Linking Organic Knowledge
OACC
Organic Agriculture Centre of Canada
oacc.info
Le réseau du savoir biologique
CABC
Centre d'agriculture biologique du Canada
agbio.ca

GREEN MANURE OPTIONS – ON-FARM DEMONSTRATION

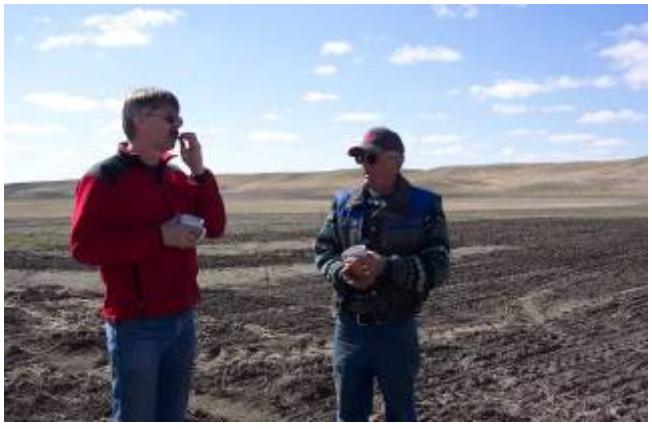
Final Research Report W2008-42

INTRODUCTION

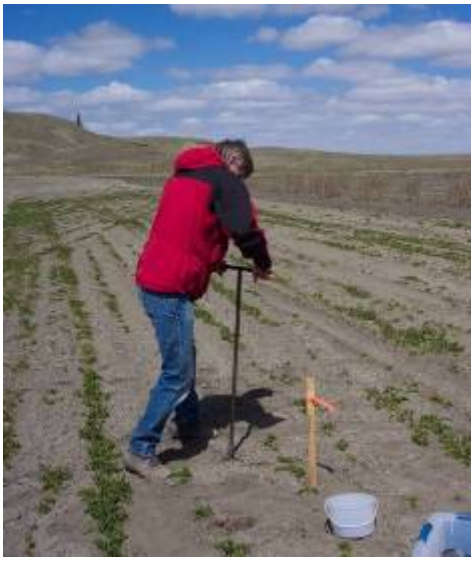
Green manures are recommended as a means of increasing soil fertility and reducing weeds but only half of Saskatchewan organic farmers use green manures. This project was developed as a partnership between the Organic Crop Improvement Association - Research and Education (OCIA RnE) and the Organic Agriculture Centre of Canada (OACC) to demonstrate the benefits of various green manure options.

Traditionally, farmers have terminated green manures by tilling to incorporate their residues. A percentage of 70% of residues below ground is recommended. Recently, it has been suggested that it may be just as beneficial to use a no-till termination and leave the residues on the surface. A second goal of this project was to test mowing as an effective way to benefit from green manures without tillage.

The study was initiated by Kirby McCuaig and conducted on Nature Acres Organic Farm (Kirby, Brenda and Schafer McCuaig) in Eastend, SK.



Martin Meinert (l) and Kirby McCuaig (r) take a break after seeding green manures (Brenda Frick)



Martin Meinert collects soil samples (Brenda Frick)

Norm Bromm repeated the experiment at Bromm's Organic Farm, Tisdale, SK. The McCuaigs and Bromms provided the seed, inoculants, machinery and labor, which included the help of interested neighbors. OACC collected samples and provided scientific support.

METHODS AT EASTEND

At Eastend, four options were compared: AC Greenfix chickling vetch, 4010 forage pea, green fallow (letting last year's volunteer crop and weed seeds grow until weeds flower) and black summer fallow (tillage as weeds emerge to keep the soil black).

Soil samples were taken at 0-6 in (0-15 cm) and 6-12 in (15-30 cm) depths in each plot in early May of 2005, 2006 and 2007. All samples tested as clay to clay loam soil, with pH measurements from 7.9 to 8.3. Levels of nitrogen (N), phosphorus (P), potassium (K) and sulfur (S) were on average 40, 42, >510, and 16 lb ac^{-1} respectively.

Plots of 21 ft x 500 ft (6.4 m x 152 m) were seeded to the green manure on May 2, 2005 after discing. Chickling vetch was seeded at 90 lb ac^{-1}; forage pea was seeded at 75 lb ac^{-1}. They were each inoculated with rhizobium. None of the plots were replicated.

One strip parallel to the treatments was mowed at early bloom of the legumes. The rest of the strips were incorporated with tillage.

Wheat was seeded across all treatments in 2006.

METHODS AT TISDALE

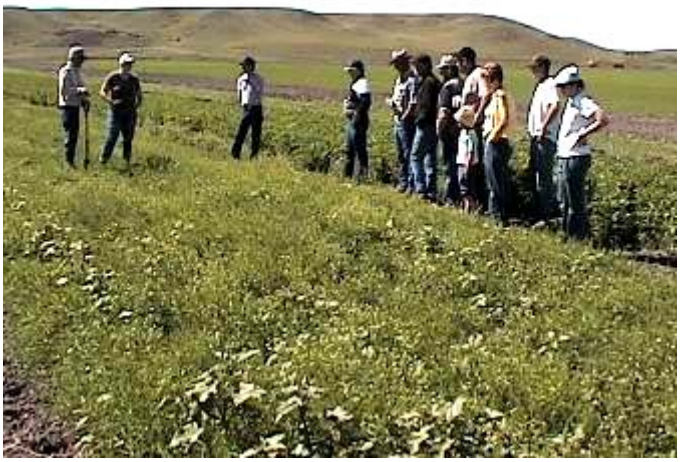
At Tisdale, five options were compared: field pea, oat, black fallow, green fallow and alfalfa/clover mix seeded the previous year. Soil samples were taken at 0-6 in (0-15 cm) and 6-12 in (15-30 cm) depths in each plot during early May of 2005. After discing, plots of 197 ft x 984 ft (60 m x 300 m) were seeded to the green manure on June 10, 2005. None of the plots were replicated.

Excess moisture in 2005 prevented termination of the green manures. Continued excess moisture in spring of 2006 prevented seeding of the succeeding crop at Tisdale. The experiment was abandoned; results are not reported here.

Seeding green manures at Tisdale (Jennifer Bromm)

RESULTS – DEMONSTRATION

The McCuaigs organized a field day in 2005 to demonstrate the green manure options. Participants toured plots and compared treatments.



Kirby McCuaig and Brenda Frick talk with producers at the field day (Jennifer Bromm)

Kirby explained that forage pea might be a useful green manure for farmers with cattle. He suggested that it be grazed in place to get the maximum benefits, including the nitrogen-rich cattle urine and manure in the forage pea field.

Kirby strongly recommended the chickling vetch, which was his green manure of choice. It is highly drought tolerant, has stronger stems and tends to break down slowly. Kirby felt that this helped provide nitrogen more closely in tune with the following crop's needs.

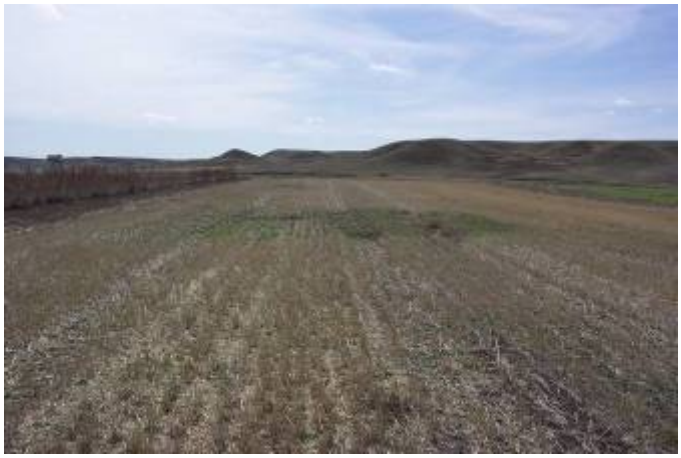
The green fallow option provided plant cover for the soil and biomass. He cautioned that timely termination was essential to avoid weeds going to seed and creating further problems.

Black fallow is not recommended for organic producers, due to the risk of potential erosion. However, N mineralization in black fallow can be an important source of fertility.

The Saskatchewan Organic Producers Association held a field day in Tisdale in 2005, featuring the green manure trial at Norm Bromm's farm. At both locations, farmer enthusiasm was high for this project.

RESULTS – GREEN MANURE AT EASTEND

Treatments are unreplicated. All results should be considered as anecdotal only.



Stubble field, May 2006: Green horizontal strip is mowed area (Brenda Frick)

Forage pea provided twice the biomass of the chickling vetch, though both plots provided similar amounts of green matter with the inclusion of weeds. Weeds in the green fallow provided about 20% of the green matter of the weed/legume mixtures.

Soil nitrogen levels in May 2006 were higher than in May 2005 for both the fallow and termination treatments. N levels increased most in soils that had been black fallowed in 2005, then the green fallow treatment, then chickling vetch and then forage pea.

Phosphorus levels were similar in 2005 and 2006 for forage pea, chickling vetch and black fallow. Phosphorus increased in the green fallow in 2006 in the mowed treatment. There is a possibility that this may be a sampling anomaly.

Sulfur levels were slightly higher at in each plot the 2006 sampling than in the 2005 sampling.

RESULTS – WHEAT YEAR (2006)

In the 2006 year, wheat establishment was much higher in tilled plots than in mowed plots (Table 1). Establishment in the black fallow plots was slightly lower than in other fallow treatments.

Weed numbers were higher in mowed plots and higher where the previous cover was forage pea than where it was chickling vetch.

Table 1. 2007 Wheat and weed counts

	Wheat Number		Weed Number plants m^{-2}	
	Tilled	**Mowed**	**Tilled**	**Mowed**
Chickling vetch	110	50	8	40
Forage pea	100	50	5	120
Green fallow	110		10	
Black fallow	90		2	

The greater emergence of weeds in the chickling vetch may have allowed those weeds to be removed at mowing, whereas the weed seed bank was less depleted in the forage pea stand.

Even including the weeds, the mowed plots had noticeably less cover. The clear rectangular area of lighter green and lower plant count in the photographs below is the area that was mowed the previous year.

RESULTS – YEAR 3 (2007)

Soil samples taken in May of 2007 showed the effect of the wheat crop in 2006. Nitrogen levels in 2007 where higher in the area that had once been mowed. Presumably less wheat in the mowed plots used less nitrogen, leaving more behind.

Available phosphorus levels were somewhat less in the plots that had once been mowed. Perhaps reduced plant growth in those plots left less of the P in the relatively more available form of decomposed plant material.

Wheat crop in 2007, showing mowed strip (Brenda Frick)

Close-up of mowed strip in wheat field in 2007 (Brenda Frick)

CONCLUSION

It is difficult to draw conclusions about the results of his demonstration project because it is a single unreplicated trial. Nevertheless, some trends are more evident than others. The use of fallow did result in additional nitrogen for the following crop. Each of the green fallows – using forage pea, chickling vetch or weeds – resulted in greater wheat density in the following year than the black fallow. Wheat established poorly in the areas where the green manure had been mowed. Weeds grew best where crops grew poorly. A single wheat crop removed much of the nitrogen provided by the green manure.

Pea green manure (Brenda McCuaig)

ACKNOWLEDGEMENTS

Brenda McCuaig, Nature Acres; Martin Meinert, Norm Bromm

Production of this bulletin was supported by:

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

Kirby McCuaig seeding green manures (Brenda Frick)

THE BOTTOM LINE...

- ✓ There are several viable options for green manures in the Prairies, including forage pea, chickling vetch or green fallow.
- ✓ Mowing should be approached cautiously for green manure termination.

CREDITS

Kirby McCuaig, Nature Acres and OCIA Research and Education; Brenda Frick and Jennifer Bromm, Organic Agriculture Centre of Canada at University of Saskatchewan; Norm Bromm, Bromm Organic Farm; Roxanne Beavers (ed.) OACC Truro

FUNDING

Saskatchewan Ministry of Agriculture
Nature Acres Organic Farm
Bromm's Organic Farm

For more information:
Visit **oacc.info** or contact us at:
University of Saskatchewan
51 Campus Dr., Saskatoon SK S7N 5A8
Tel: (306) 966-4975 Fax: (306) 966-5015
Email: organic@usask.ca

UNIVERSITY OF SASKATCHEWAN

Saskatchewan Ministry of Agriculture