

Adapting Cover Crops to Vegetable Production Systems

Andy Bary
WSU-Puyallup
soils1.org



Goals / desirable traits for cover crops

Soil builder

Nitrogen fixation

Nutrient scavenging

Weed suppression

Erosion control

Grazing potential

Quick growth

Classes of cover crops

Grasses, Legumes, Other broad-leaved crops

Oats

Wheat

Rye

Barley

Sudan grass

Millet

Ryegrass



Classes of cover crops

Grasses, Legumes, Other broad-leaved crops

Clovers

crimson

white

red

Vetches

hairy

common

Chickling

Fava bean

Soybean

Pea

Sunn Hemp



Classes of cover crops

Grasses, Legumes, Other broad-leaved crops

Rape

Mustards

Oil seed Radish

Phacelia

Buckwheat





Interseeded Cover Crops: The Good the Bad the Ugly

Inter-Seeding Relay Planting



When one crop is
planted between the
rows of an existing
crop

Legumes or grasses

Another cash crop

Timing

Cover Crops We Tried

Rye grass

Hairy vetch

Red clover

Crimson clover

Common vetch

White clover

Black medic

Sub clover

Woolly pod vetch



Cash Crops We Have Tried



Lettuce

Broccoli

Radish

Spinach

Sweet corn

Carrot

Bean

Winter

Squash



Photos 29 Oct 2003



Hairy vetch
good fall growth

Hairy vetch planted into
corn July 17

Hairy vetch planted into
bean June 29



Photos 5 April 2004



Hairy Vetch
Same plots in April

Hairy vetch planted into
corn July 17

Hairy vetch planted into
bean June 29

On-farm
Experiment
March 5, 2004

Interseeded
Hairy Vetch

Interseeded
Red Clover





Interseeded red
clover
October 24, 2005

Interseeded June 30



Planted October 4



October 24, 2005



Interseeded hairy
vetch

October 24, 2005

Interseeded June 30

Planted October 4



Interseeded cover crops in spring

Hairy vetch planted
into spinach.
Good stand.



Red clover planted into
winter squash.
Bad stand,
Too much shade by
squash



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

Hairy vetch
Winter Disease and
Recovery



Recovery of hairy
vetch
Photo 5 April 2004

Inter seeding Cover crops: When to plant

Early planting of hairy vetch may set up for winter damage

Early planting of red clover provides more time for establishment

Late planting (after September) results in little fall growth

Avoid planting too early and reducing yield and crop harvest complications

Interseeding



Reasons for interseeding

Weed suppression – reduce herbicide use

Increase organic matter – nitrogen source

Soil conservation – erosion control

Reduce nitrate leaching – absorb excess

Objectives

- To identify cultivation tools and interseeding strategies that will maximize weed suppression and minimize crop-cover competition.
- To integrate strategies into production practices with reduced herbicide use and synthetic fertilizer inputs.



Living mulch/interseeded crop
performance is a function of:

Time of planting

Seeding density

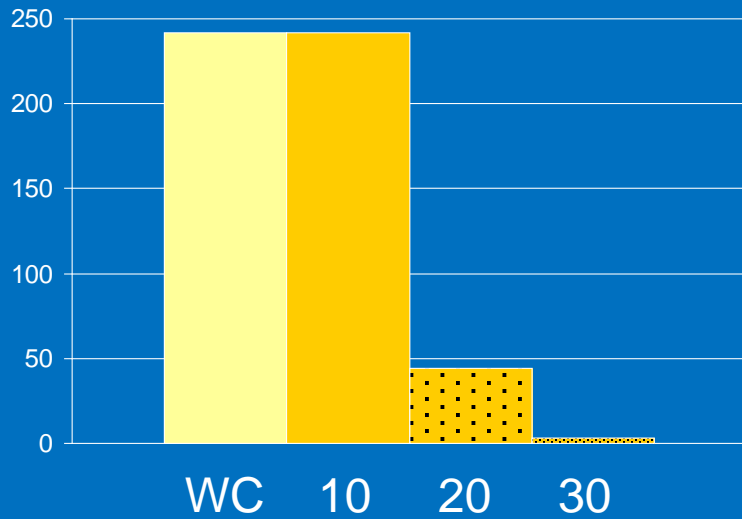
Precipitation

Cultivation/interseeding in cabbage --- 3 Phases ---

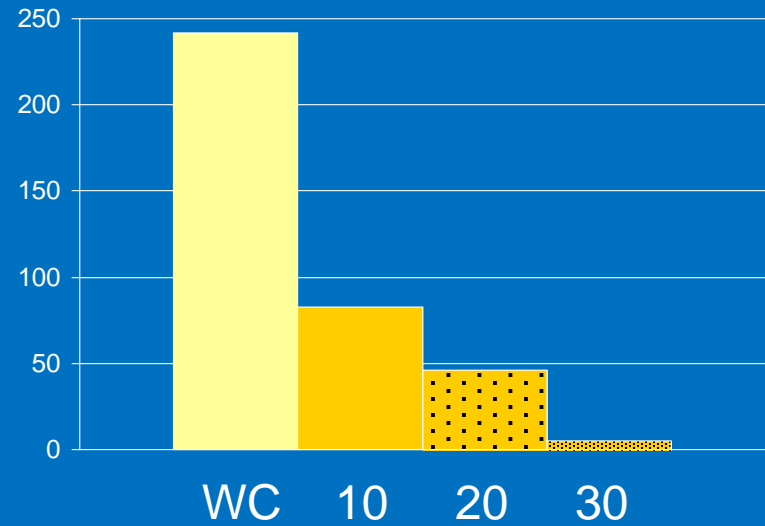
- I. Timing and species evaluation
- II. Effect of supplemental nitrogen
- III. Herbicide regulation of cover crops

Weed Biomass at Harvest (1995-96)

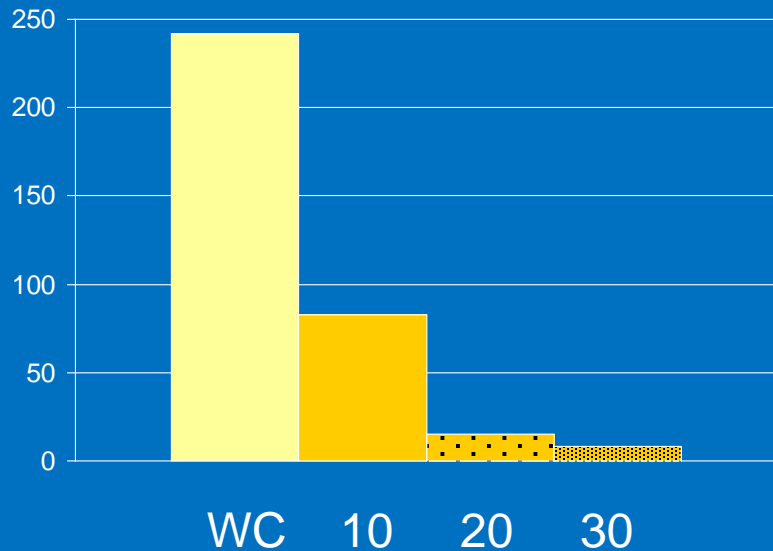
Cultivation Only



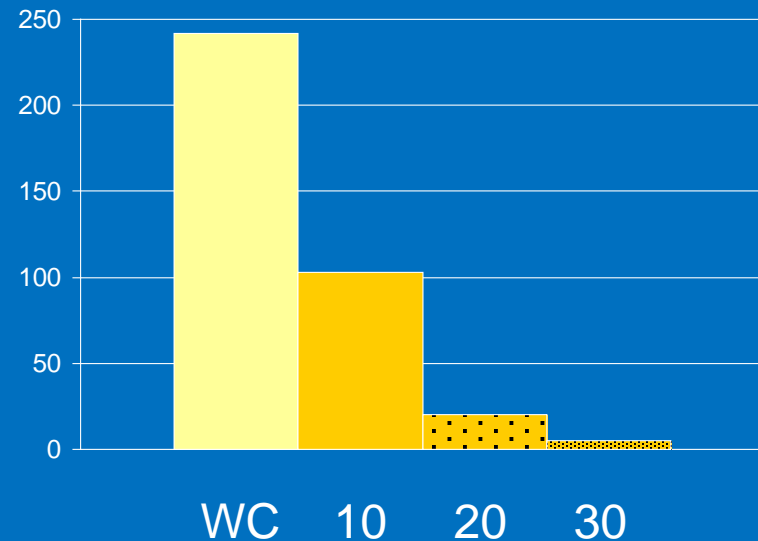
Hairy Vetch



Lana Vetch

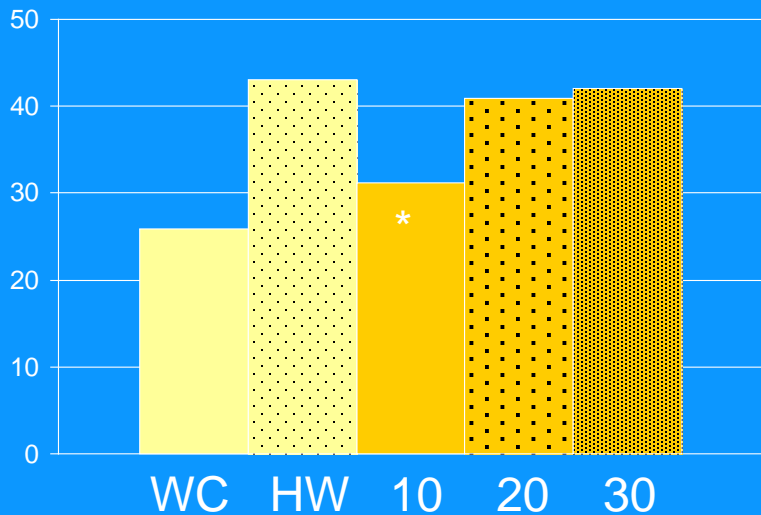


Oat

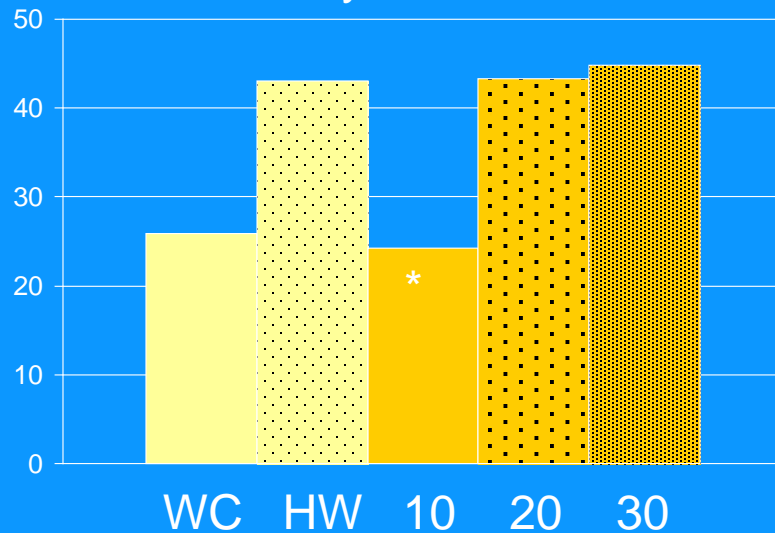


Cabbage Yield (1995-96)

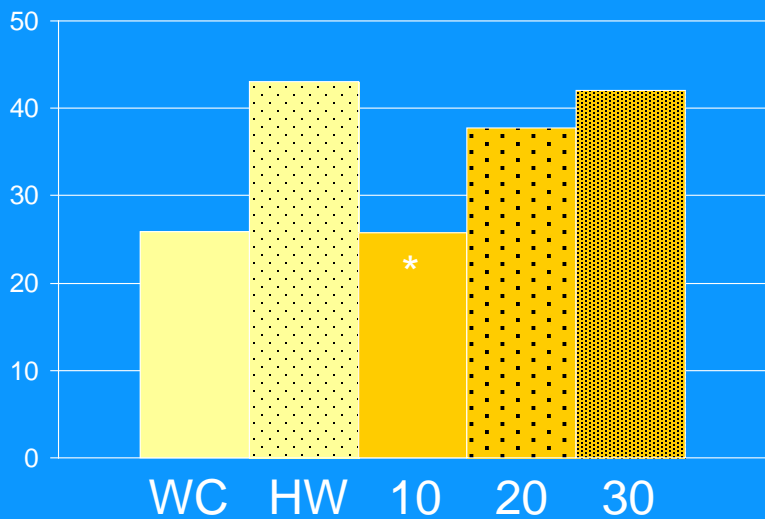
Cultivation Only



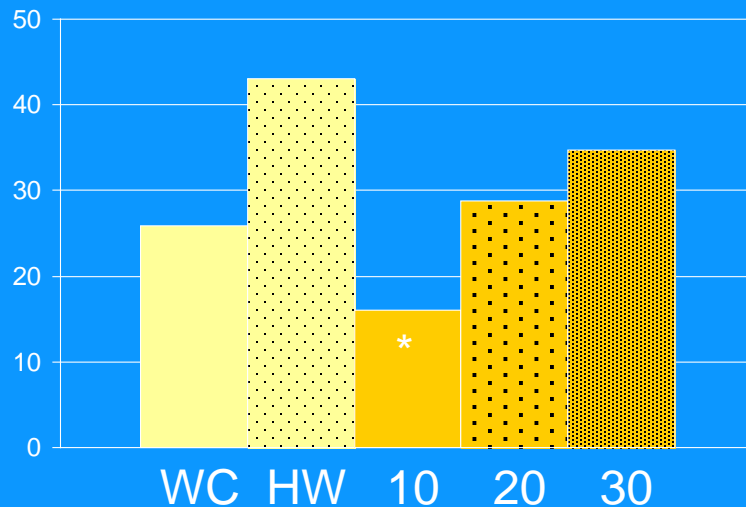
Hairy Vetch



Lana Vetch



Oat



* Significantly reduced compared to HW

Effect of additional nitrogen on cover crop biomass, weed biomass and yield in interseeded cabbage (1997-98)

	Cover Biomass		Weed Biomass		Yield	
	(g / 0.5m ²)		(g / 0.5m ²)		(Ton/A)	
	-N	+N	-N	+N	-N	+N
Weedy check	---	---	216	322	17	21
Handweeded	---	---	1	2	27	32
Dual Magnum + Tough	---	---	2	4	28	35
Cultivation 10 and 20 DAT						
Cultivation	---	---	12	58	27	30
Hairy vetch + cultivation	62	38	5	23	25	32
Oats + cultivation	230	260	6	11	23	27
Cultivation 10, 20, and 30 DAT						
Cultivation	---	---	16	8	28	33
Hairy vetch + cultivation	44	31	2	6	29	34
Oats + cultivation	118	149	1	3	26	32

-N = No nitrogen sidedressed, +N = 50 lb/A nitrogen sidedressed

Cultivation and Interseeding Study Conclusions

- Multiple cultivations significantly reduced weed pressure
- Earliest interseeding date had the most competition
- Cover crops compete with weeds *and* crops
- Additional nitrogen eliminated yield loss with hairy vetch, but not with oats
- Cover crop regulation effect was inconclusive



Fall Cover Crop Blends Study

Evaluate effect of rye-hairy vetch seeding ratio and planting date on cover crop establishment, weed pressure, dry matter production and N accumulation

Evaluate effect of harvest date on cover crop dry matter production and residue quality

Experimental Design

Established in Sept 2004, six year study

Split-plot design with cover crop as main plot and planting date as split

Five cover crop treatments:

100% rye

75% rye, 25% vetch

50% rye, 50% vetch

25% rye, 75% vetch

100% vetch

(Pure rye receives 89 kg N ha⁻¹ annually)

*Treatment included in 2008-2010 seasons

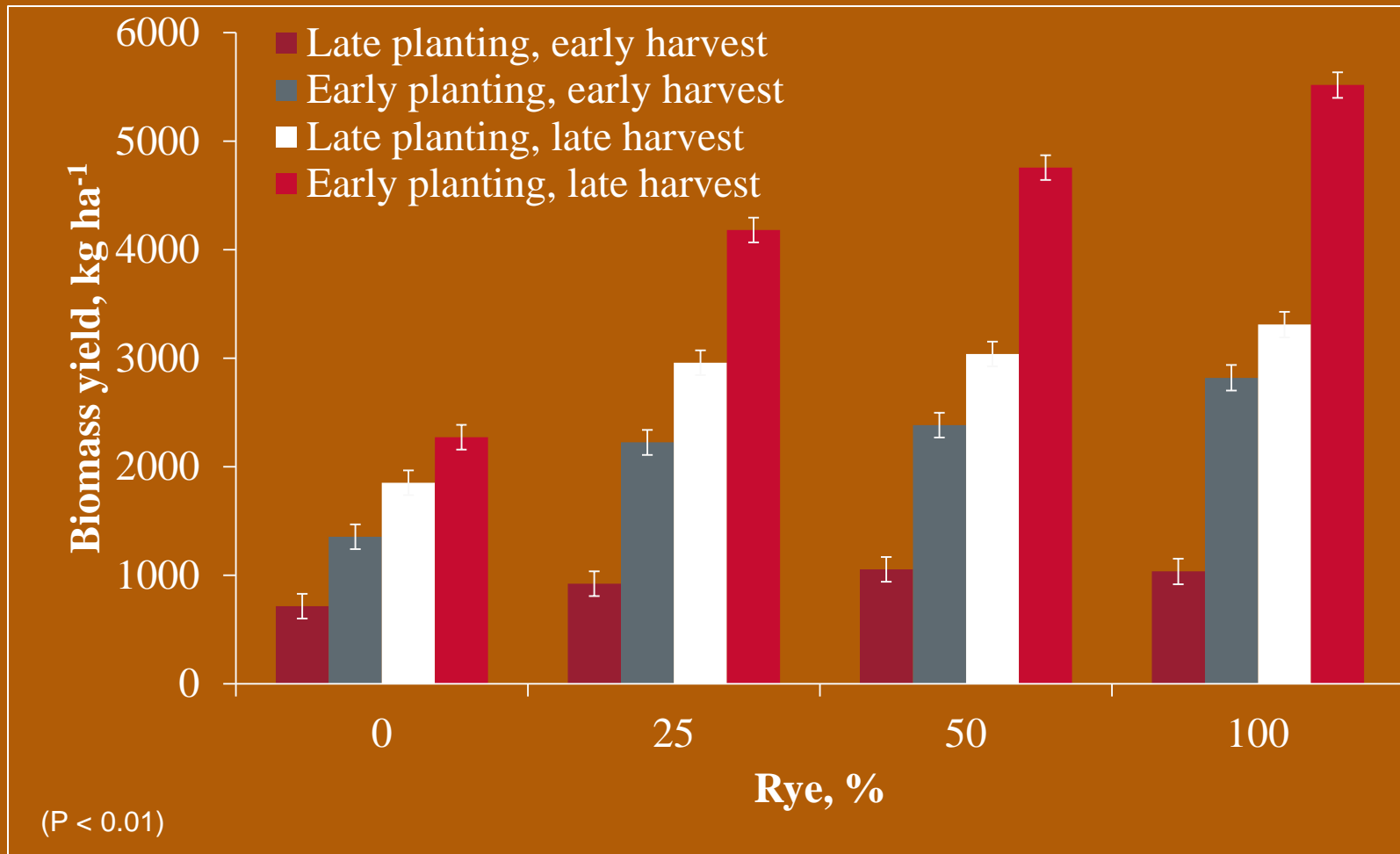


Post harvest cover crop nutrient dynamics

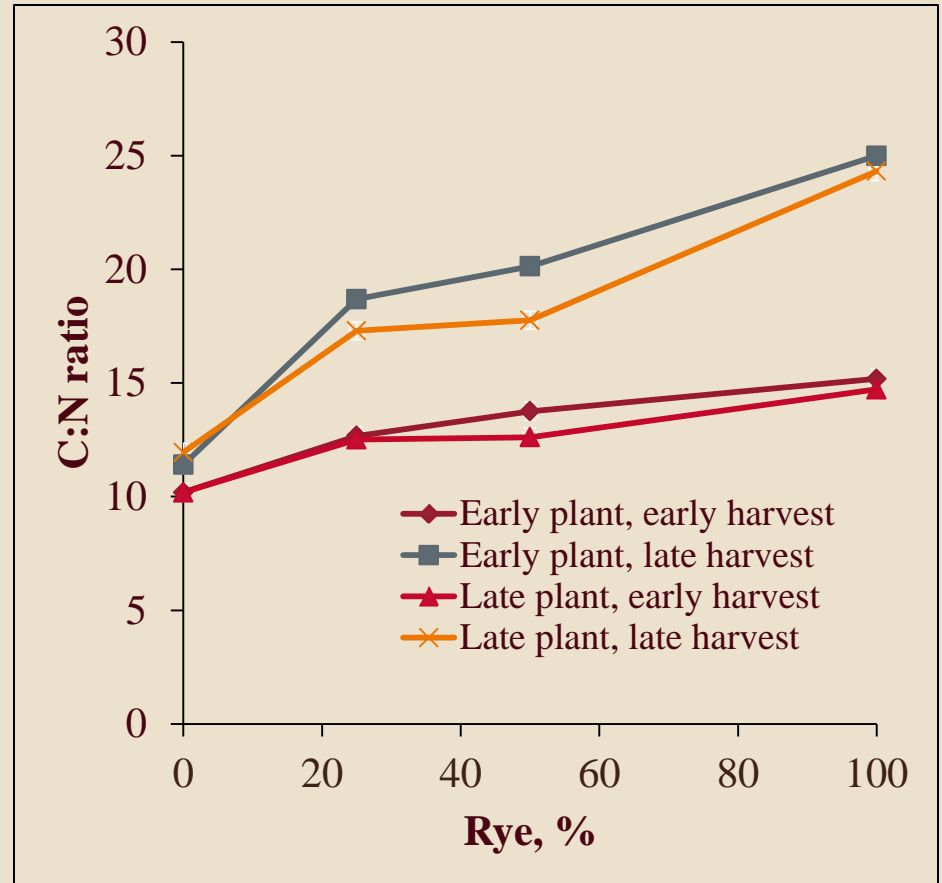


Field Activity	2008-09
Early Planting	17 Sept
Late Planting	2 Oct
Early Harvest	30 Mar
Late Harvest	27 Apr
Field chopped	5 May
Residue incorporated	7 May
Soil sampled for NO ₃ ⁻	26 June

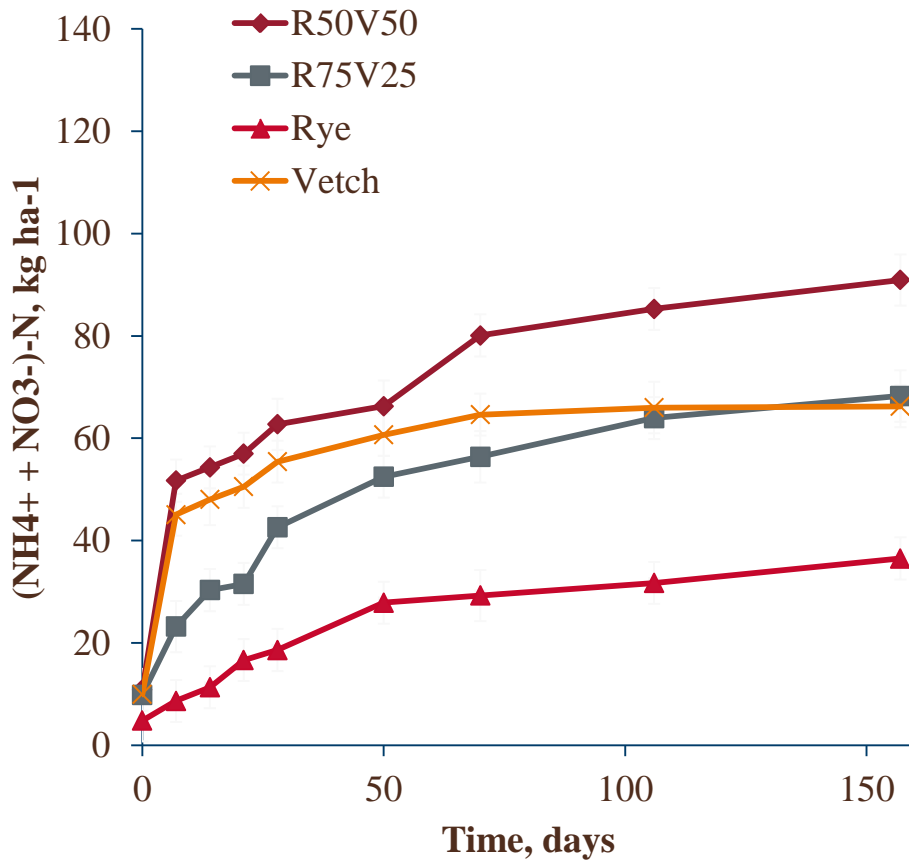
Cover crop biomass yields



Residue N concentration and C:N ratio



Incubation results



Summary

- Delay in planting date decrease cover crop dry matter
- Late incorporation increase dry matter production but lower residue quality
- Late planting and early harvest insufficient biomass to impact N dynamics in next cash crop
- A 50:50 rye-hairy vetch blend planted by October will produce significant dry matter and N release to cash crops



Summer Cover Crops and Weed Control

Summer Cover Crops



Sunn Hemp

Clovers

Vetches

Oats

Wheat

Soybean

Sudan grass

Rape

Oil Seed Radish

Buckwheat

Summer cover crops and weed control

	Biomass Yield 48 DAS Wt/a	Weed Biomass As percent of Weedy control
Mustard, Buckwheat, Rape, oil seed radish	4.8-8.2	0.6-6.5
Sudan Grass, oats, millet, lana vetch	3.1-7.9	20-29
Sunn hemp, soybean, chickling vetch, white, yellow and red clover	0.5-5.7	42-71
Weedy check	-	100

On the Web

www.soils1.org

Links to lots of interesting publications

Progress reports on our cover crops research

Using Cover Crops in Oregon

www.smallfarms.oregonstate.edu/sites/default/files/publications/em8704covercrops.pdf

Building Soils for Better Crops

www.sare.org/publications/bsbc/bsbc.pdf

Managing Cover Crops Profitably

www.sare.org/publications/covercrops/covercrops.pdf