Cover Cropping Strategies

To forget how to dig the earth and to tend the soil is to forget ourselves.

- Gandhi

WASHINGTON STATE UNIVERSITY EXTENSION

What are Cover Crops?

"Crops grown to improve the farming system"

"Crop grown between cash crop rotations"

Cover crop – grown to prevent soil erosion

Green manure crop – grown to help maintain soil organic matter and increase nitrogen availability

Catch crop – grown to retrieve available nutrients following a cash crop

Benefits of Cover Crops

Economical

- Reduced Fertilizer Costs
  - Nitrogen for cash crops
  - Scavenging nutrients
- Potential Improved Yields

Benefits of Cover Crops

Economical

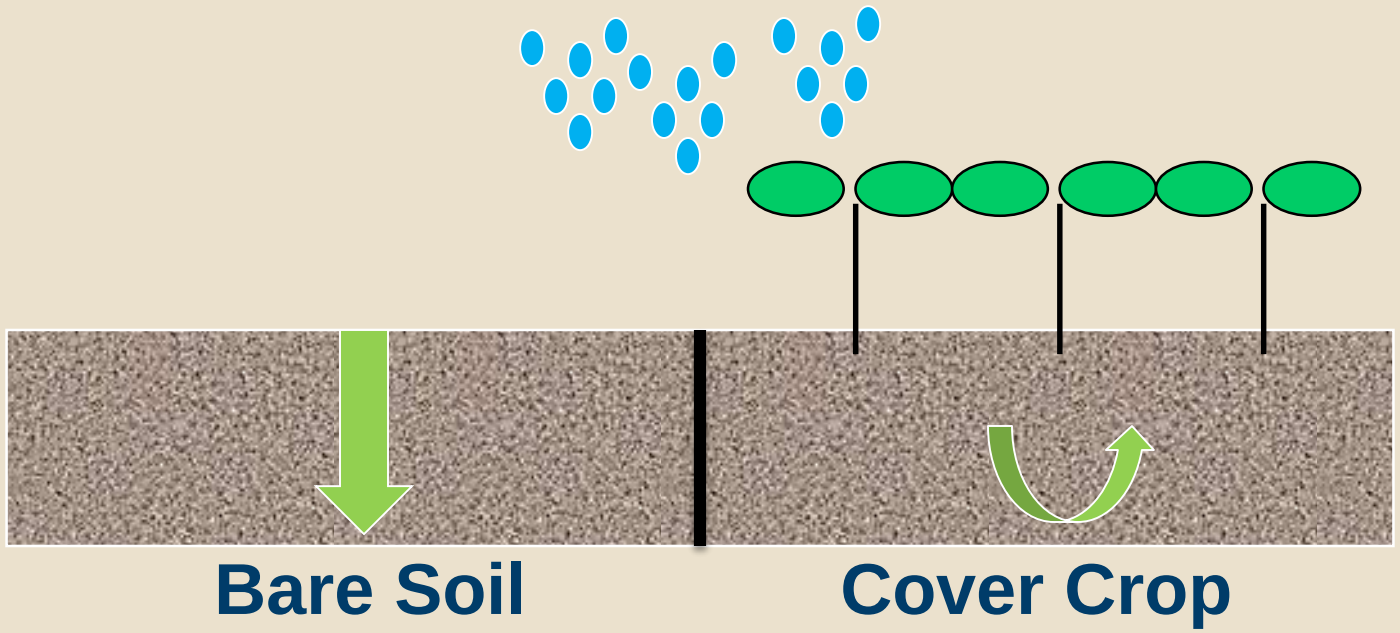
Reduced Need for Pesticides

- Weed competition
- Allelopathy (Weeds and Pathogens)
- Attract Beneficial Insects

Environmental

Protect Water Quality

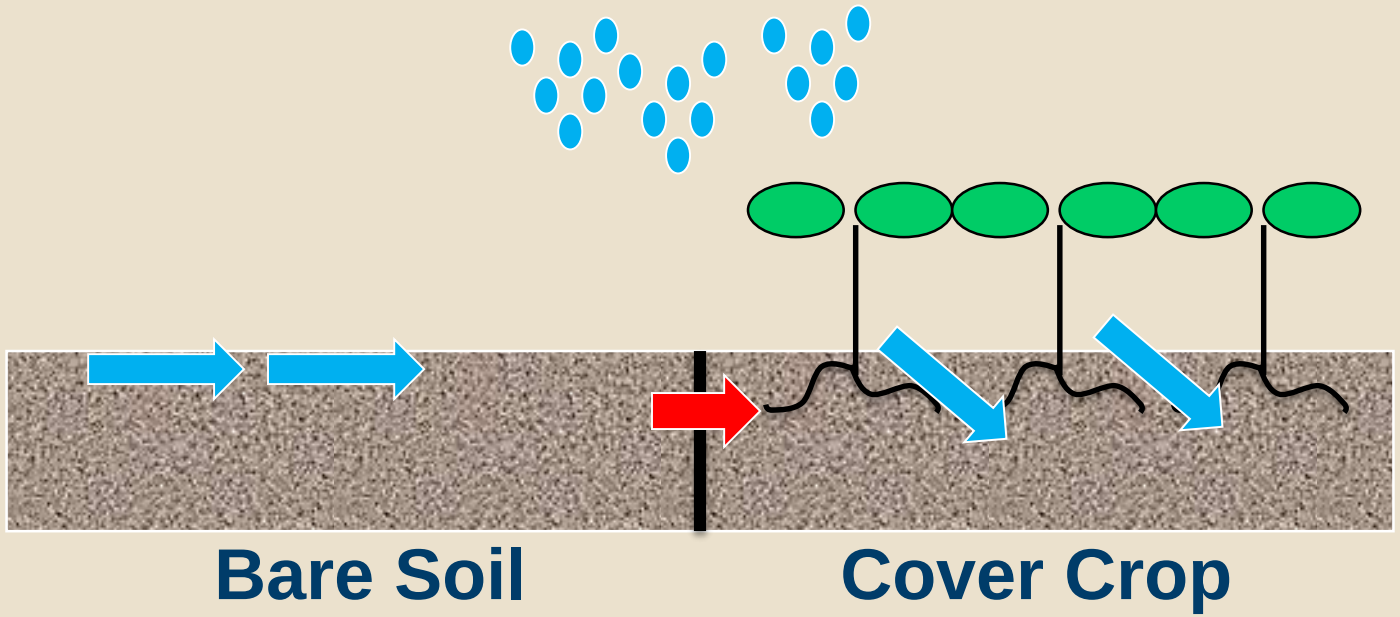
Nutrient Leaching



Environmental

Prevent Soil Erosion

- Hold soil
- Reduced raindrop impact
- Increased water infiltration



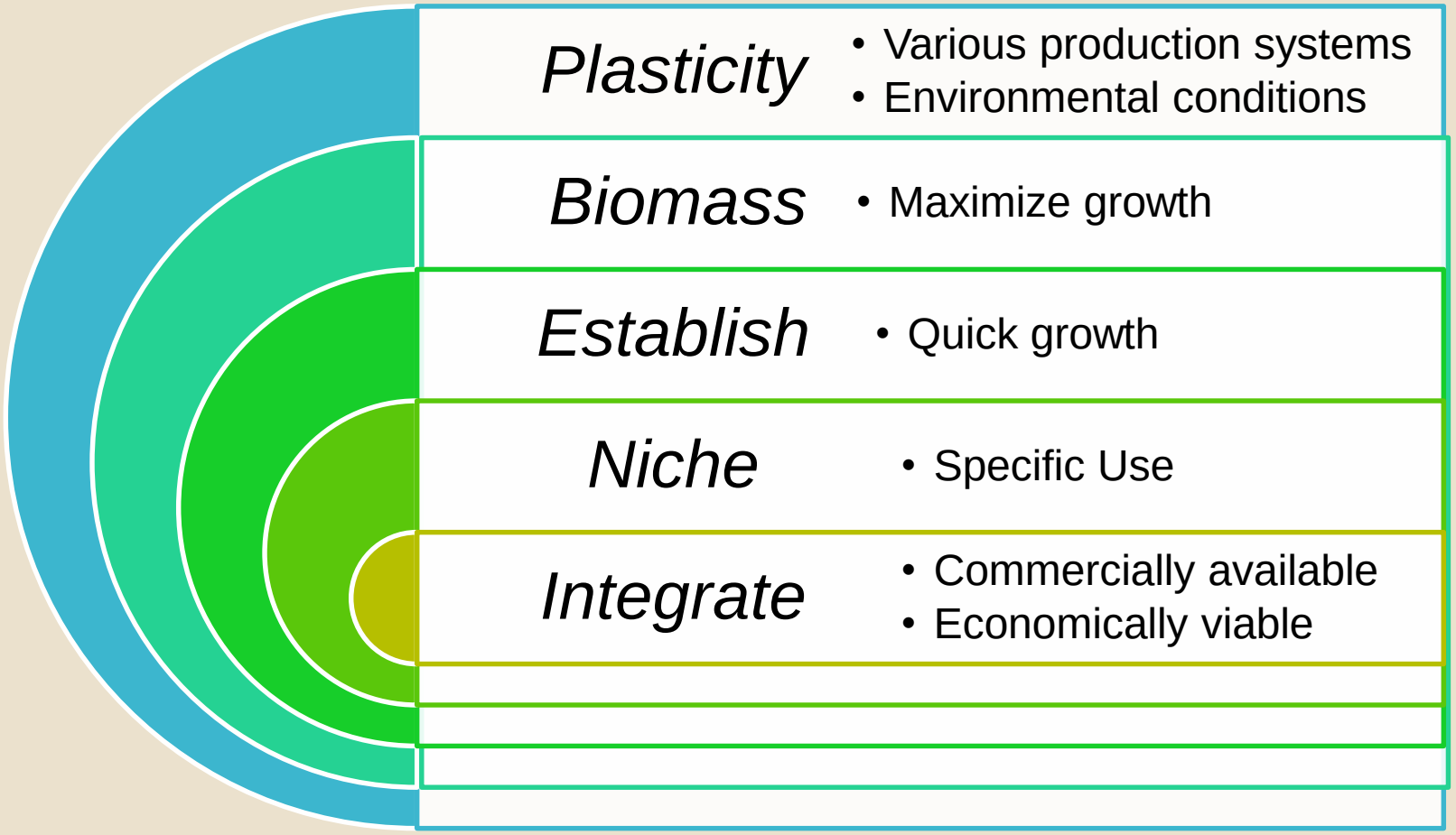
Environmental

Conserve Soil Moisture

- Increased infiltration
- Reduced soil evaporation
- Decreased soil temperatures

Bare Soil **Cover Crop**

Cover Crop Characteristics



Cover Crop Choice

Goal

Problem or Use

Identify

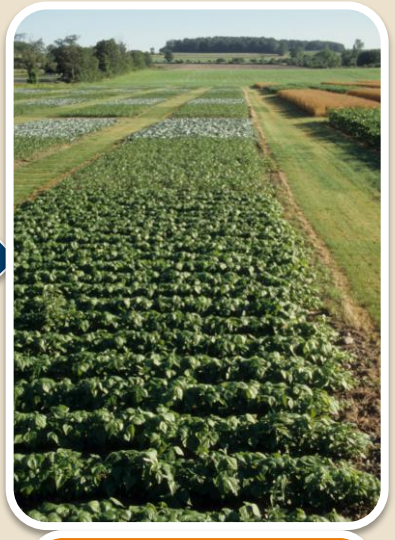
Place

Time

Niche

Select

Cover Crop



Integrate Cropping System

Why Grow Cover Crops?

- Soil builder
- Erosion control
- Nitrogen fixation
- Nutrient scavenging
- Weed suppression
- Attract beneficial insects

Cover crops typically include cereals (and other grasses), legumes, and other broadleaves.

Cereal and grass cover crops

- Rye, oats, triticale, wheat, annual ryegrass
- Rapid growth in fall:
  - Protects soil
  - Captures N
- They may slow down the growth of cash crops in the spring

Cereal Rye

- “Old reliable”
- Good fall growth and weed suppression with September planting
- Cold hardy
- Tends to immobilize a little N after incorporation

Oats

- Early planting gives good weed-suppressing biomass
- Spring varieties often winterkill

Winter Wheat

More open stand than rye

Winter hardy

Slower maturing than rye

Good for late plantings

Legume Cover Crops

Vetch, crimson clover, peas etc.

Supply nitrogen to soil

Slow growth in fall

- Less protection of soil
- Less competition for weeds

Hairy Vetch

- Our most reliable winter legume cover crop
- Decent establishment
- Fall plantings are winter hardy
- Good biomass and N fixation
- Blends well with cereals
- Good for summer cover, too

Common Vetch

Another vigorous legume

Easier to incorporate than hairy vetch

Crimson Clover

Less vigorous, less winter hardy, and less biomass than hairy vetch. Easy to incorporate in spring. Stems become woody after flowering.

Fava Beans

Plant later than other legumes (early October)

Marginally winter hardy

Small seeded varieties used for cover crops

Other Cover Crops

- Buckwheat
- Brassicas
- Phacellia

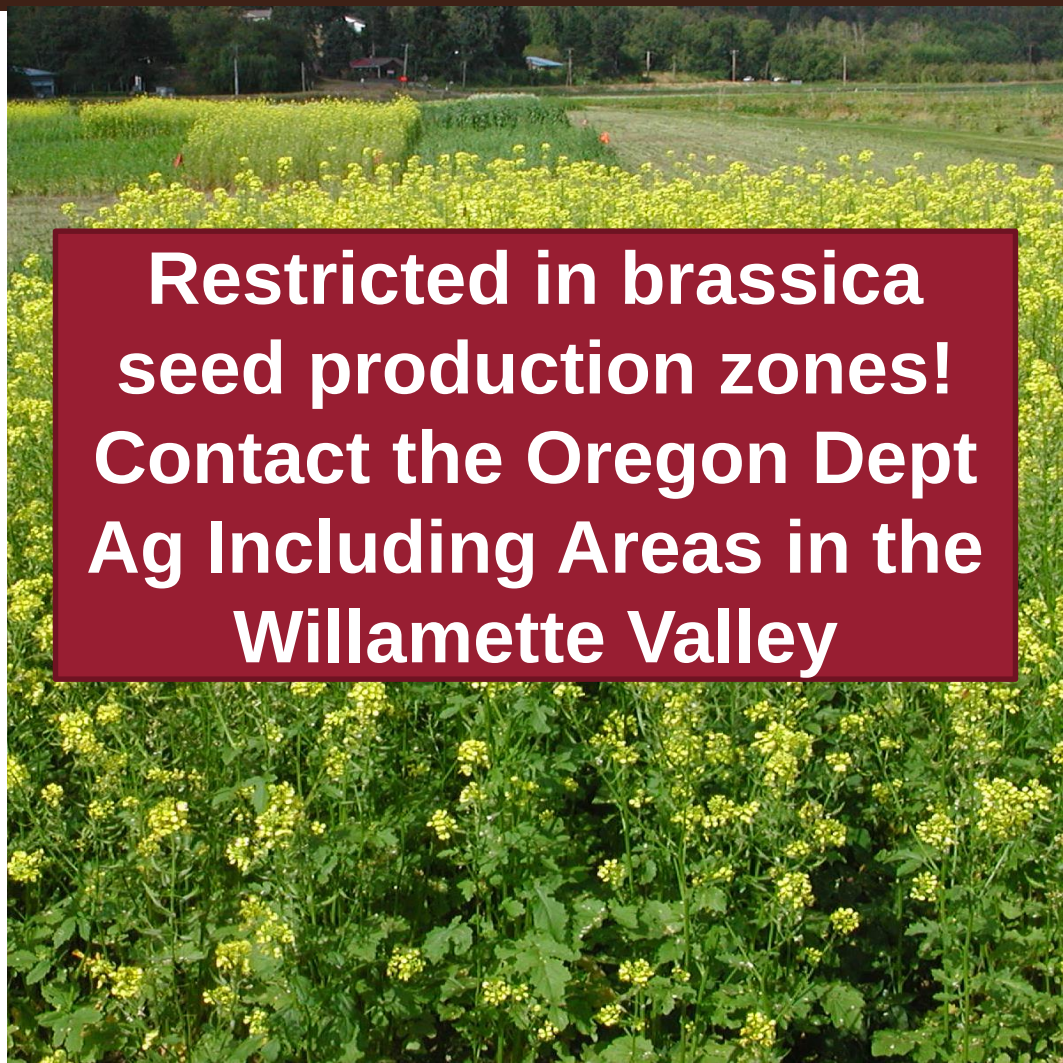
These fit important summer niches in our environment

Other: Buckwheat

- Grows quickly
- Good weed suppression
- Biomass breaks down quickly
- Killed by frost

Other: Brassicas

- Mustards, oilseed radish, canola
- Grows fast from small seed.
- Excellent weed suppression
- Some evidence of disease suppression
- Don’t let them go to seed or they will become a big weed problem



Other:Phacellia

- Fast growing
- Attracts pollinators
- Good N scavenger

Cereal-legume blends provide benefits of both types of cover crops and reduce winter weeds

Cereal rye – hairy vetch blend planted at a 1:1 seeding ratio in September

Early planting gets the best results.

Planted 14 Sept 2009

Planted 29 Sept 2009

Delaying planting from mid-September until early October reduces winter cover by 60% and spring biomass by 50%.

Relay planting is a way to establish cover crops in beds that are harvested late in the fall.

Carrots planted in late July; Hairy vetch interseeded in September; Carrots harvested in December

Incorporating Cover Crops into the Soil

- Turn cover crops under before they go to seed
- Wait 2 to 3 weeks before planting crops
- If cover crop is tall and hard to turn under, mow it first to break up stems

Cover crops:
How much to plant

- Cereal rye 80 to 120 lb/acre
- Hairy vetch 25 to 50 lb/acre
- Buckwheat 60 to 90 lb/acre
- Crimson clover 15 to 30 lb/acre
- Red clover 10 to 20 lb/acre
- Annual ryegrass 15 to 30 lb/acre

Legume strategies

Relay intercropping

Plant as blend with cereal or grass

Hairy vetch
good fall growth

Hairy vetch planted into corn July 17

Hairy vetch planted into bean June 29

Photos 29 Oct 2003

Hairy vetch
Winter Disease and Recovery

Disease on June planted Relay vetch following January snowfall. Photo 4 Feb 2004

Recovery of hairy vetch Photo 5 April 2004

Can I use cover crops to supply nitrogen to the next cash crop?

- Type of cover crop
  - Legume vs. non-legume
- Amount of biomass
  - Type of cover crop
  - Planting and termination dates
  - Weather/climate
- Maturity of cover crop
  - Termination date

Cover Crop Resources

New fact sheets on cover crop selection and management

Cover crops for Home Gardens West of the Cascades

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET FS111E

This bulletin is one of a three-part series on cover crops for home gardeners. It focuses on choosing the best cover crops for gardens in Washington and Oregon, west of the Cascades. A companion bulletin, Cover Crops for Home Gardens East of the Cascades, focuses on choosing the best cover crops for gardens in Washington and Oregon, east of the Cascades. The third bulletin in this series covers the management of garden cover crops, including planning, planting, managing nutrients, and terminating plants.

Cover Crop Resources

New fact sheets on cover crop selection and management

Methods for Successful Cover Crop Management in Your Home Garden

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS119E

This fact sheet is one of a three-part series on cover crops for home gardeners. It focuses on methods for managing garden cover crops, including planning, planting, managing nutrients, and terminating plants. This series also includes fact sheets on *Cover Crops for Home Gardens West of the Cascades* and *Cover Crops for Home Gardens East of the Cascades*.

ESTIMATING PLANT-AVAILABLE NITROGEN RELEASE FROM COVER CROPS

D.M. Sullivan and N.D. Andrews

Estimating plant-available nitrogen release from cover crops

Estimating plant-available nitrogen release from cover crops

Estimating plant-available nitrogen release from cover crops

Step 8. Estimate PAN using Table 2 or OSU Organic Fertilizer and Cover Crop Calculator.

Table 3.—Worksheet for estimating site-specific plant-available N release from cover crop.[1]

Line no.		Your value	Example: Vetch	Units
1	Area sampled to determine cover crop biomass: *Quadrat area (ft^2) x number of quadrats*		16	ft^2
2	Number of sample areas per acre: *43,560 ft^2/acre ÷ Line 1*		2,723	sample areas/ acre
3	Wet weight of cover crop field sample (lb)		12	lb wet cover crop
4	Percent DM in cover crop: *lab data or your "shortcut" estimate*[2]		15	DM, % in wet cover crop biomass
5	Calculate cover crop DM (ton/a): *(Line 2 x Line 3 x Line 4 ÷ 100) ÷ 2,000*		2.45	ton DM/acre
6	Cover crop total N percentage: *lab data or your "shortcut" estimate (N, % dry wt)*[3]		3. 0	N, % in cover crop DM
7	Plant-available N from cover crop decomposition: *Find your %N in DM in column 1 of Table 2 (page 5), and then find estimated PAN release under the "Calculator" column.*		24	PAN, lb/ton DM
8	Calculate plant-available N for summer crop[4] (lb PAN/acre): *Line 5 x Line 7*		59	PAN, lb/acre

[1]The OSU Organic Fertilizer and Cover Crop Calculator calculates PAN (Line 8) from the input data in lines 1–6.
[2]See sidebar "Shortcut method" and Appendix C (page 20). A closed cover crop canopy retains moisture, so cover crop dry matter is relatively consistent across sampling dates.
[3]See sidebar "Shortcut method."
[4]Typical values for PAN are 30 to 70 lb N/a for winter cereal/legume cover crops killed in mid-April (see Case Study 5, page 15). Check your calculations if your PAN estimate (Line 7) is greater than 100 lb PAN/a. This is the maximum PAN value observed for excellent vetch cover crops allowed to grow to bud stage (total cover crop N uptake = 150 to 200 lb N/a).

Estimating plant-available nitrogen release from cover crops

Table 1.—Nitrogen fate after rapid phase of cover crop decomposition is completed.[1,2]

Cover crop (%N in DM)	Growth stage	Biomass DM	Cover crop N uptake	N fate	
				N in soil organic matter	Plant-available N (PAN) NH_4-N + NO_3-N
		(lb/a)	(lb/a)	(lb/a)	(lb/a)
Common vetch (3% N)	vegetative	3,000	90	40	50
Cereal rye (2% N)	stem elongation	3,000	60	40	20
Cereal rye (1% N)	heading	8,000	80	107	-27

[1]Rapid decomposition typically occurs during the first 4 to 6 weeks after cover crop plowdown.
[2]Assumptions: Cover crops contain 40 percent C in DM; 60 percent of cover crop C is decomposed (lost as carbon dioxide); all cover crop N is retained (zero N loss); stable soil organic matter has C:N ratio of 12:1; 1% N = 20 lb N/ton DM.

Estimating plant-available nitrogen release from cover crops

- **Legume cover crops provide up to 100 lb PAN/a. To maximize PAN contribution from legumes, kill the cover crop at bud stage (early May).**
- **Cereal cover crops immobilize up to 50 lb PAN/a. To minimize PAN immobilization from cereals, kill the cover crop during the early stem elongation (jointing) growth stage (early April).**
- **Legume/cereal cover crop mixtures provide a wide range of PAN contributions, depending on legume content. When cover crop dry matter is 75 percent from cereals + 25 percent from legumes, PAN is usually near zero.**

Estimating plant-available nitrogen release from cover crops

- **A laboratory analysis for cover crop total N as a percentage in dry matter (DM) is a good predictor of a cover crop's capacity to release PAN for the summer crop.**
  - **When cover crops contain a low N percentage (less than 1.5 percent N in DM), they provide little or no PAN.**
  - **When cover crops contain a high N percentage (3.5 percent N in DM), they provide approximately 35 lb PAN/ton of dry matter.**
  - **PAN release increases linearly, as cover crop N percentage (in DM) increases from 1.5 to 3.5 percent.**

Estimating plant-available nitrogen release from cover crops

Cover crops decompose rapidly and release or immobilize PAN rapidly. Most PAN is released in 4 to 6 weeks after cover crop kill.

PAN from legume cover crops is usually much less expensive than PAN from organic fertilizers.

Values for cover crop PAN listed here are most applicable to winter cover crop/summer vegetable crop rotations in western Oregon and Washington.

Choosing Cover Crop Strategies

1.) What are your **goals**?

2.) Identify the best **Place** and **Time** for a cover crop

3.) Describe **Niche** – management and environmental constraints

4.) Select the **Best Cover Crop**

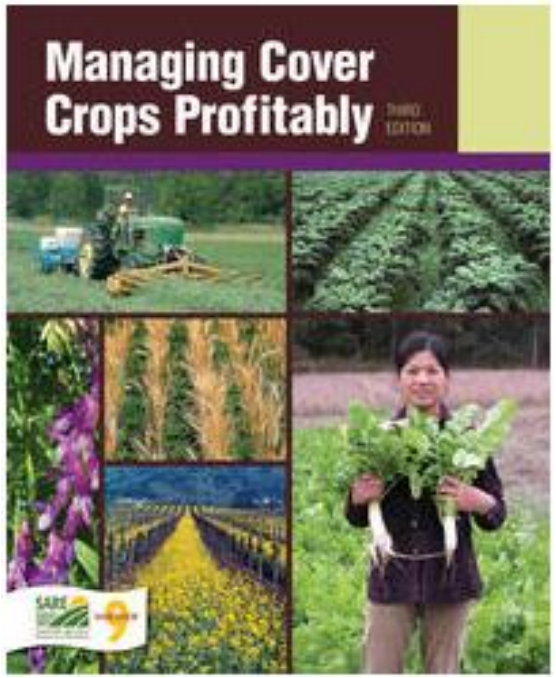
5.) Or **Build Rotation** around cover crops

Chris Benedict, WSU

Organic reduced tillage research is focused on saving labor and fossil fuel, improving weed management and improving soil quality.

Current experiments focus on cover crop selection, method of termination, and preparation method for planting.

Questions



Andy Bary
Soils1.org

Managing Cover Crops Profitability
http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition