

Cover Crops

Organic Soil Fertility Management

Feeding the Soil to Feed the Plants



Presentation

- Definitions
- Cover crops for organic matter additions and weed control
- Why, when, what cover crops to grow
- Types of cover crops and benefits





Cover Crops

A wide-angle photograph of a vast agricultural field. The foreground and middle ground are filled with a dense carpet of cover crops, primarily in shades of purple and pink, with some green foliage visible. The field extends to a flat horizon line under a bright blue sky with scattered white clouds. The overall scene is bright and clear, suggesting a sunny day.

Why grow cover crops?

When to grow a cover crops crop

What cover crops to grow

Semantics

Cover Crop: grown mainly to reduce soil erosion by covering the ground with living vegetation and living roots that hold the soil.

Green Manure Crop: grown to help maintain soil organic matter and fertility.

Catch Crop: grown to retrieve remaining nutrients in the soil following a cash crop, prevents nutrient loss over the winter.

Why Grow a Cover Crop?

A. Primary Benefits (goals) of cover cropping

1. Reduce the need for OM additions & improve soil structure & soil tilth
2. Legumes CCs supply much of needed N additions
3. Break weed & insect pest cycles
4. Improve soil biological activity
5. Improve yields by enhancing overall soil health
6. Protect against soil erosion
7. Conserve soil moisture
8. Protect water quality
9. Cumulative benefits

B. Secondary Benefits

1. Source of mulch
2. Harvest for forage
3. Seed production
4. Livestock grazing

Necessity of Organic Matter Addition is Organic Farming

- Organic matter additions to the soil add
 - Carbon and nutrients for micro organisms
 - Micro organism in the soil breakdown OM
 - The breakdown of OM releases nutrients for crops
- In order to maintain sufficient nutrients for your crop
 - Organic matter must be added to the soil to replace organic matter breakdown and crop nutrient uptake to main soil fertility and sustainability
- Organic matter can be add in many forms:
 - Green manures (cover crops turned into the soil)
 - Animal manures
 - Composts (animal or plant source or both)
 - Crop residues

Planting Date Comparison



September 1

October 1

What Cover Crop to Grow

Selecting the best cover crops for your farm

Clarify primary needs

Identify the best time and place for CC in your system

Test a few options

What is your primary need?

- a. Provide nitrogen (legumes)
- b. OM additions
- c. Improve soil structure
- d. Reduce soil erosion
- e. Provide weed control
- f. Provide habitat for beneficial insects
- g. Manage nutrients

Secondary needs?

- a. Better drainage (deep rooted crops – Buckwheat)
- b. Mulch production

Different Types of Cover Crops

Winter annuals – winter rye, barley, wheat, peas, hairy vetch....

Cool season annuals – oats, rye

Warm season annuals – buckwheat, cowpeas, sweet clover, berseem clover....

Perennials

Short lived – medics, red clover (biennial)

Long lived – white clover, alfalfa

Winter Annuals

Hairy Vetch



Cool Season Annuals



Summer Annual - Buckwheat



Perennials



Benefits of Cover Cropping

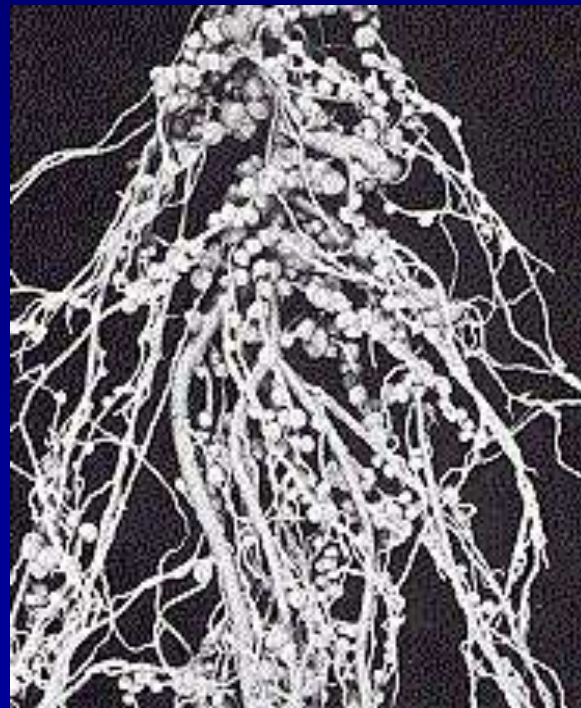
Reduce the need for off-field OM additions &
improve soil structure & tilth
food for micro-organisms
replenish active OM lost during cultivation
Grow your fertilizer in the field!

Legumes supply much of the need N
in symbiosis with

Rhizobia Bacteria



- Rhizobia: soil bacteria responsible for symbiotic nitrogen fixation on legume roots.
- Rhizobia fixes atmospheric nitrogen for use by legume plants in exchange for food (sugars) from the plant that keep the bacteria living!
- Rhizobia are species specific and seed must be inoculated the first time it is planted.



Green Manure crops improve yields by enhancing soil health

Feed the soil that feeds the crops

Soil MO number and diversity increase rapidly after crop incorporation

During microbial breakdown nutrients are released

Crop	N lbs/ac	P lbs/ac	K lbs/ac
Alfalfa (5 tons)	200	50	240
Clover	110	20	130
Winter Peas	150	20	160
Rye	90	20	110

Common C:N ratios of Cover Crops

C:N ratios and soil micro-organisms

C for energy

N for structures

Optimum for OM decomposition 25:1-15:1

<u>Organic Material</u>	<u>C:N ratio</u>
Young rye	14:1
Clovers	15:1
Rye at flowering	20:1
Corn stalks	60:1
Sawdust	400:1

Biomass additions of Non-Legumes

Non-Legume Cover Crop	Biomass tons/ac/yr
Barley	1.5 – 5.0
Rye (cereal)	1.5 – 5.0
Winter Wheat	1.5 – 3.5
Buckwheat	1.0 – 1.5

Adapted from MCCP

Winter Rye and Winter Pea cover crop and Dave Herz



Biomass additions of Legumes

Legume Cover Crop	Biomass tons/ac	Nitrogen lbs/ac
Sweet Clovers	1.8	120
Winter Peas	2.0 – 3.0	90 - 150
White Clover	1.0 - 3.0	80 - 200
Red Clover	1.0 – 2.5	70 - 150

Adapted from P. Sullivan (attra)

N Distribution of Legume Cover Crops

Crop	Tops (%N)	Roots (%N)
Peas	89	11
Clovers	68	32
Alfalfa	58	42

Adapted from MCCP

Cover Crops break weed and insect pest cycles

Cover crops are integral in crop diversity & rotations that break pest cycles

Cover cropping for weed management

Cover Crops suppress weed by competing for
light
nutrients
moisture

some also produce germination inhibitors

Cereal grain are excellent choices for suppressing late fall and early spring weeds

Warm season annuals can smother summer weeds

Cumulative benefits

You can increase the range of benefits by:

1. Increasing the diversity of cover crops grown
2. Increasing the frequency of cover cropping
3. Increase the length of cover cropping



When to Grow Cover Crops

What's the best time to CC in your system

Make a rotation time line for each field (18-24 months)

Show

1. Seeding time
2. Harvest time
3. Fallow periods

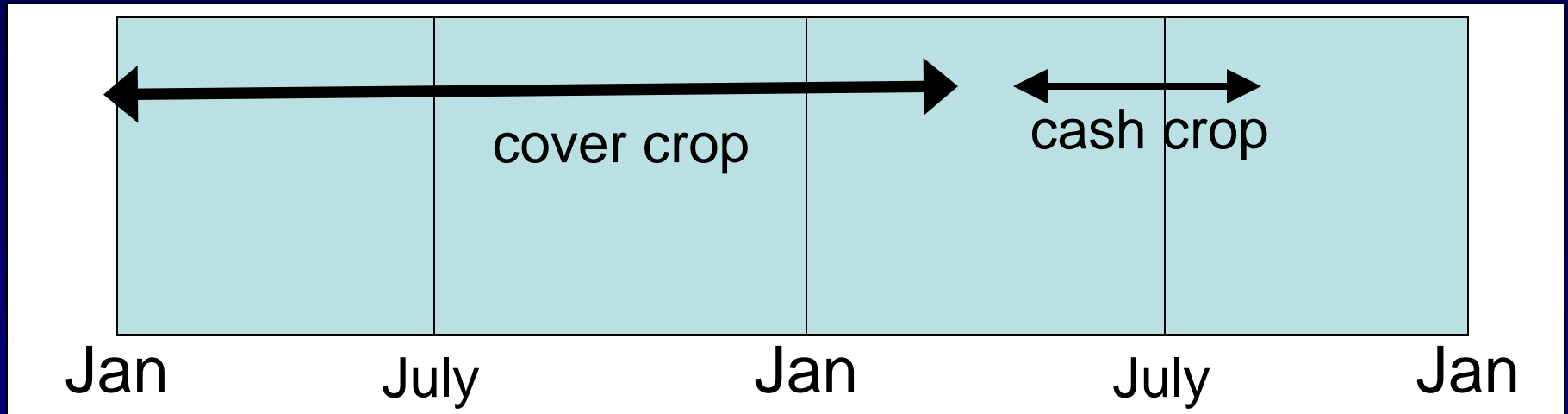
Look for:

open periods in each field
opportunities in your work schedule

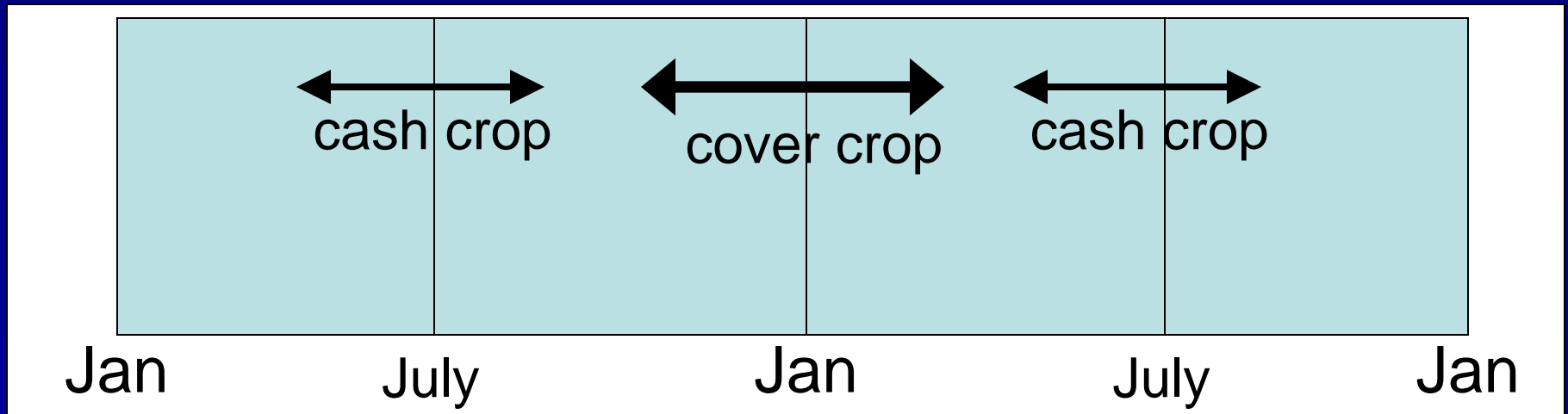
Examples: Winter fallow
Summer fallow
Small grains (winter & spring)
Full season fallow

Field Timeline Examples

South 40



North 40



Cover Cropping Sequences

Planning is paramount!!!!!!!!!!!!

Cash Crop	Cover Crop
<u>Early Spring</u> (Spinach, peas, radishes)	Fall planted, winter kill Oats, annual cool season
<u>Main Season</u> (Peppers, tomatoes, vines, Onions, flowers)	Fall planted legume Hairy vetch, winter peas & grain (rye, wheat, etc.)
<u>Fall (July – Aug. planting)</u> (Brassicas)	Winter legume, spring oats, peas, buckwheat

Green Manures & Cover Crops break weed and insect pest cycles
CC & GM are integral in crop diversity & rotations

Weed management

suppress weeds by competing for

light

nutrients

moisture

some also produce germination inhibitors

Cereal grain are excellent choices for suppressing late fall and
early spring weeds & prevent winter erosion

Manipulating N supply with Green Manures

1. Green Manure Management

- a. N release dependent on temperature and soil moisture (>55° F, field capacity)
- b. Timing of N release to crop need
- c. Manipulation of residue quality
 1. Early = green leaves = fast decomposition
 2. Later = stems = slower decomposition

2. Residue Management

- a. The lower the C:N the faster the decomposition
- b. Legumes typically have low C:N ratios compared to non-legumes
- c. Mixing Green Manures – adding rye to legumes slows decomposition

Residue Management continued

4. Leaves decompose five times faster than stems
5. Soil incorporation speeds decomposition

RULE OF THUMB:

Incorporate = 60% of nutrients

Surface = 40% of nutrients

Growth Management

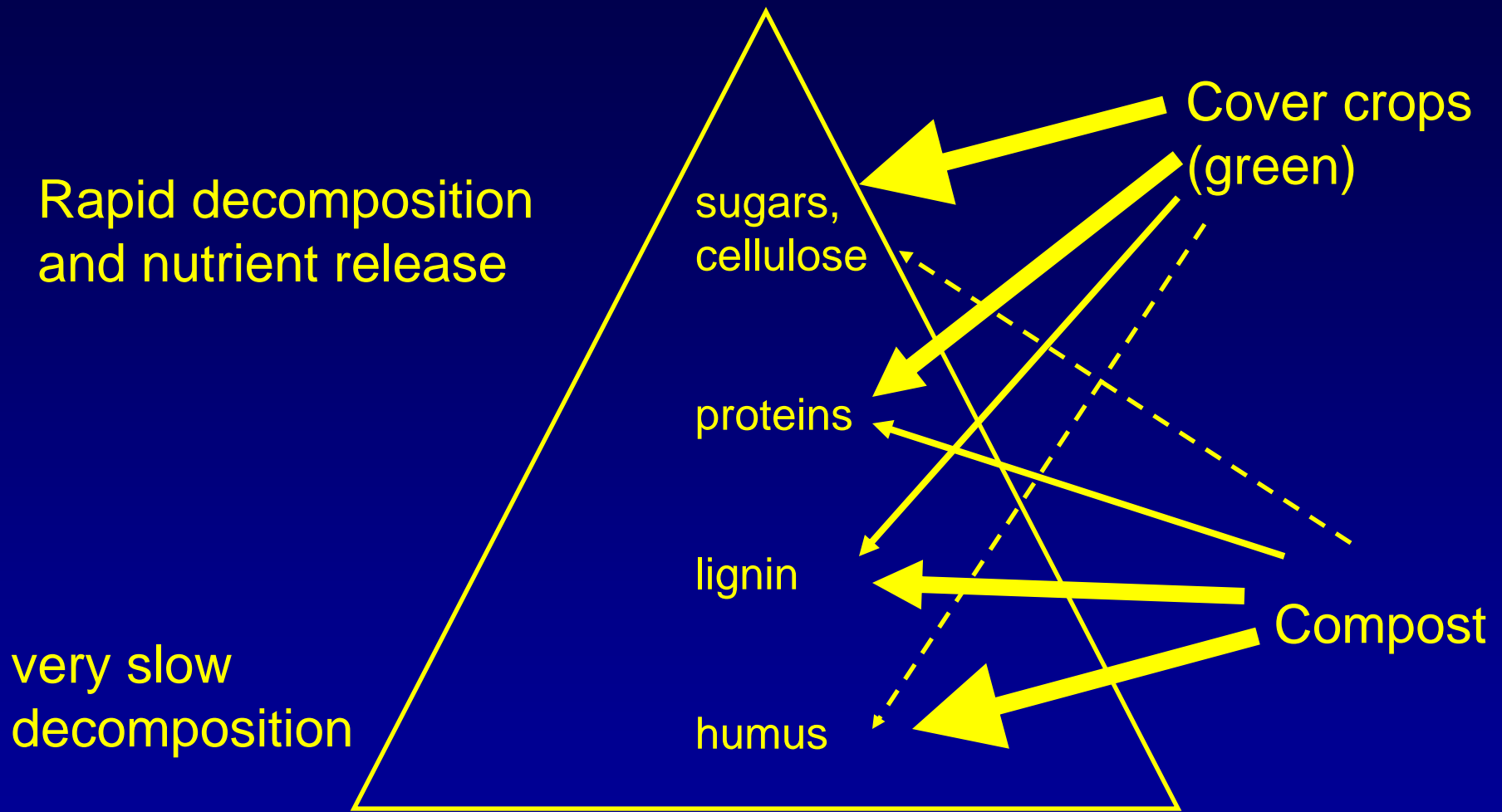
1. Low plant populations increase stem content
2. Higher plant population increase leaf production
3. Leaves dominate early in growth cycle
4. Stems dominate later in growth cycle
5. When to cut GM critical to your objectives

Subsequent Crop Management

1. N release is dependent on decomposition
2. Green Manures may represent source of slow release nutrients
3. Surface applied residues encourage near surface rooting esp. when N release is high.



Effects of Residues –Green manures & composts



Adapted from Building soils for better crops

Web Resources on Cover Cropping/Green Manures

USDA's Sustainable Ag Network (SAN)
Managing Cover Crops Profitably

www.sare.org/publications

Appropriate Technology Transfer for Rural Areas
ATTRA

www.attra.ncat.org

Cover Crops on the Intensive Market Farm

www.cias.wisc.edu

Questions?

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Thank You!

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