PODF
PRAIRIE ORGANIC DEVELOPMENT FUND

LESSON 2: PART 2
January 6, 2023

Tillage and Weed Control

The Prairie Organic Development Fund

- Investment platform established to develop organic agriculture and marketing in the Canadian Prairies
- Builds resilience in the sector by investing in
  - organic provincial associations (Capacity Fund); and
  - high impact programs (Innovation Fund) related to marketing, research, policy, education and capacity development that have broad public benefit to the organic sector.

www.organicdevelopmentfund.org

The Prairie Organic Development Fund is grateful for the support of:

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We gratefully acknowledge funding from the Canadian Agricultural Partnership.

www.organicdevelopmentfund.org

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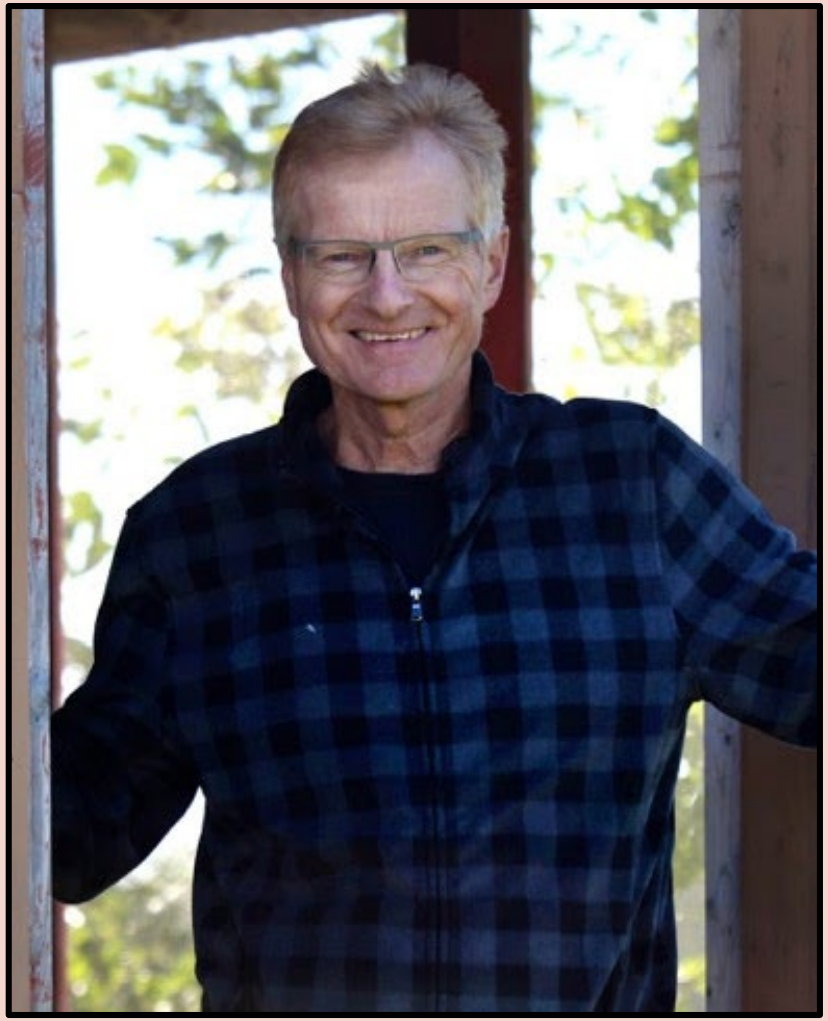
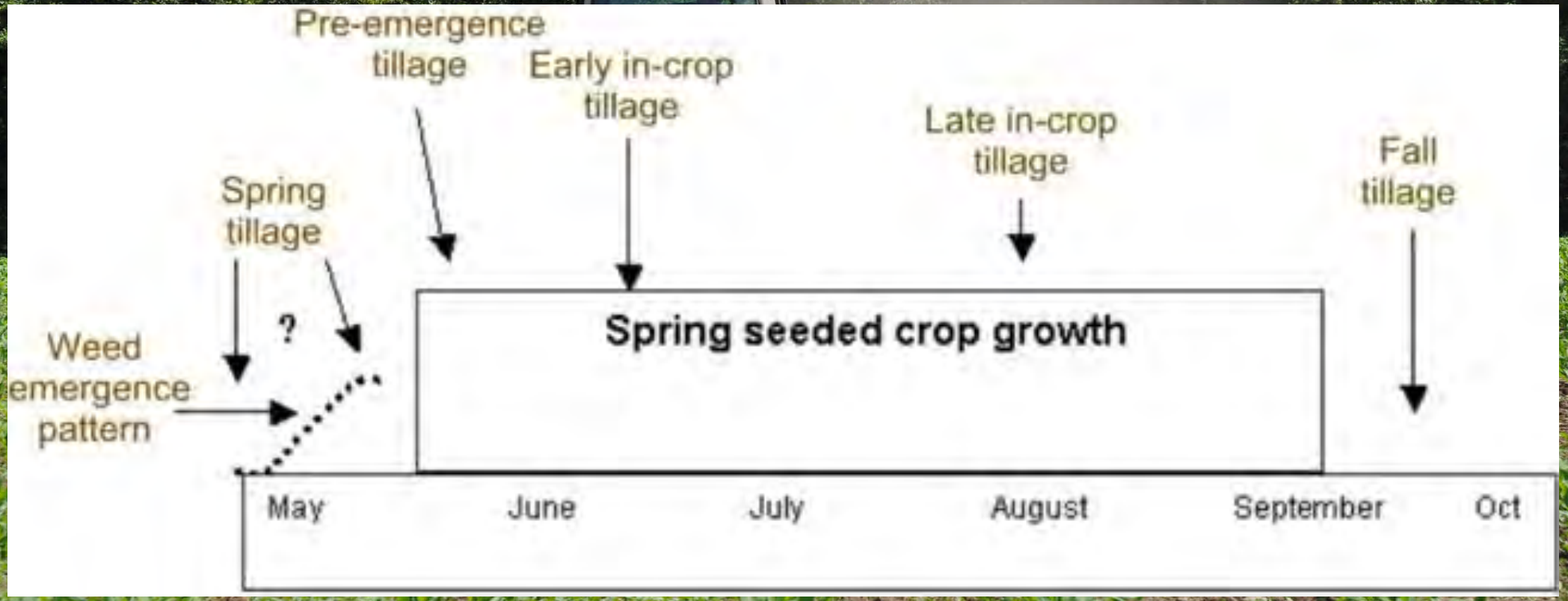
umanitoba.ca/outreach/naturalagriculture/



Lesson 2. Part 2. Tillage and Weed Control

Tillage for Weed Control

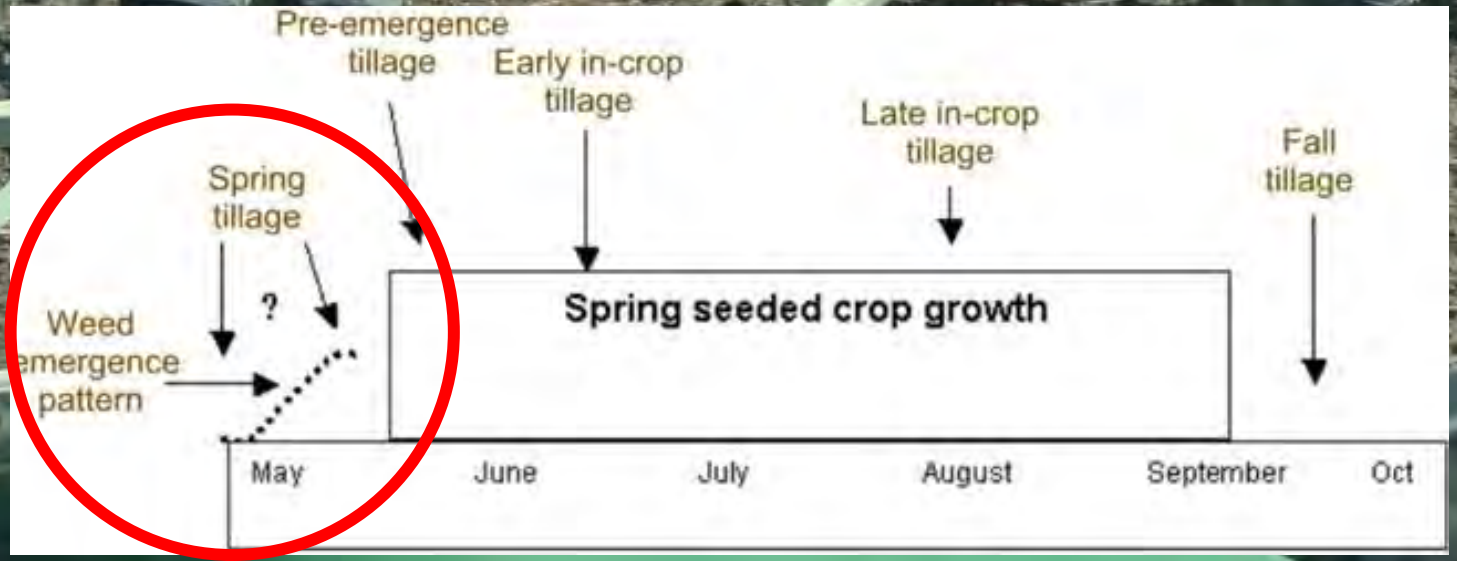
- Organic agriculture is very challenging without tillage

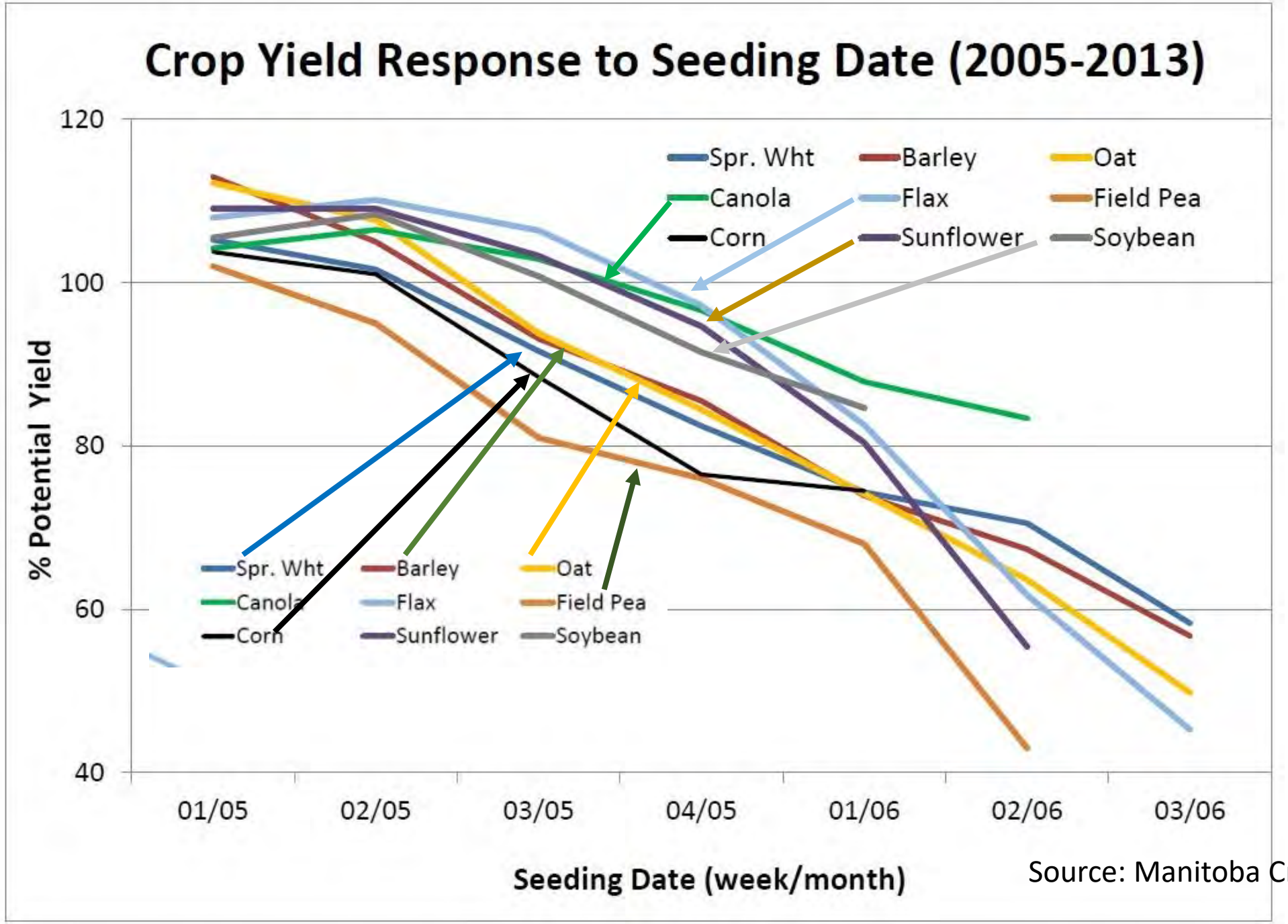


Pre-plant tillage/false seedbed/stale seedbed

Seeding Dates?

"Should seeding be done early, before the flush of weeds in the spring, or should it be done after most weeds have germinated?"





Source: Manitoba Crop Insurance

Thanks to Matthew Dewavrin, agr.

Les Fermes Longprés (2009) Ltée.

Cultivator to terminate red clover cover crops. Shanks firmly mounted on machine to promote effective undercutting of clover

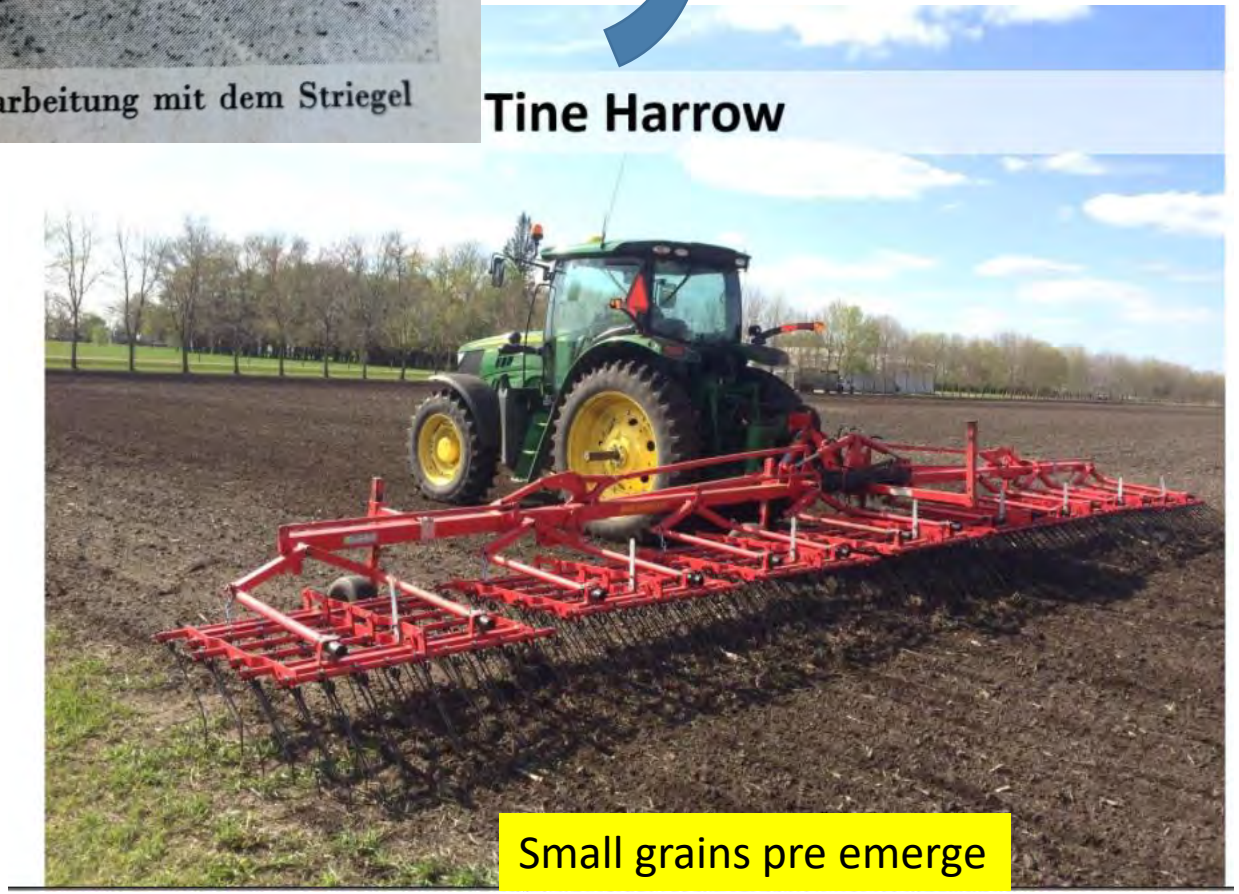
Pre-emergent tillage/blind harrowing

Abb. 122: Ganzflächige Bearbeitung mit dem Striegel

Rotary Hoe

For edible beans

Tine Harrow



Small grains pre emerge

Lely harrowing soybeans

Damage to crop at hook stage

Timing is important

White Thread Stage

Post Emergence Tillage

Credit: Jason Peters

- Preemergence harrowing increased the average crop yield by 6.2%, post-emergence harrowing by 4.0% and the
- combined effect was 10%.

- Crop yield was mainly increased on hard-packed soils.

- Weed and crop responses varied strongly among experiments, but the efficacy of pre- and post-emergence weed harrowing was positively correlated across experiments.

- Weed species composition was of minor importance regarding weed control.

- The study indicates that one aggressive postemergence cultivation may be as good as one preemergence and one less aggressive post-emergence cultivation

Brandsæter, L.O., Mangerud, K. and Rasmussen, J., 2012. Interactions between pre-and post-emergence weed harrowing in spring cereals. Weed Research, 52(4), pp.338-347.

Some of the machines and tillage systems for Organic soybean weed control in Minnesota

Dry beans tolerant to rotation harrow.

Crop biomass and yield response to rotary weeder applications at different stages of crop growth in pinto bean, black bean and navy bean production in 2018 in Carman, Manitoba. Stanley and Entz. 2022. New tools for mechanical weed control in low-input dry bean (Phaseolus vulgaris) production.Can. J. Plant Science. https://doi.org/10.1139/CJPS-2021-0282.

Stage	*Crop biomass*	*Yield*[a]
	kg ha^{-1}	
Pinto Bean		
Ground crack/hook	*5379.2*	*1408.4a*
VC	*4298.2*	*1267.6ab*
V1-V2	*4443.0*	*1232.9ab*
V3-V5	*4763.8*	*1311ab*
V8	*3509.3*	*1115.2b*
R1	*4143.2*	*715.1c*
Weed-free	*4471.8*	*1262.2ab*
P value	***NS***	***P=0.0011***
Black Bean		
Ground crack/hook	*4670.7*	*1394.7*
VC	*4419.3*	*1197.3*
V1	*5014.4*	*1381.8*
V2-V3	*4291.2*	*1374.5*
V5	*4527.1*	*1223*
R1	*4343.7*	*1162.7*
Weed-free	*4694.4*	*1254.8*
P value	***NS***	***NS***
Navy Bean		
VE-VC	*5708.3*	*1454.0ab*
VC-V1	*6490.3*	*1578.9a*
V2-V3	*6824.3*	*1439.5ab*
V4-V5	*5468.5*	*1141.2c*
R1	*5654.4*	*1299.0bc*
Weed-free	*5825.5*	*1372.27b*
P value	***NS***	***P=0.0069***

[a] Within a column, means followed by different letters are significantly different at the 0.05 probability level according Fisher $LSD_{0.05}$

Broadcast seeded, then harrowed using Phoenix harrow

Phoenix harrow

Flaming soybeans on-row in Minnesota

A weed control option when fields are too wet for tillage

Inter-row cultivation/scuffling

Abb. 123: Schlepperhackmaschine Bilder: Heller, Dethlingen

Interrow tillage guided by human operator

Germany, 1949

Organic dry beans, Manitoba

Inter-row cultivation in organic, narrow-row dry beans

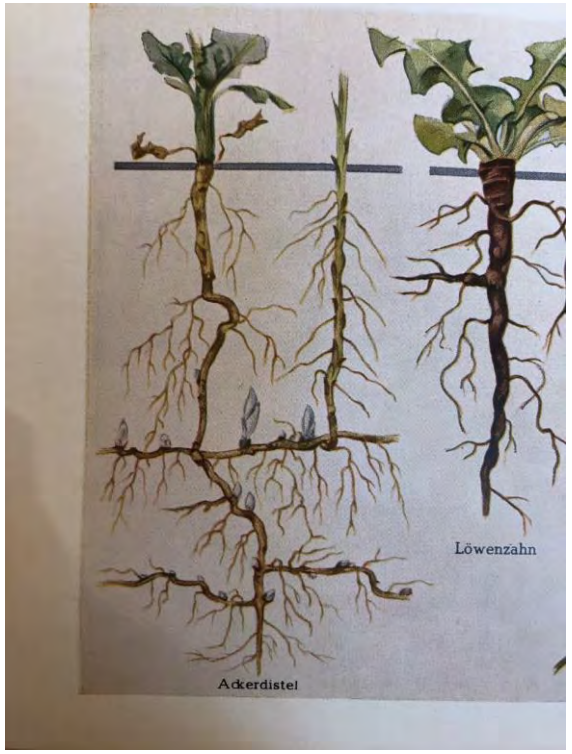
Interseeding ryegrass in organic corn, Quebec with inter-row tillage

Wide row corn and cover crops, Manitoba (Dr. Yvonne Lawley).

Tillage has limits

Wild oats

Canada thistle



Alfalfa hay depletes

- Wild oat soil seedbank
- Thistle root reserves

In-crop weed clipping

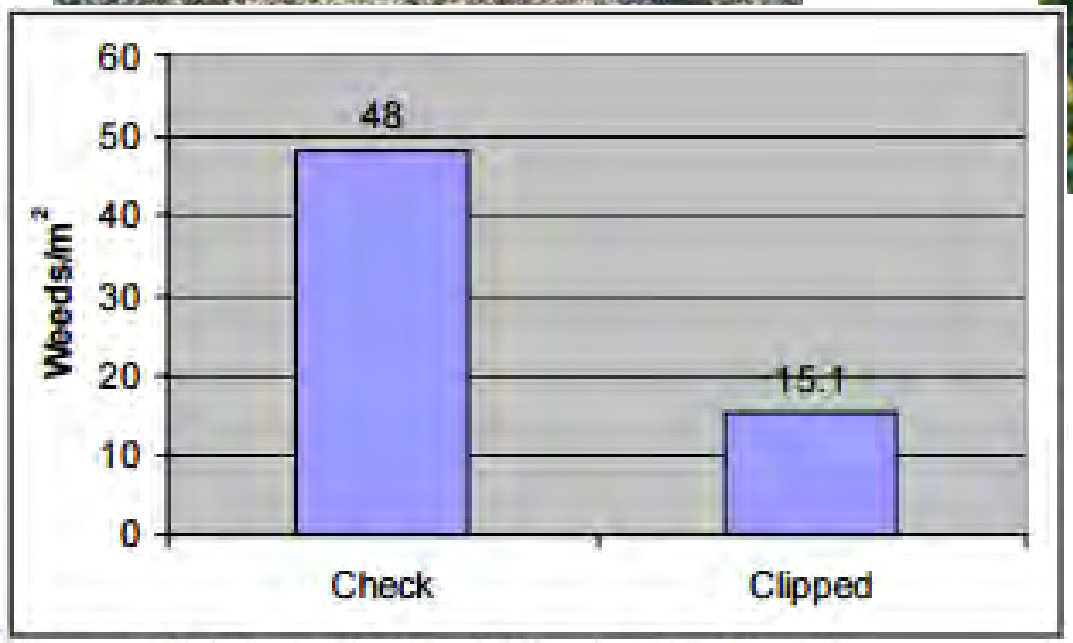
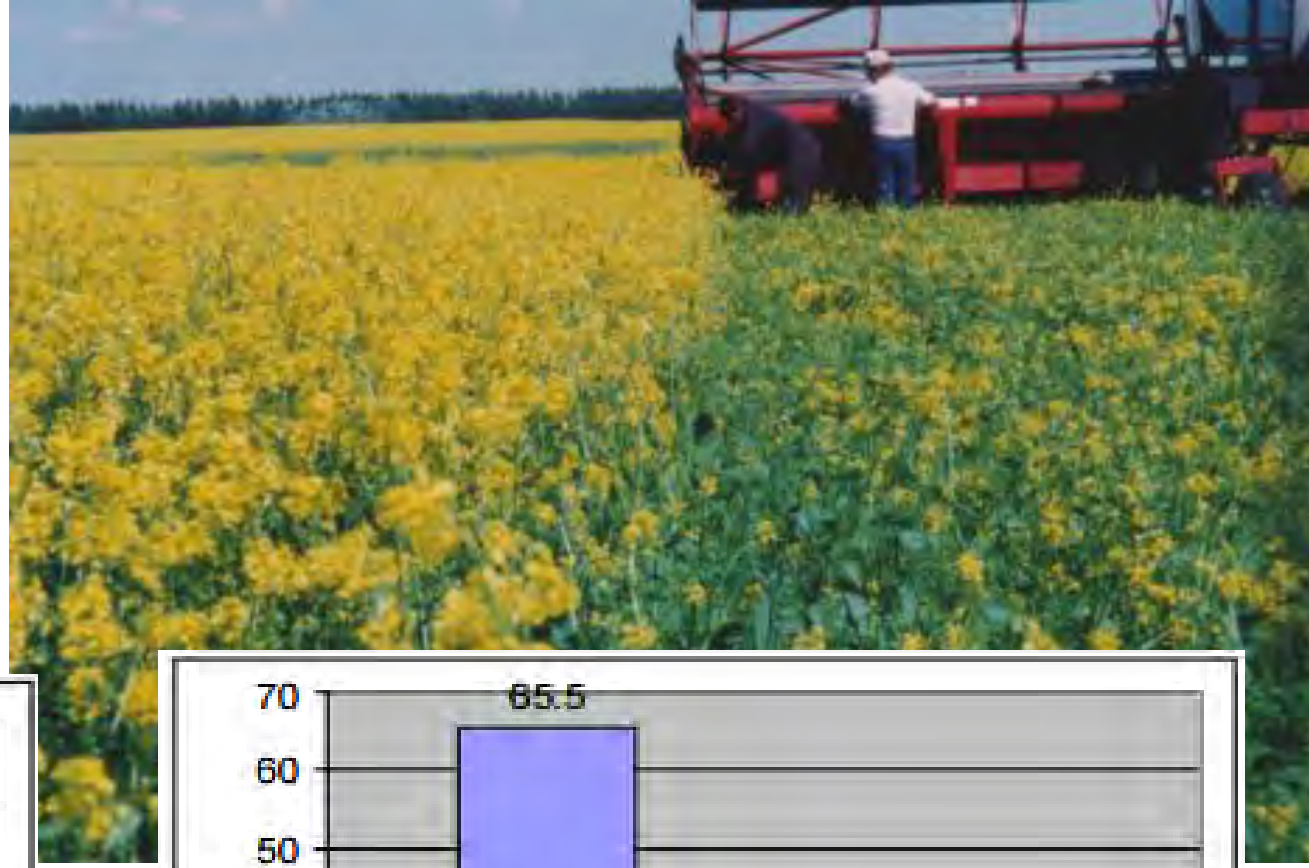


Figure 12. Effect of Weed Clipping on Weed Population 2001 - Site #1.



n Agr.

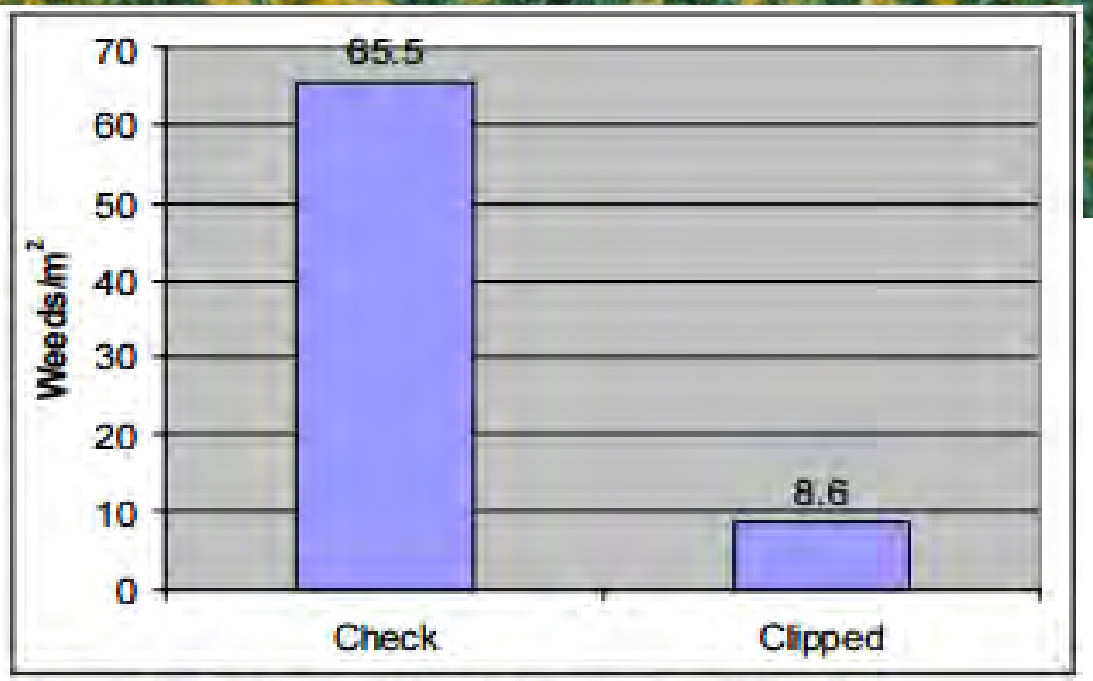


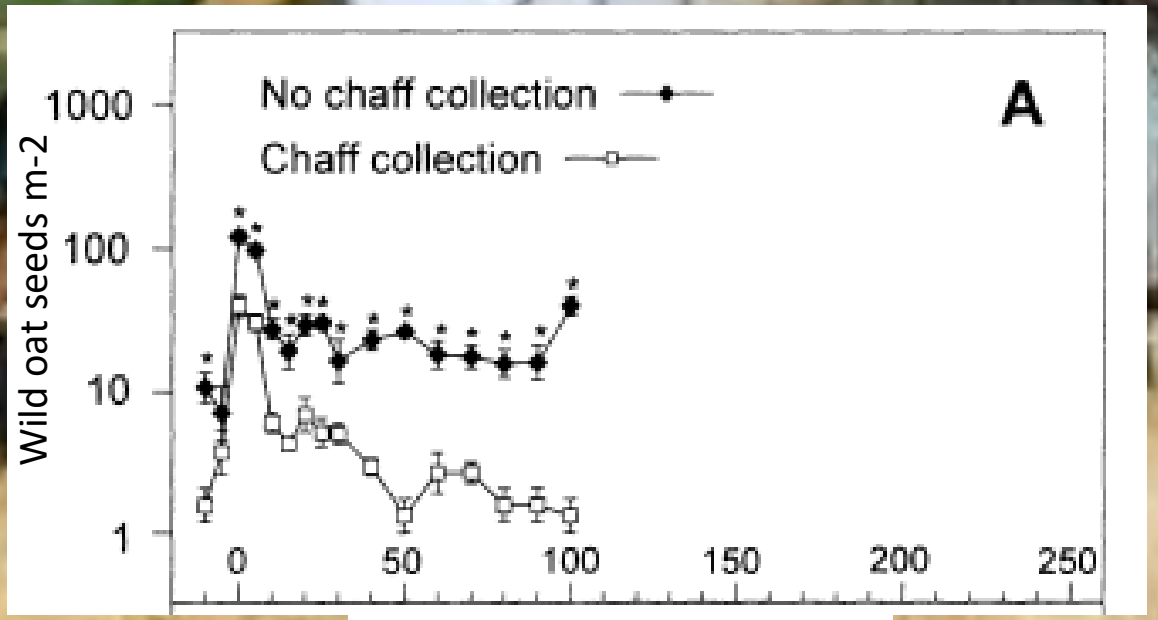
Figure 13. Effect of Weed Clipping on Weed Population 2001 - Site #3.

The CombCut
In-Crop Weed Seed Management

Weed Control at Harvest

Weed Control at Harvest

Combine harvester dispersal of wild oat with and without chaff collection



Shirtliffe, S.J. and Entz, M.H., 2005. Chaff collection reduces seed dispersal of wild oat (Avena fatua) by a combine harvester. *Weed Science*, *53*(4), pp.465-470.

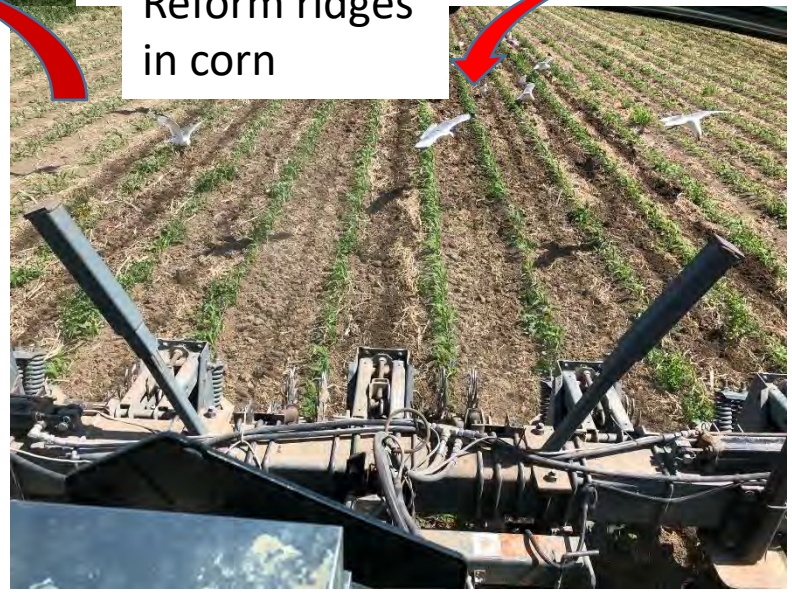
Conservation Tillage for Organic Production

Thanks to Matthew Dewavrin, agr.
Les Fermes Longprés (2009) Ltée.

Build ridges

Year 2. Seed corn onto ridges

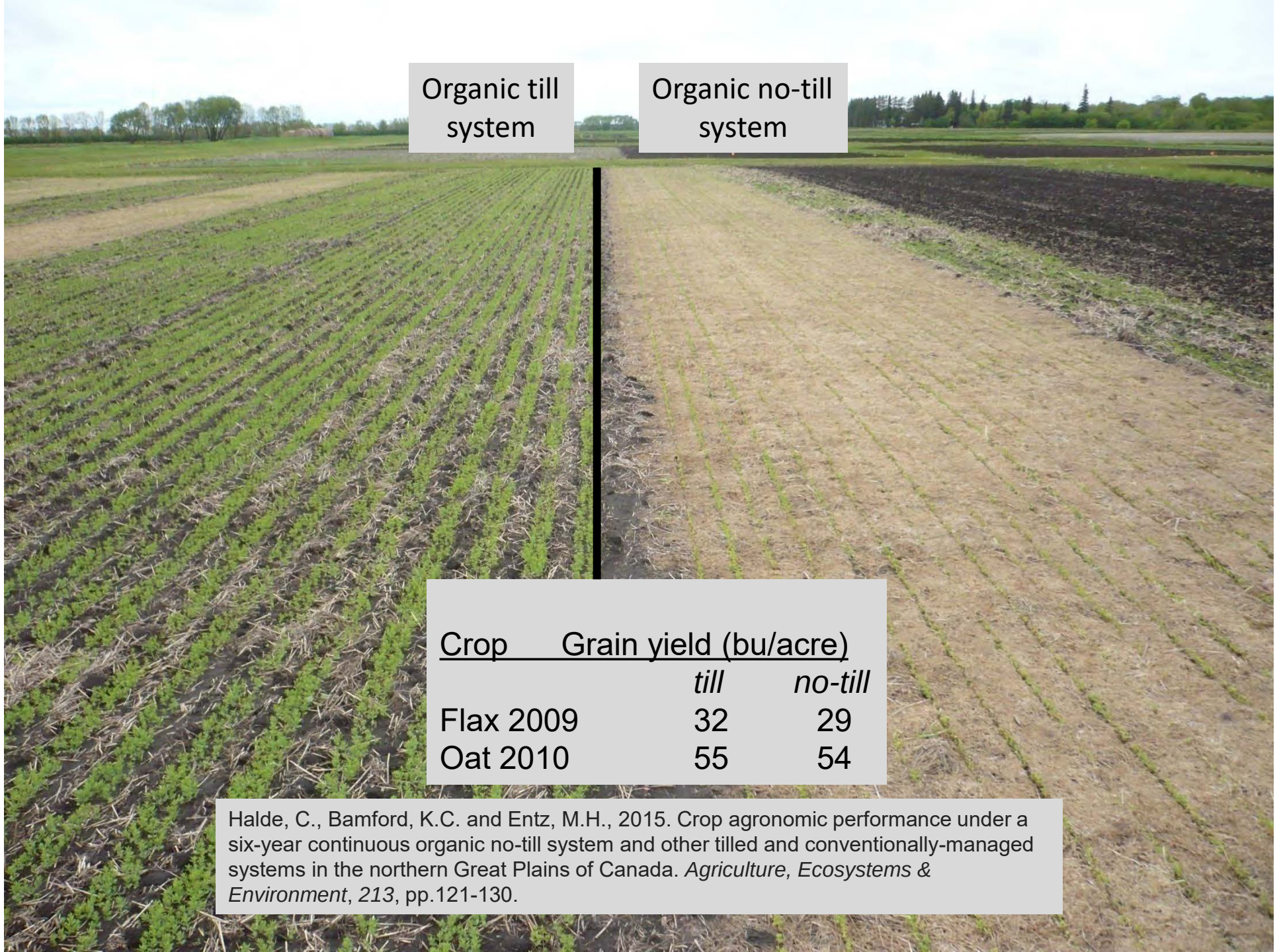
Reform ridges
in corn



Year 3. Seed soybeans on ridges

Conservation Tillage for Organic Production

Organic Rotational No-till



Crop	Grain yield (bu/acre)	
	till	*no-till*
Flax 2009	32	29
Oat 2010	55	54

Halde, C., Bamford, K.C. and Entz, M.H., 2015. Crop agronomic performance under a six-year continuous organic no-till system and other tilled and conventionally-managed systems in the northern Great Plains of Canada. *Agriculture, Ecosystems & Environment*, *213*, pp.121-130.

Fall rye mulch systems in organic production
Fergus Falls, Minnesota

Trying the Fergus Falls, Minnesota system in Carman, Manitoba with soybeans and dry beans

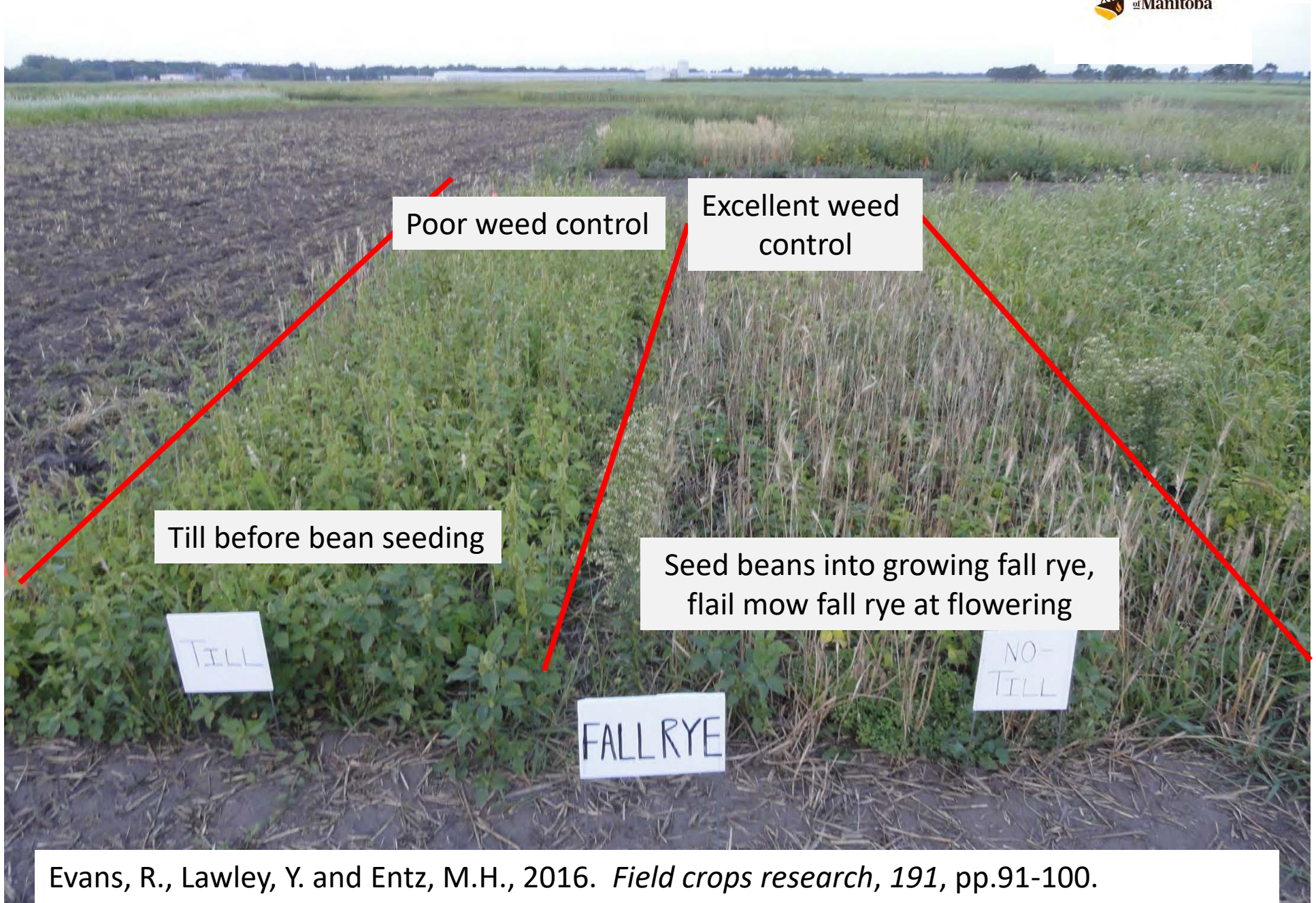
Soybeans establish well in rye

University of Manitoba


Flail mower used to kill rye once rye flowers

Rye in organic soybean production

This system did not work as well in dry beans



Evans, R., Lawley, Y. and Entz, M.H., 2016. *Field crops research*, *191*, pp.91-100.

3 Gen organics near Kitchner, Ontario used same system but roller rye instead of flail mowing.

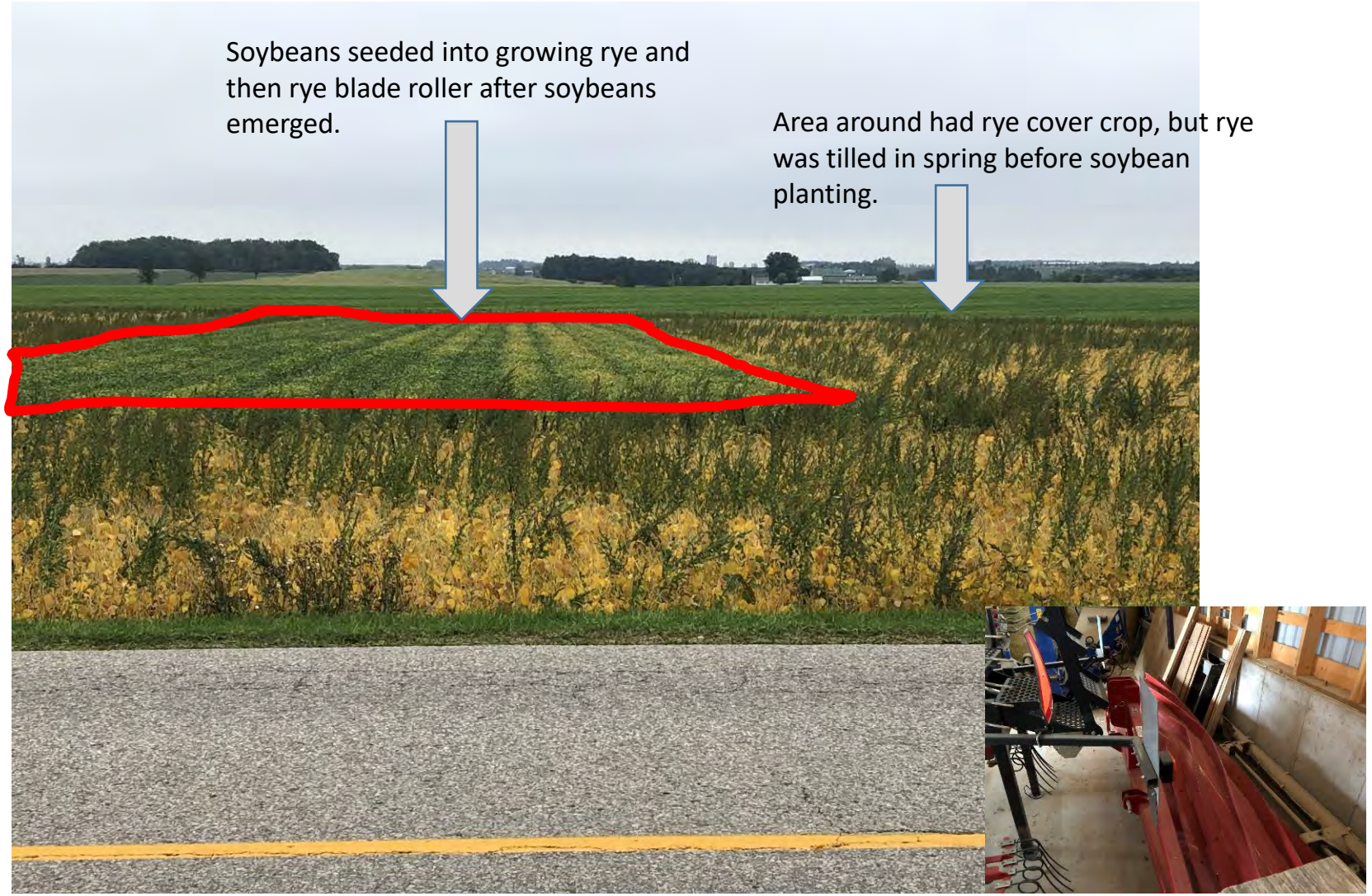


Photo: 2019

Seed fall rye in fall

Cut fall rye for
forage in late May

https://www.3genorganics.ca/

Seed soybeans
In 2022, 72 bu/acre
organic soybeans

Conservation Tillage for Organic Production

Dryland organic grain farming

Photo credit: Vilicus Organic Farm, Montana

Glenbow Museum, Calgary

Wide blade cultivator for organic plots at Glenlea, 2022

Perennial grass strips

https://vilicusfarms.com/

Broadcast seeded, then harrowed using Phoenix harrow

Uses in Prairie organics?

Establishing ryegrass in peas or lentils

Using snowmelt water to establish plants

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