Potential for cover crops to manage nutrients

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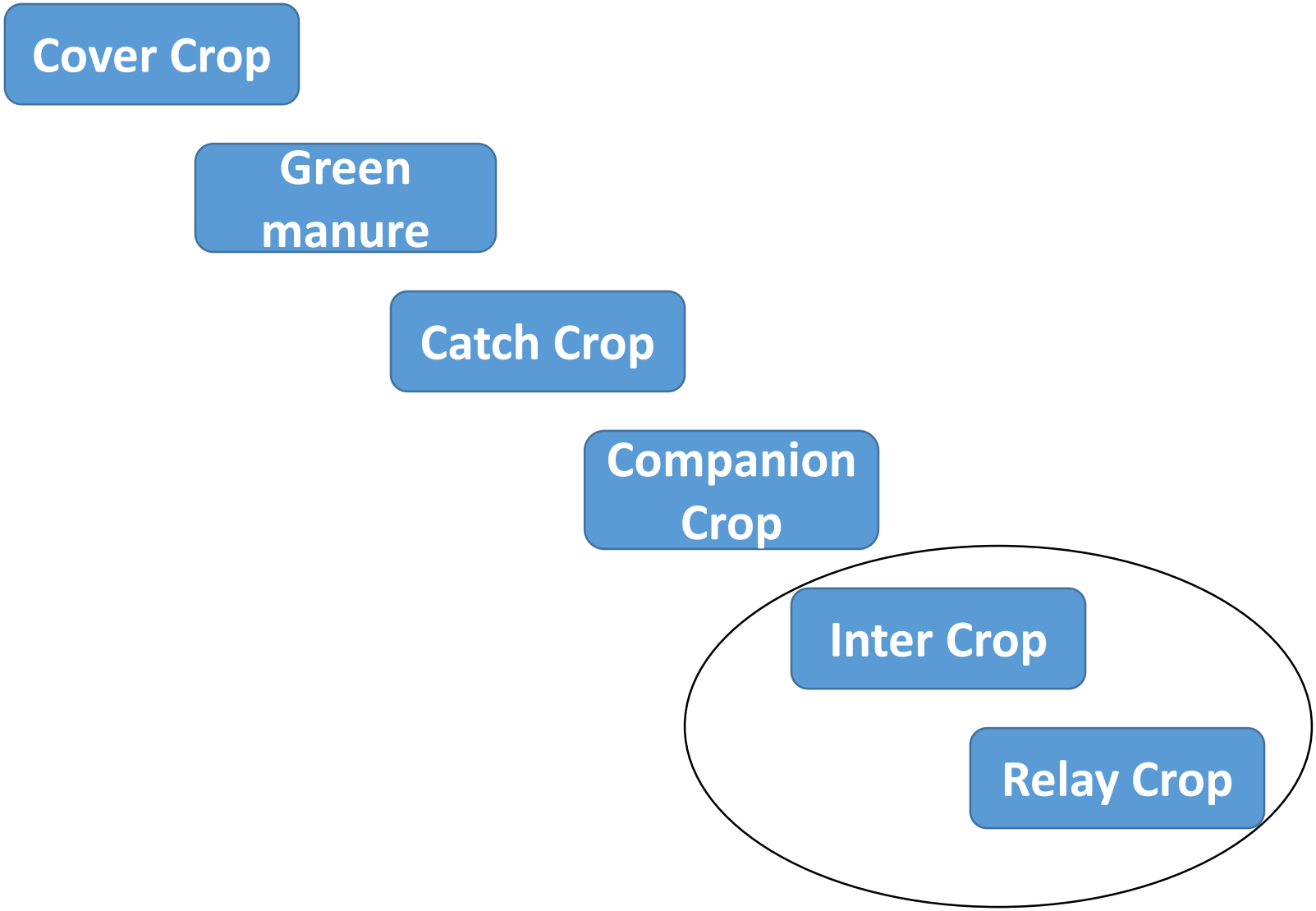
Outline

- **Cover crop definitions**
- **Potential for inter crop and relay crop systems**
- **Cover crop uses**
- **Nutrient management with covers**
- **Local research examples**

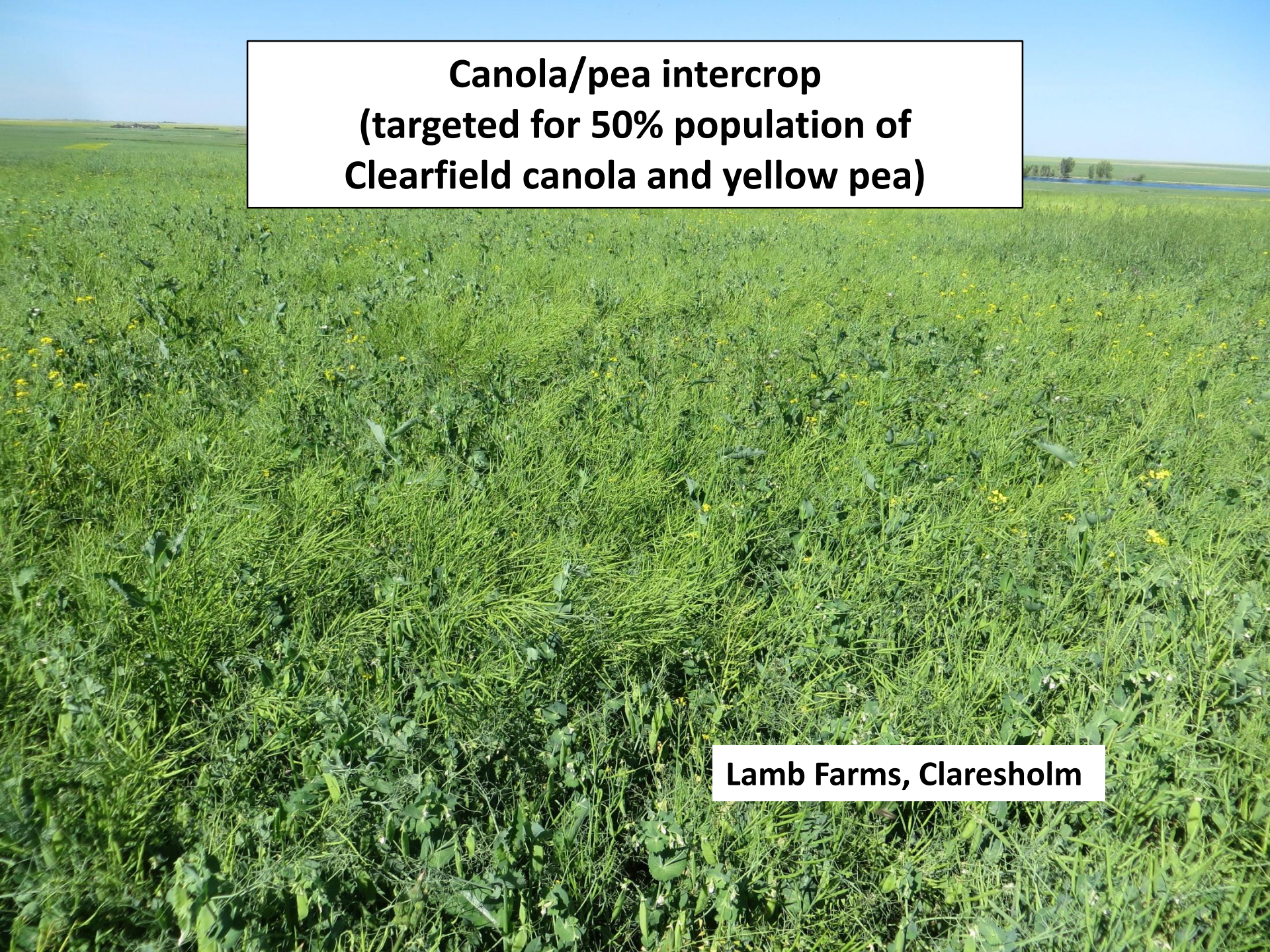

Cover Crop
Green manure
Catch Crop
Companion Crop
Inter Crop
Relay Crop

Inter cropping – more than one crop, similar maturity, separated after combining

Mustard/Maple Pea
1/3 rate mustard, 2/3 pea

Flax/Chickpea
(alternate rows)

Derek Axten farm, Saskatchewan


Canola/pea intercrop
(targeted for 50% population of
Clearfield canola and yellow pea)
Lamb Farms, Claresholm

Intercrops

- **Potential to increase production versus a single species**
- **Confuse pests – potentially less insect and disease?**
- **Challenge to figure out the fertility package**
- **Disease/rotation implications?**
- **Cleaning costs**

Relay cropping

Type of double cropping where second crop is seeded with first crop and then grazed or cut as forage after harvest of main crop

Photos taken on June 24/16

Irrigated winter wheat on canola
Under seeded with drill in late April:

- **annual ryegrass and red clover**

Relay crop allowed to regrow and grazed in fall after winter wheat harvest


Winter wheat at harvest


Cover crop regrowth –
early November


Provided about 8 AUM's/ha

- Erosion control
- Soil quality
- Grazing for livestock
- Pest suppression
- Improve biodiversity
- Manage soil H_2O
- Manage nutrients
  - Legumes – fix N
  - Biomass – catch crop
  - Reduce runoff

Fall-seeded cover crops after dry bean and potato in southern Alberta

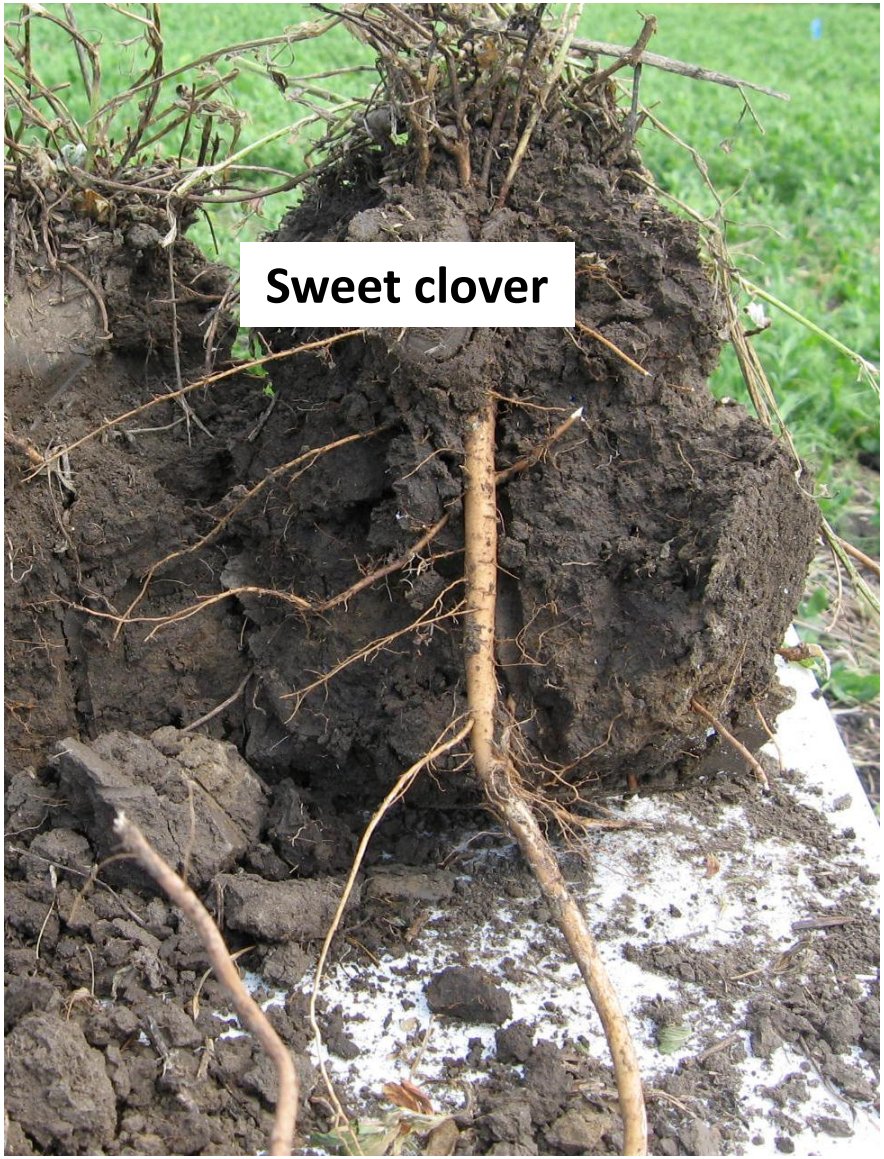
J. R. Moyer and R. E. Blackshaw

Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403-1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1 (e-mail: moyerj@agr.gc.ca). *LRC contribution number 38708015. Received 10 March 2008, accepted 15 September 2008.*

Moyer, J. R. and Blackshaw, R. E. 2009. **Fall-seeded cover crops after dry bean and potato in southern Alberta.** Can. J. Plant Sci. **89:** 133–139. Dry bean (*Phaseolus vulgaris* L.) and potato (*Solanum tuberosum* L.) usually provide insufficient plant residue cover after harvest to protect the soil from wind erosion. Experiments were conducted at the Lethbridge Research Centre to determine the potential beneficial effects of planting cereal cover crops after Russett Burbank potato, which is harvested in late September or October, and dry bean, which is harvested in mid- to late September at Lethbridge, Alberta. Annual cereals planted after potato provided insufficient ground cover to protect the soil from erosion in the fall or spring. Winter annual cereals after potato and dry bean and annual cereals after dry bean usually provided enough residue in the spring (>30% ground cover). However, winter cereals killed with glyphosate just before seeding spring wheat (*Triticum aestivum* L.) consistently reduced wheat yield. Reductions in available N and soil moisture due to winter annual cereals were small, and likely did not reduce wheat yield. None of the cover crops provided enough ground cover to reduce weed density. Additional research is required to assess the benefits of seeding annual cereals after early-maturing potato varieties and after dry bean, which matures earlier at lower elevations in southern Alberta, with more heat units.

Photo by Justin Duban

Soil improvement – soil organic matter and soil structure



Multi-species cover crop including sorghum-sudangrass and brassica species

Photo by Justin Duban

Brassica cover, winter, 2017

Photo by Justin Duban

Multi-species cover crop for grazing

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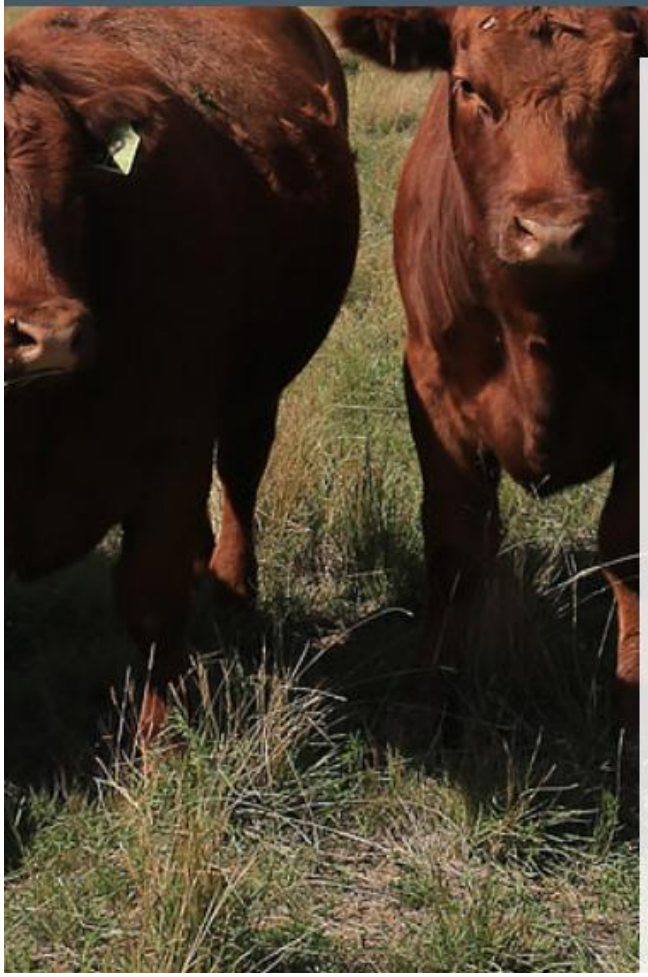


Cocktail Blends Provide Fall Grazing

August 31, 2016 | Ed Haag, AgscribeMedia

For many farmers in the grain and beef production regions of the U.S., the planting season ends when the last of the seed wheat or corn kernels are tucked neatly in the ground, but for a growing number of savvy farmers, it's only the beginning.

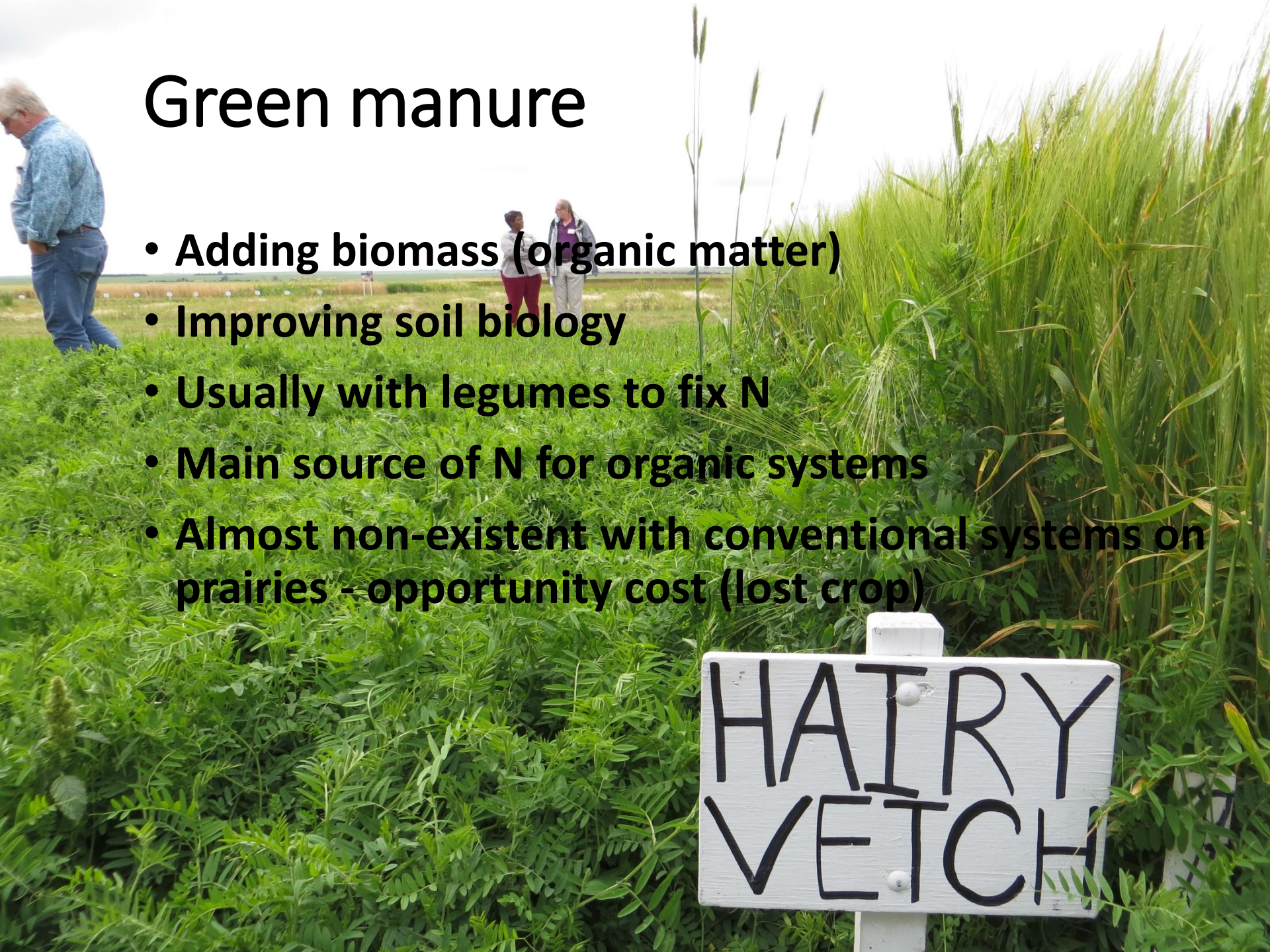
"By not planting that cover crop after harvest, you're passing up on a great opportunity to make more money and improve your soil health," says Ken Miller, district technician for the Burleigh County Soil Conservation District, Bismarck, ND.

Cover crop potential for grazing or forage
Dr. Mike Schellenberg, AAFC, Swift Current, SK


Monoculture
12" spacing
PEAS

Green manure

- **Adding biomass (organic matter)**
- **Improving soil biology**
- **Usually with legumes to fix N**
- **Main source of N for organic systems**
- **Almost non-existent with conventional systems on prairies - opportunity cost (lost crop)**



Nitrogen contribution of various types of legumes

Legume	Plant N derived from atmosphere (%)	N fixed symbiotically (kg ha^{1})
Alfalfa	80	114 - 300
Sweet clover	90	5 - 250
Faba Bean	90	178 - 300
Field Pea	80	2 - 200
Lentil	80	10 - 150

Adapted from Heichel, 1987 and Green and Biederbeck, 1995.

Suitability of legume cover crop-winter wheat intercrops on the semi-arid Canadian prairies

Robert E. Blackshaw, Louis J. Molnar, and James R. Moyer

Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403–1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1 (e-mail: robert.blackshaw@agr.gc.ca). *LRC Contribution number 38710002. Received 14 January 2010, accepted 1 April 2010.*

http://www.topcropmanager.com/cereals/cover-crops-with-winter-wheat-15442

Study design

- Winter wheat with fall and spring under seeded legumes
  - 23 cm wide row spacing with legumes planted mid-row
- Legumes included alfalfa, red clover and winter pea
- Alfalfa and red clover regrew following winter wheat harvest and was terminated with glyphosate in mid-October
- Canola planted following spring, plot split with half fertilized (80 kg/ha N + 10 kg/ha P)

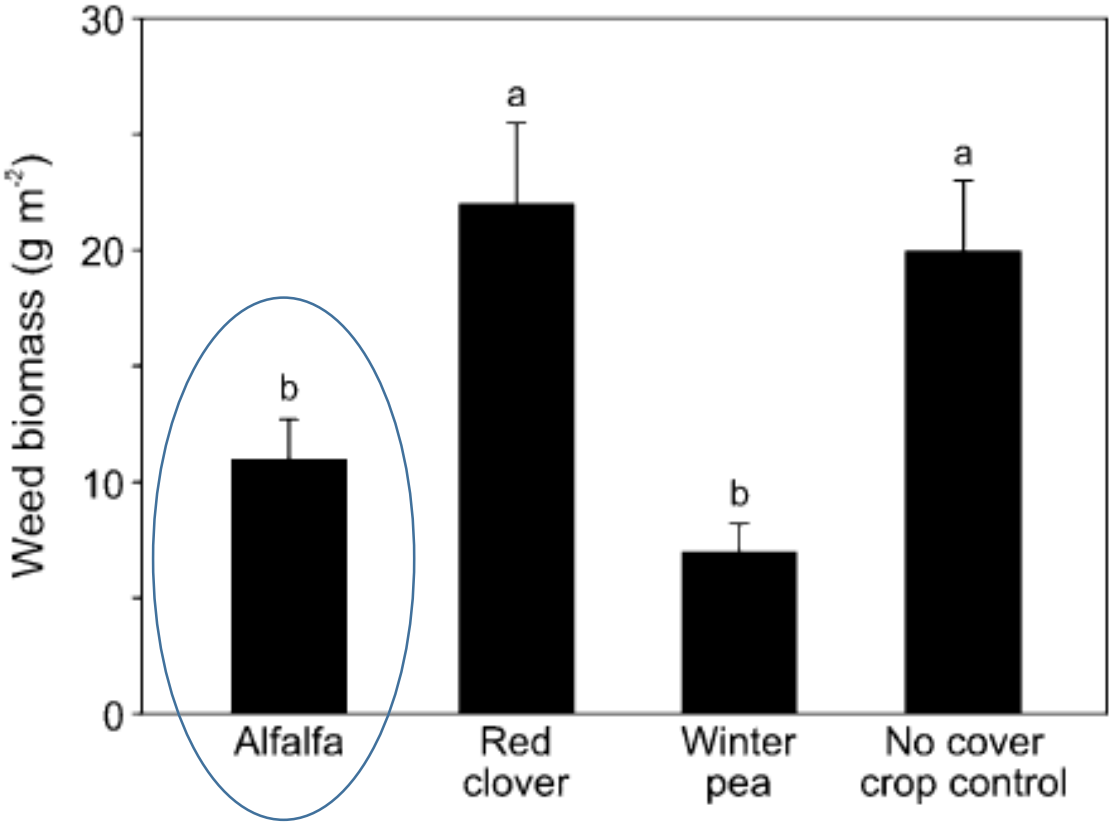


Fig. 1. Weed aboveground dry weight biomass as affected by legume cover crops in exp. 2. Means followed by the same letter are not significantly different ($P > 0.05$) according to Fisher's protected LSD. Error bars indicate standard error of the mean.

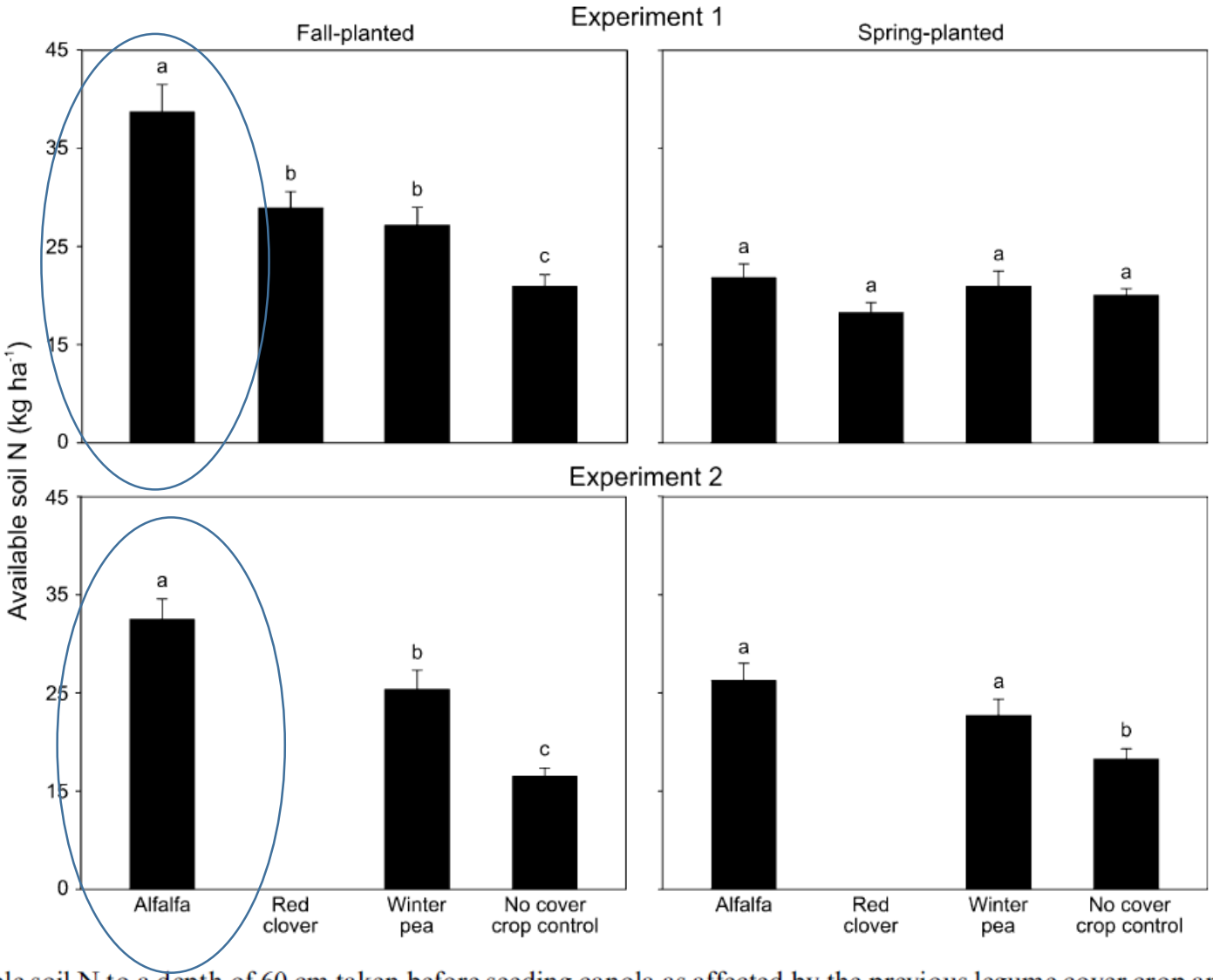


Fig. 2. Available soil N to a depth of 60 cm taken before seeding canola as affected by the previous legume cover crop and cover crop seeding date. Red clover biomass was near zero in exp. 2 and thus data were not collected. Means within an experiment and seeding date followed by the same letter are not significantly different ($P > 0.05$) according to Fisher's protected LSD. Error bars indicate standard error of the mean.

Findings

- Best was alfalfa under-seeded in the fall
  - Highest N-benefit to following crop
  - Minimal yield suppression to winter wheat
  - Best for weed suppression in winter wheat
  - Highest following crop yield (canola)
- Fall winter pea was reduced winter wheat yield
- Fall red clover tended to winter kill
- Spring alfalfa, red clover and winter pea established but had limited growth or measured benefits


Photography by K. C. Klein 2006

Sweet Clover Termination Effects on Weeds, Soil Water, Soil Nitrogen, and Succeeding Wheat Yield

Robert E. Blackshaw,* Louis J. Molnar, and James R. Moyer

- One of many studies by Blackshaw and Moyer at Lethbridge looking at sweet clover under seeded in first year, terminated following June at bud to early bloom

Findings:

- Sweet clover supressed weeds, improved soil N and benefitted following wheat yield (compared to conventional fallow)
- Soil moisture recharged during fallow following termination (equivalent to conventional fallow)
- Mowing was similar to disking for weed control and following crop yields (slight reduction for mowing versus tillage in one year of study)
- Removing as hay reduced N benefit and weed suppression

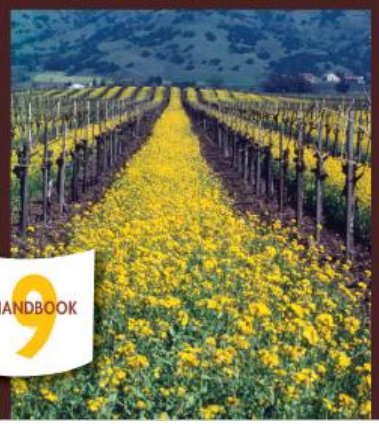
Sweet clover seedlings broadcast into Sunflower (photo - July 2)

Kirschenman Farm, Hilda

Late August ← Fall rye seeding date → Late October

Managing Cover Crops Profitably

THIRD EDITION



SARE Sustainable Agriculture Research & Education

HANDBOOK 9

Summary

- Green manure, inter-crops for grain or relay crops as forage are mainstream for organic systems and may have a fit for some conventional systems
- Covers protect soil and have potential to improve soil health
- Legume covers contribute fixed N, main source for organic systems
- Covers can help retain soil nutrient in an organic form and reduce “leakage” (leaching, de-nitrification and runoff)

Thanks!

FarmWise Inc.

Agronomy and Cropping System Specialist

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