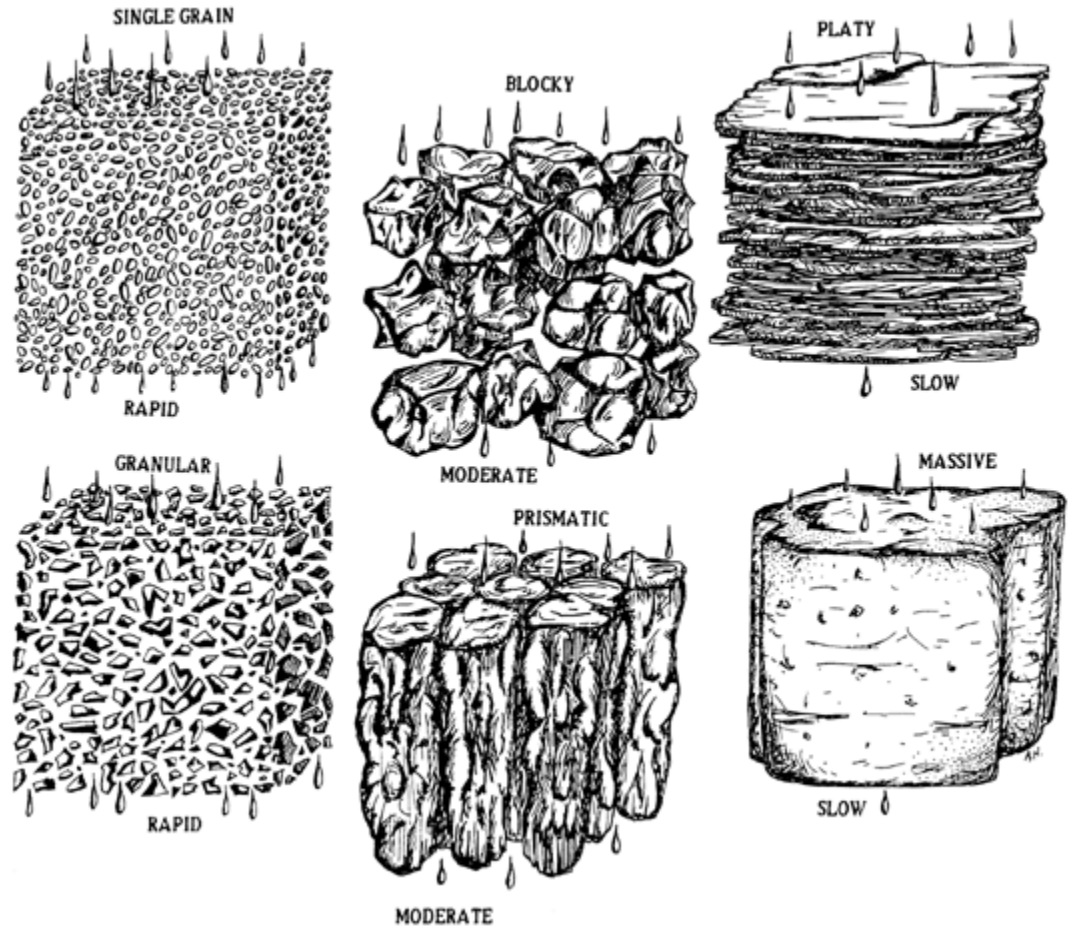
Soil Types

- Most soils are a mixture of different soil textures
 - Often a soil type will be dominated by a particular texture
- Can group soil types by how well drain and major texture class they contain
 - Heavy soils
 - Contain a high proportion of clay
 - Light soils
 - Contain a high proportion of sand
- Important to be aware of the soil type because it will determine the management practices you need to use



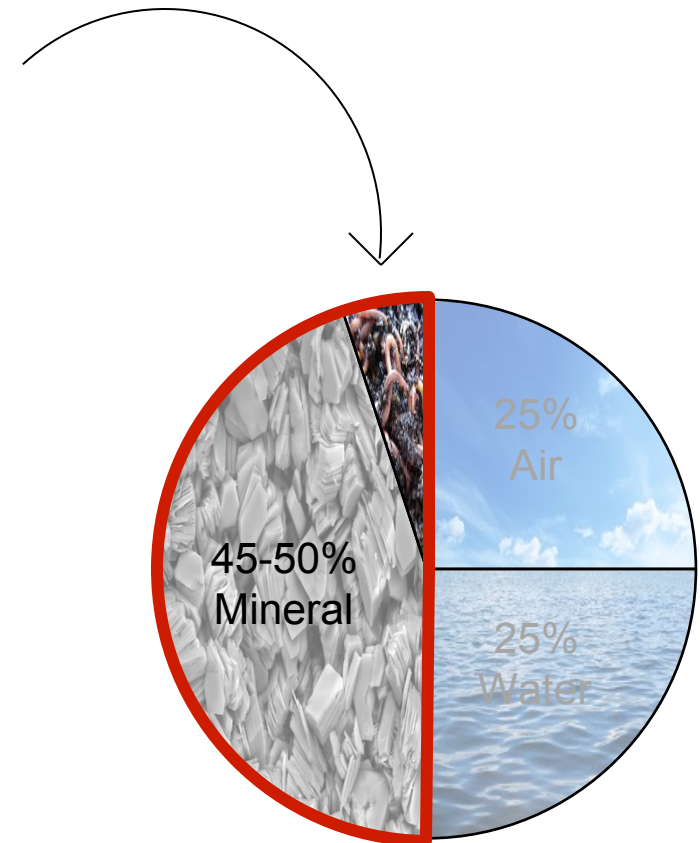
Soil Structure

- Surface soil structure CAN be changed.
- Organic matter
- Compaction



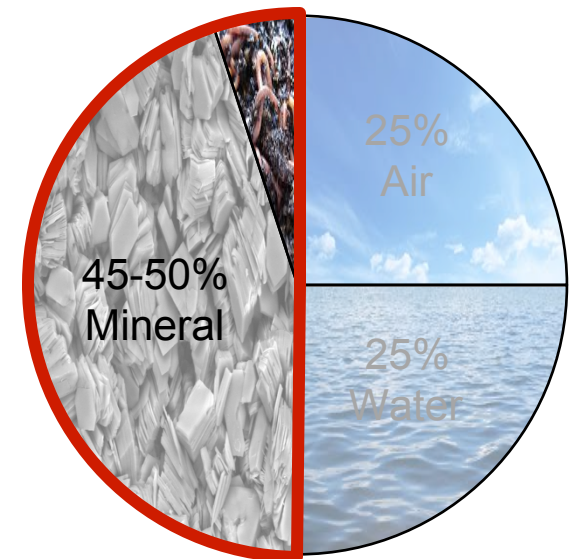
Soil Organic Matter (SOM)

- Organic Matter can make up anywhere from 1 to 5% of soil
- It's VERY important!
- We can change how much is in soil with how we manage soil.



Soil Organic Matter (SOM)

- Organic = materials that were once alive, either recently or thousands of years ago
- Mostly a source of carbon (C) and nitrogen (N), but can also provide other nutrients - very nutritious!



SOIL HEALTH



Why Should I Care about Soil Health?

What conditions let crops do well? What is soil like when crops are healthy?

How do your farming practices change the soil?

Do you have any practices to improve your soil?



Micro-organisms make nutrients available for plants



Having a more diverse soil food web can mean that inputs are broken down more efficiently for plants to use



Reduce erosion, increase soil water



Having better aggregation decreases erosion and runoff



Stronger plants



Water filtration



Having good soil quality means good water filtration!



**MORE
PRODUCTIVE
CROPS**



WAYS TO IMPROVE SOIL HEALTH



1. Crop rotation



2. Minimize tillage



3. Add organic matter



4. Cover crops



Discussion

What practices do you use on your farm to maintain or improve soil health?

Are there any practices that you would like to use in the future?





COVER CROPS



What is a cover crop?

- **COVER CROP:** grown to prevent soil erosion and manage soil organic matter
- **GREEN MANURE:** builds soil organic matter and increase plant available nitrogen
- **CATCH CROP:** retrieves left over nutrients to prevent pollution

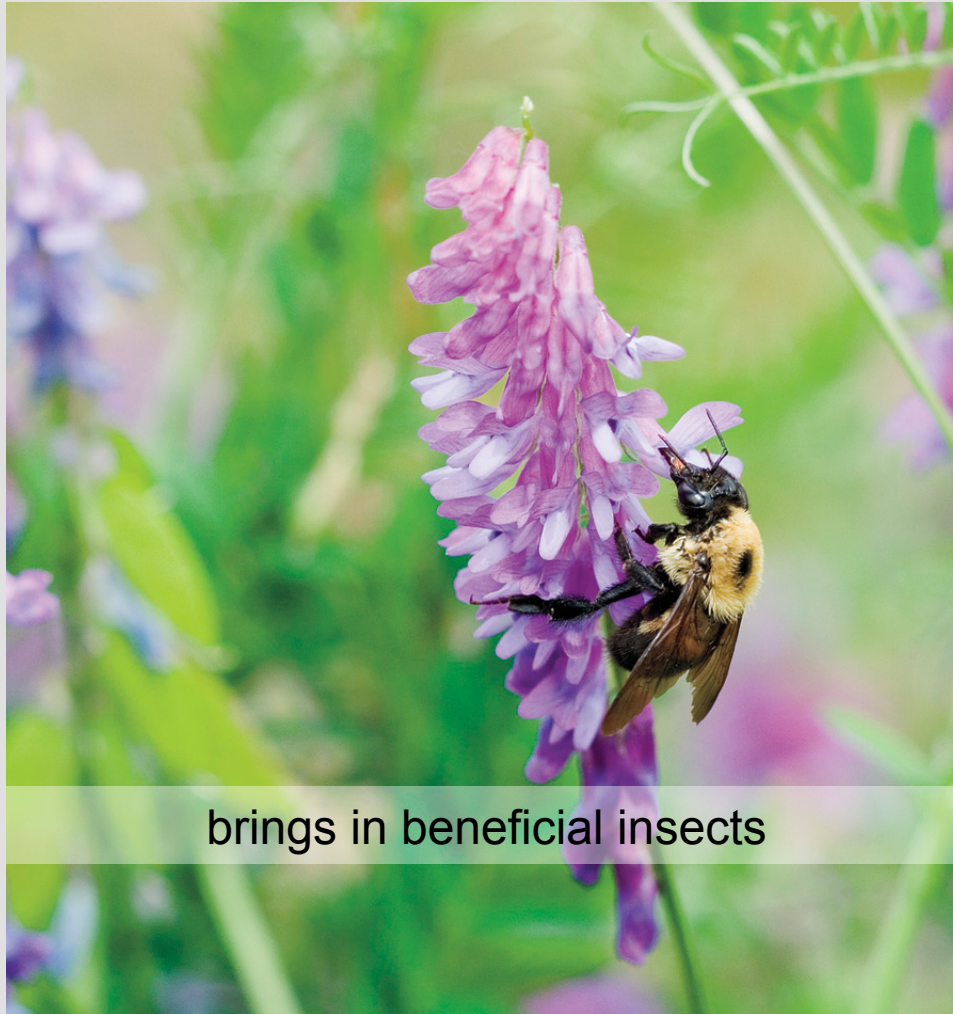


Benefits of cover crops

- How are cover crops different from other amendments?



Benefits of cover crops



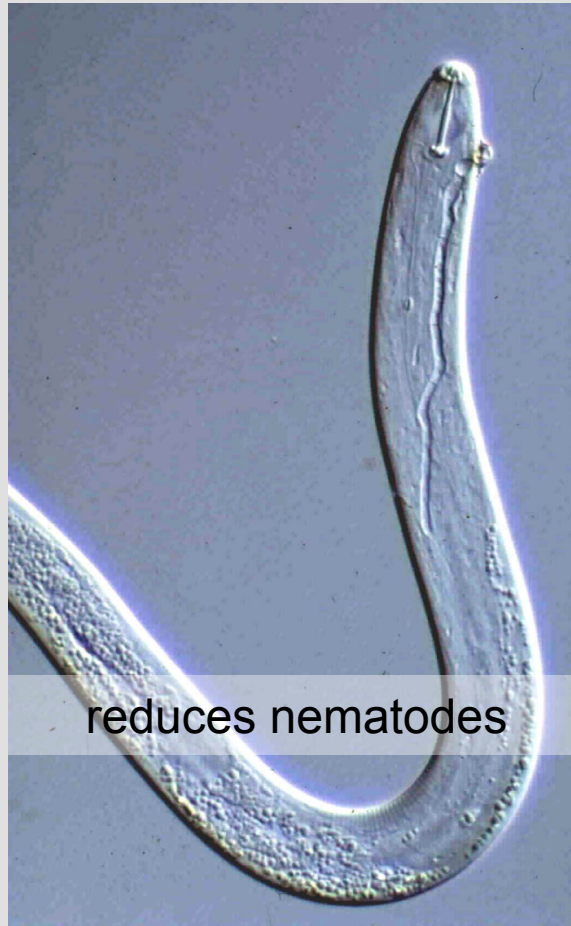
brings in beneficial insects



Benefits of cover crops



Benefits of cover crops



reduces nematodes



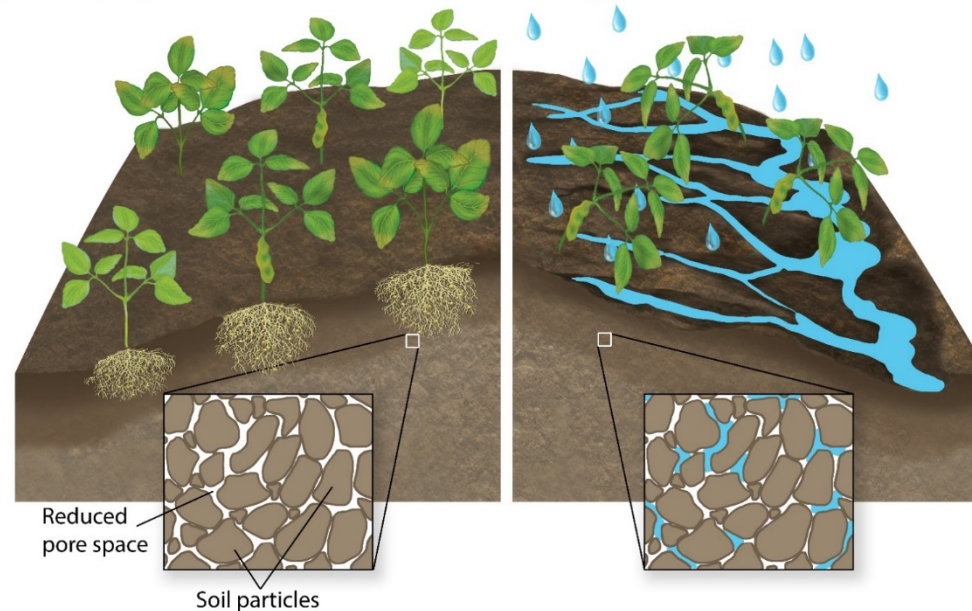
Benefits of cover crops



Soil quality and water infiltration

Compaction of soils break down aggregate and compresses soil particles together. Roots have difficulty penetrating deeply.

Compacted soils lose the ability to absorb water easily, leading to increased erosion and low subsoil moisture.

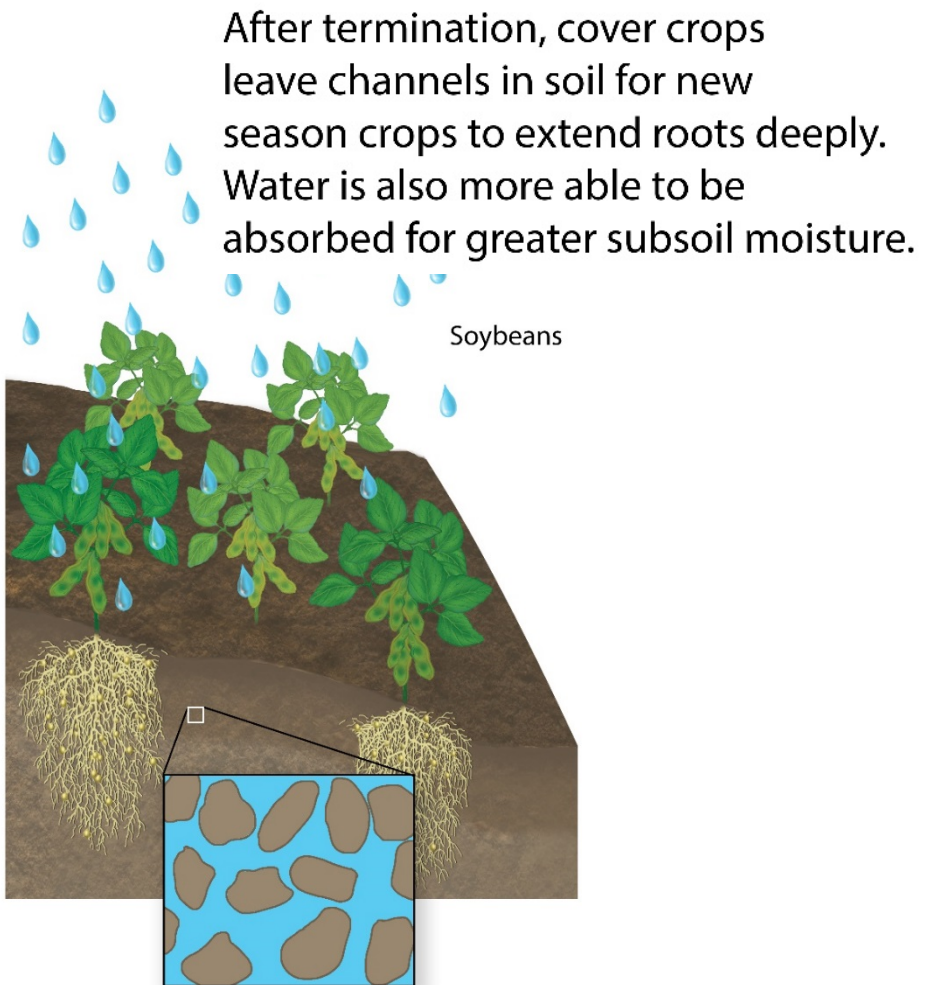
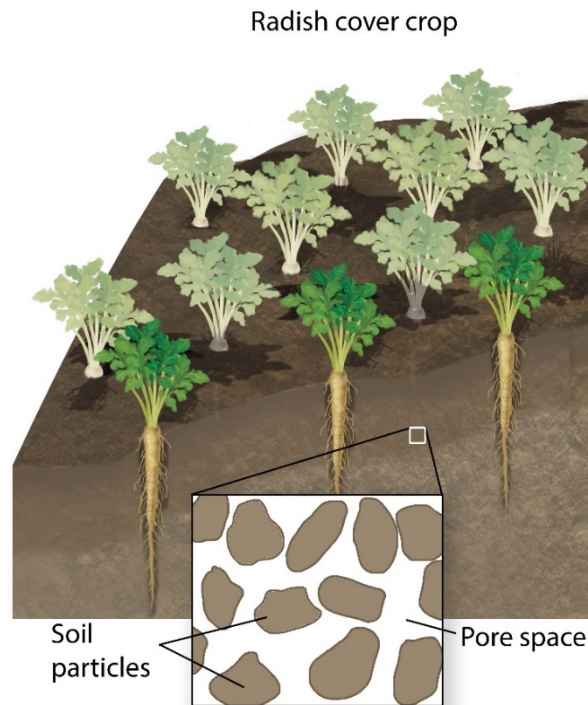


Graphic: Carlyn Iverson and USDA-SARE



Cover crops improve infiltration and mitigate erosion

Cover crops such as radishes extend their strong roots deep into soil creating pathways for water, increasing subsoil moisture and mitigating erosion during strong rain events



Cover crops reduce erosion



Photo: "Let's talk cover crops!". USDA Fact Sheet.



Benefits of cover crops



increases water infiltration



Benefits of cover crops



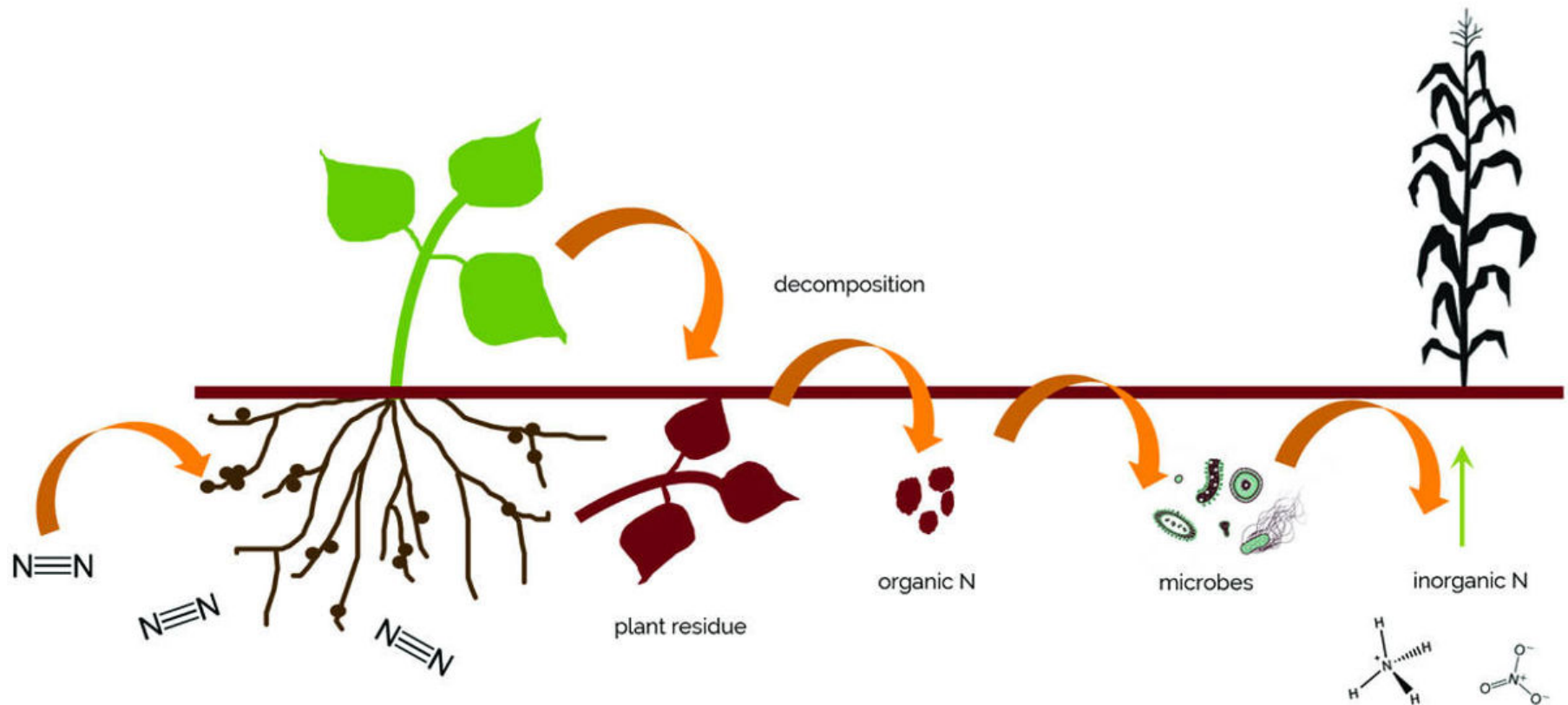
scavenges excess nutrients



Benefits of cover crops



Nitrogen credit



Free fertilizer

Table 9.5. Green manure nitrogen credits.

Crop	< 6" growth	> 6" growth
	————— lb N/a to credit —————	
Alfalfa	40	60–100 ^a
Clover, red	40	50–80 ^a
Clover, sweet	40	80–120 ^a
Vetch	40	40–90 ^{a,b}

^a Use the upper end of the range for spring seeded green manures that are plowed under the following spring. Use the lower end of the range for fall seedings.

^b If top growth is more than 12 inches before tillage credit 110–160 lb N/a.



Benefits of cover crops



controls weeds



Benefits of cover crops



adds organic matter



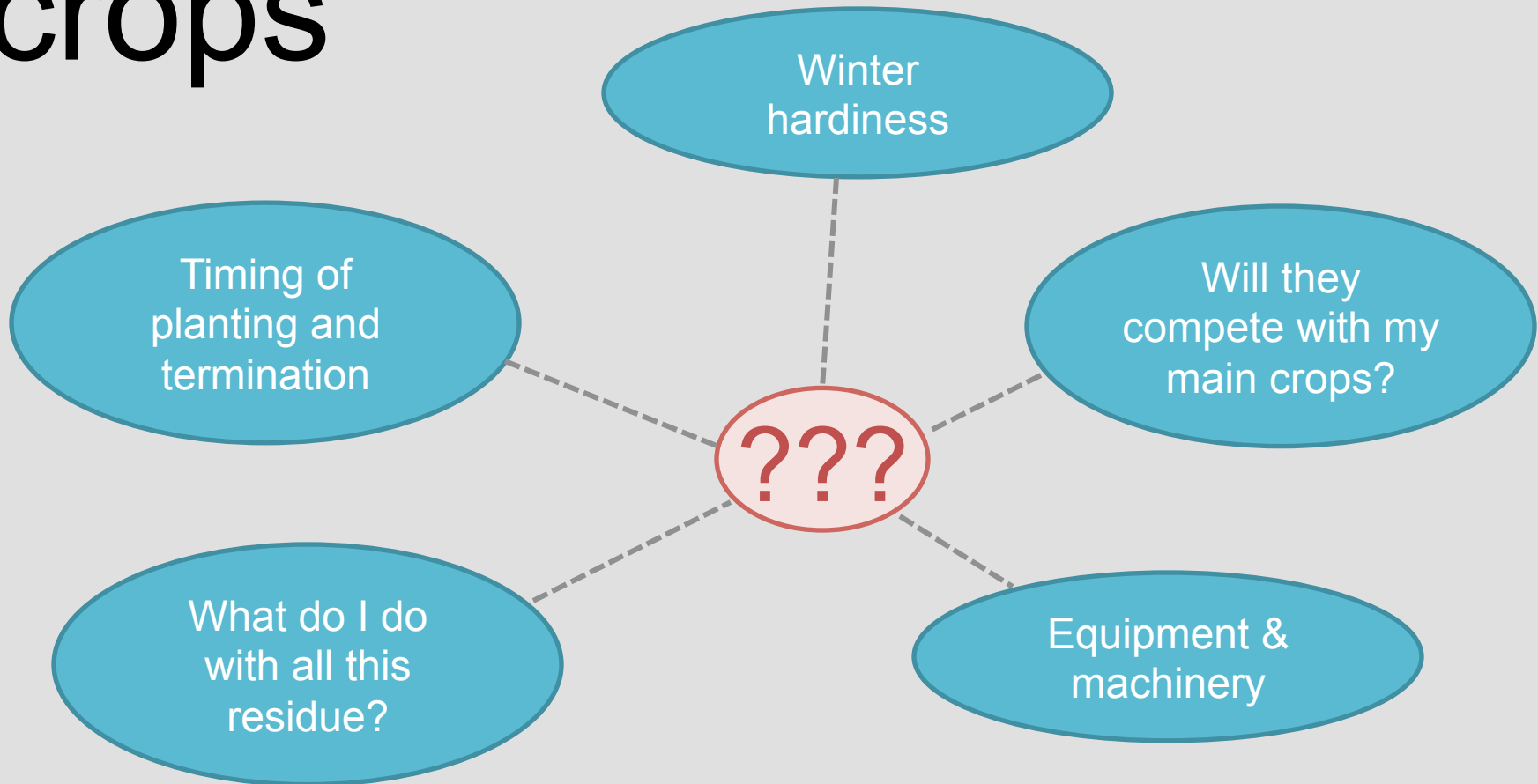
Discussion

Have you grown cover crops? What was your experience?

What questions do you have about cover crops?



Challenges of cover crops



Selecting a cover crop

- Choose a goal
- Establish seasonal windows
- Make plans for termination
- Start small, experiment!



Types of Cover Crops

Non-legume

- Grasses, brassicas, buckwheat
- Uses
 - Add organic matter
 - Suppress weeds
 - Reduce erosion
 - Scavenge nutrients
 - Do NOT contribute N

Legume

- Vetch, clover, peas, alfalfa
- Uses
 - Fix nitrogen
 - Reduce erosion
 - Usually less organic matter and biomass than a grass



Choose a goal

- Reduce erosion
 - Anything that keeps the ground covered
 - Grasses are great at scavenging nutrients
- Provide N
 - Legumes
 - Terminate when flowers appear
- Fall catch crop
 - Grasses or brassicas
 - Scavenge nutrients
- Add organic matter
 - Anything with lots of roots, especially grasses
- Weed suppression
 - Brassicas, grasses
 - Quick growth
- Reduce soil compaction
 - Large rooted crops such as tillage radish



Cover Crop Chart

Credit: Territorial Seeds

Key to Symbols

= Excellent
 = Very Good
 = Good
 = Fair
 = Poor

	Species	When To Plant	Min Germ Temp	Seeding Depth Inches	Seed Per 1000 sq ft	Pounds Of Seed Per Acre	Hardiness To Zone	Legume N Source	Nitrogen Recycler	Chokes Out Weeds	Pounds Organic Matter Per Acre	Forage Or Hay	Attracts Beneficial Insects	Erosion Control	Nematode/Symphytan Control	Soil Builder	
Legumes	Summer Alfalfa	Late Summer	45°F	¼-½	½ lb	15-20	5				2000-4000						
	Hairy Vetch	Early Autumn, Spring & Summer	55°F	1½-2½	1 lb	25-40	4				2300-5000						
	Common Vetch	Early Autumn, Spring & Summer	55°F	1½-2½	1 lb	25-40	4				2300-5000						
	Austrian Field Peas	Autumn	40°F	1-3	2-4 lbs	75-100	7				4000-5000						
	Crimson Clover	Anytime	45°F	¼-½	1-2 lbs	30-40	7				3500-5500						
	Mammoth Red Clover	Early Autumn	40°F	¼-½	½ lb	20	4				4000-6000						
	Miniclover®	Spring to Autumn	40°F	¼-½	1-2 lbs	8-10	4				2000-6000						
	New Zealand White Clover	Spring to Autumn	40°F	¼-½	¼ lb	6-10	4				2000-6000						
	Berseem Clover	Early Autumn	42°F	¼-½	1 lb	15-20	8				6000-10,000						
	Fava Beans	Autumn	55°F	1-3	5 lbs	200	7				3500-7000						
	FIXatioN Balansa Clover	Early Autumn	40°F	⅛-¼	1-2 lbs	5-8	4				6000-10,000						
Brassicas	Mustard	Spring & Summer	40°F	¼-¾	¼-½ lb	15-20	7				5000-12,000						
	Radish	Late Summer	45°F	¼-½	½ lb	10-12	8				4000-7000						
	Turnips	Spring to Late Summer	45°F	¼-½	¼ lb	5-7	6				8000-12,000						
Cereal Grains & Grasses	Annual Rye Grass	Early Autumn	40°F	½	1 lb	20-30	5				2000-9000						
	Buckwheat	After last frost	48°F	½-1½	2-3 lbs	75-100	Not Frost Tolerant				2000-4000						
	Sudangrass	Late Spring to Late Summer	60°F	½-1½	1-2 lbs	30-50	Not Frost Tolerant				8000-10,000						
	Winter Rye Grain	Autumn	34°F	½-2	3-4 lbs	75-150	3				3000-10,000						
	Winter Barley	Late Summer to Autumn	37°F	¾-2	2-3 lbs	75-125	7				2000-10,000						
	Winter Triticale	Autumn	34°F	1½-2	2-3 lbs	60-120	6				6000-8000						
	Winter Wheat	Autumn	38°F	½-1½	3-4 lbs	70-150	4				3000-8000						
	Winter Oats	Autumn	38°F	¾-2	2-3 lbs	100-120	8				2000-10,000						

Timing

- Fitting cover crops in between cash crops can be a challenge.
- Consider different options through the year
 - Winter-killed covers for early spring planting
 - Over-wintered covers for late spring/early summer planting
 - Mid-summer cover between spring and fall crops



Establish seasonal windows



Full season (parsnips, celery)

Summer (tomatoes, eggplant)

Spring
(arugula,
broccoli)

Fall
(arugula,
broccoli)



Establish seasonal windows



Full season

Fall-seeded, winter hardy

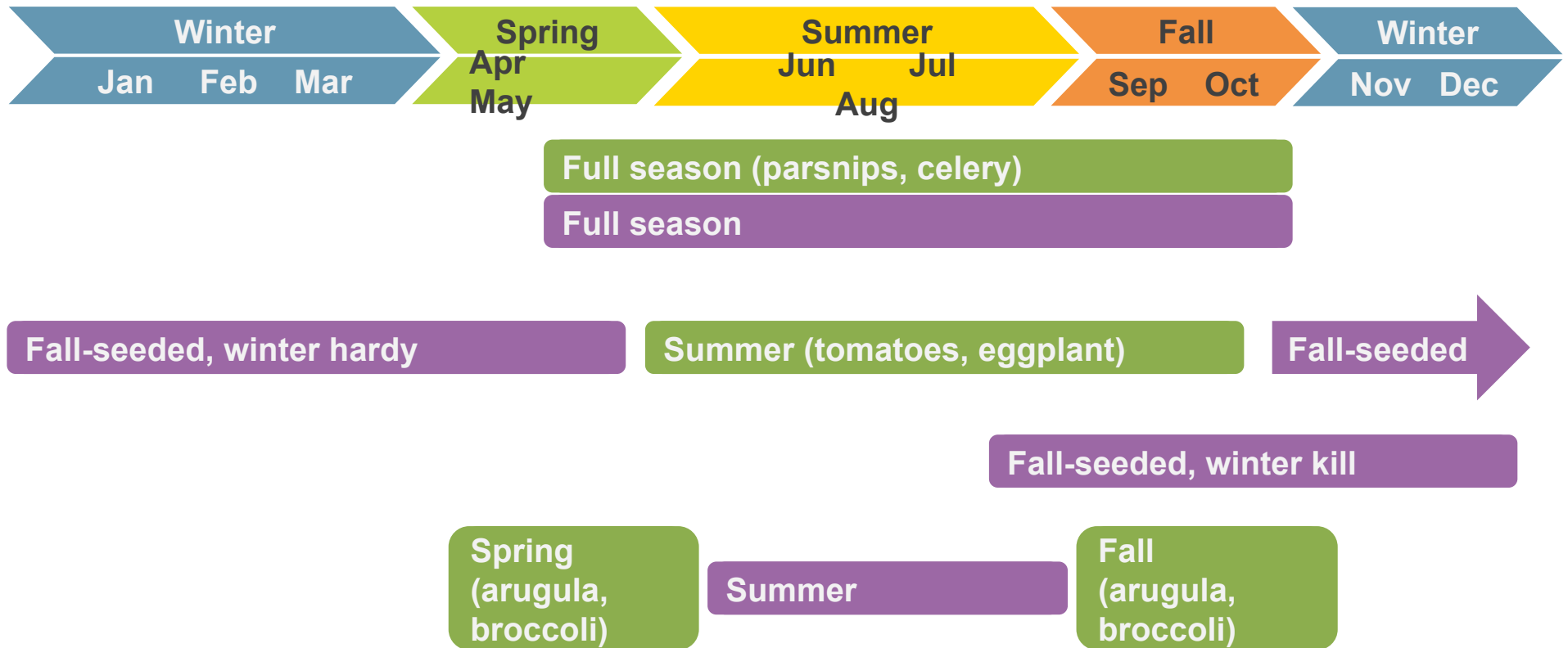
Fall-seeded

Fall-seeded, winter kill

Summer



Establish seasonal windows



Cash crop competition

- Correct timing of planting and termination can reduce or eliminate cash crop competition
- Plan for some time (1-2 weeks) between cover crop termination and cash crop planting
- Cover crops can often be seeded into a standing cash crop.



Winter-hardiness



- Choose cold-hardy varieties
- Warm winters with light snow cover and windy conditions make winter survival more challenging



Plan for termination



Cover crop summary

1. Choose a goal
2. Look for seasonal windows
3. Plan for termination
4. Start small, experiment



Thank You!

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FINDING YOUR SOIL TYPE

Anne Pfeiffer, September 2012





You are here: Web Soil Survey Home

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The simple yet powerful way to access and use soil data.



Welcome to Web Soil Survey (WSS)



Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Four Basic Steps

1 Define.



Use the **Area of Interest** tab to define your area of interest.

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Area of Interest

Import AOI

Quick Navigation

Address

Address ?

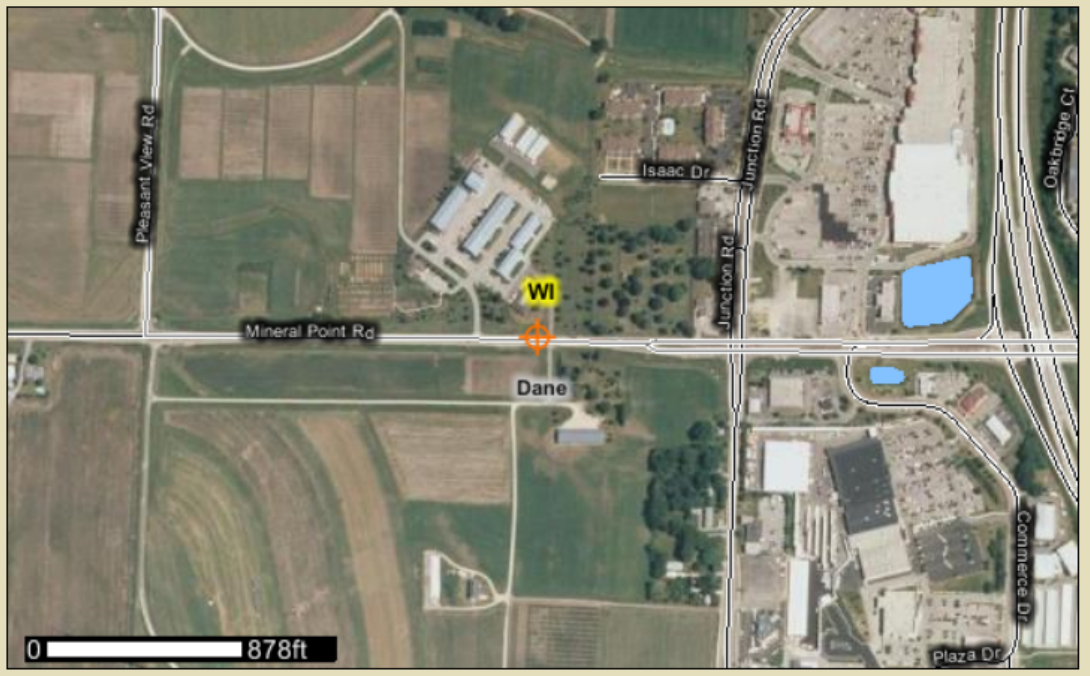
Show location marker

- State and County
- Soil Survey Area
- Latitude and Longitude
- PLSS (Section, Township, Range)
- Bureau of Land Management
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- Hydrologic Unit

Area of Interest Interactive Map

Legend

View Extent



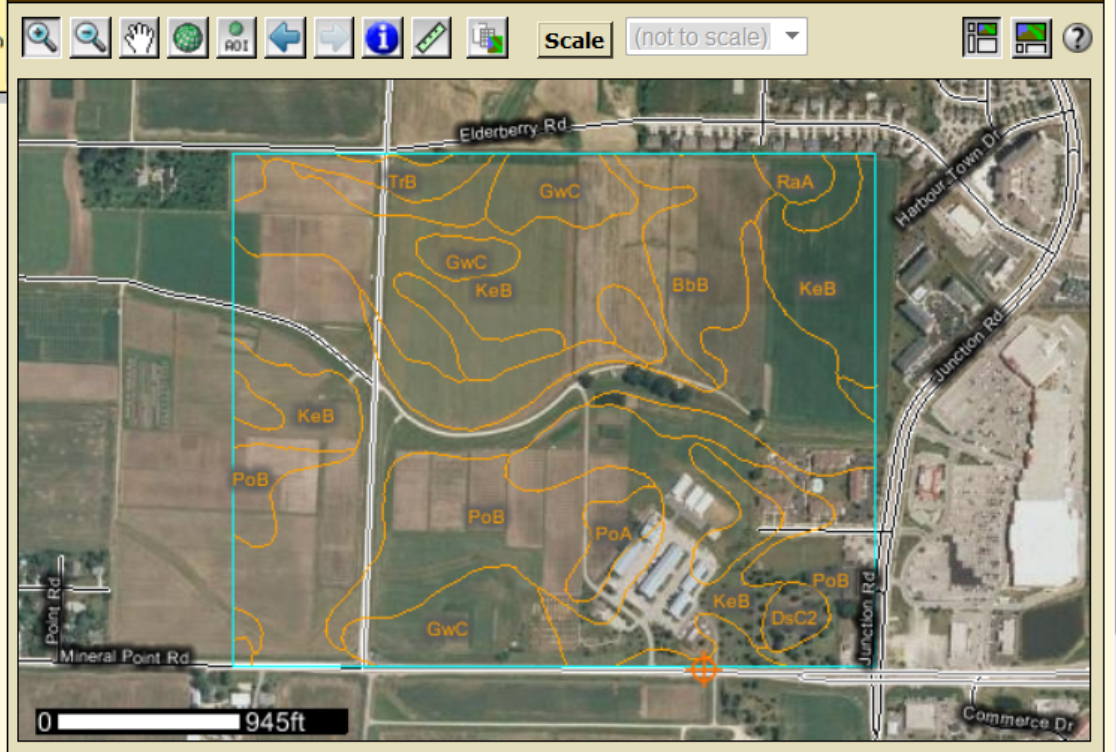
Search

Map Unit Legend

Dane County, Wisconsin (WI025)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BbB	Batavia silt loam, gravelly substratum, 2 to 6 percent slopes	14.6	7.4%
DsC2	Dresden silt loam, 6 to 12 percent slopes, eroded	9.6	4.9%
GwC	Griswold loam, 6 to 12 percent slopes	19.6	10.0%
KeB	Kegonsa silt loam, 2 to 6 percent slopes	58.4	29.7%
PoA	Plano silt loam, gravelly substratum, 0 to 2 percent slopes	47.2	24.0%
PoB	Plano silt loam, gravelly substratum, 2 to 6 percent slopes	41.1	20.9%

Soil Map



Map Unit Description

Printable Version

Area of Interest (AOI)

Search

Map Unit Legend

Dane County, Wisconsin (WI)

Map Unit Symbol	Map Unit Name
BbB	Batavia silt loam, gravelly substratum, 2 to 6 percent slopes
DsC2	Dresden silt loam, 6 to 12 percent slopes, eroded
GwC	Griswold loam, 6 to 12 percent slopes
KeB	Kegonsa silt loam, 2 to 6 percent slopes
PoA	Plano silt loam, gravelly substratum, 0 to 2 percent slopes
PoB	Plano silt loam, gravelly substratum, 2 to 6 percent slopes
RaA	Radford silt loam, 0 to 3 percent slopes
RnC2	Ringwood silt loam, 6 to 12 percent slopes, eroded
TrB	Troyel silt loam, 1

Report — Map Unit Description

Dane County, Wisconsin

KeB—Kegonsa silt loam, 2 to 6 percent slopes

Map Unit Setting

Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days

Map Unit Composition

Kegonsa and similar soils: 100 percent

Description of Kegonsa

Setting

Landform: Outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over sandy and gravelly outwash

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

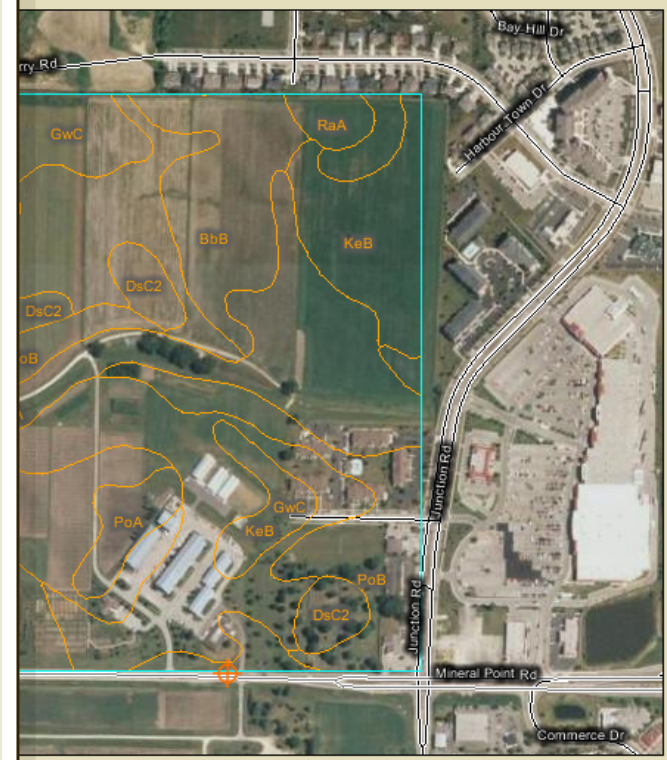
0 to 12 inches: Silt loam
12 to 29 inches: Silt loam
29 to 33 inches: Sandy clay loam
33 to 60 inches: Gravelly coarse sand

Description — Map Unit Description

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soil map for this area is intended to be used. Mapping of soils in your AOI were mapped at 1:15,840. The design of map are dependent on that map scale. In cause misunderstanding of the detail of mapping and the small areas of contrasting soils that could have been

Discussion

- How could you use this information to choose a farm site?
- How can this information help you manage your land?

