



Forages in Rotation

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Over the past year there has been a lot of interest from both livestock and grain producers wanting information on including legume forages in short rotation in cropping systems. Research shows that adding legume forages into an annual cropping rotation can be a viable option, providing high quality feed, good yields and reasonable levels of residual soil nitrogen (N) two years after legumes are taken out of a cropping system, providing an alternative way to build soil N.

Table 5. Typical nitrogen contributions from green manure crops in Manitoba ^{6, 7}.

Green manure crop	Amount of available nitrogen (lb/ac)		
	Year 1	Year 2	Year 3
Full season growth			
Alfalfa (4 year stand)	70	25	7
Sweet clover	55	20	
Chickling vetch	75	5	
Indian Head lentil	70	10	
Relay seeded with winter cereals			
Annual alfalfa	45-55	5	
Red clover (spring terminated)	20-25	5	
Double cropped after winter cereals			
Chickling vetch	25-40		
Indian Head lentil	20-35		
Summerfallow	55	-4	

Source Mb Soil Fertility Guide

Work out of Saskatchewan with the Western Beef Development Center (WBDC) and AAFC showed overall net returns after four years were higher for those rotations that included forages as compared to standard annual crop rotations. The four-year study was to determine the amount of residual N from a two-year crop of alfalfa or red clover in a four-year rotation with wheat and canola. The rotations included: alfalfa-alfalfa-wheat-canola; red clover-red clover-wheat-canola; barley-pea-wheat-canola; and a control barley-flax-wheat-canola. The legume forages were terminated at the end of year two, followed by Unity wheat grown on all treatments in 2012, and Liberty Link (L130) canola on all treatments in 2013, with no additional N fertilizer applied to either crop.

This study was broken down in to two parts. After the second year the forage legumes provided revenues that exceeded the control rotation at all sites, except Melfort, which experienced exceptional yields on flax. The flax yield at Melfort was 3456 kg/ha or 55 bu/ac, nearly double the five-year average yield (28.6 bu/ac). If flax yield had been in line with the five-year average, the alfalfa-alfalfa-wheat-canola rotation would have had the highest cumulative net returns. Overall, the cumulative average net returns for all sites after two years was \$346/ha on alfalfa, \$236/ha on red clover and \$7/ha for the barley-pea rotation. Due to the exceptionally high flax yields at Melfort, the cumulative average net return for the barley-flax rotation was \$297/ha.

Looking at the four-year cumulative average net returns of the study the legume-legume-wheat-canola rotations were highest at all locations except Melfort again largely due to the exceptional flax yields. With some exceptions the plots with alfalfa and red clover out yielded the control plots by an average of 40% for wheat and canola. The nitrogen fixed by the legumes varied from soil zone and climatic conditions. Taking four-year cumulative net returns and Nitrogen Fertilizer Equivalent values together, the alfalfa rotation was the highest at Melfort (\$2558/ha) and Swift Current (\$613/ha); however, the red clover rotation was higher at Saskatoon (\$1764/ha) and Lanigan (\$1577/ha). The project results show that including short rotation legumes can provide residual soil N for uptake by subsequent annual crops and the net returns are competitive with a typical rotation like the control (barley-flax-wheat-canola).

One of the things that I didn't see in this study was the yield benefit of crop rotations. MASC data shows that there is a 2-4% yield hit in a barley-flax-wheat rotation and this may have contributed somewhat to the lower returns in the control plots.

Previous Crop	Crop Planted									
	Winter Wheat	Spring Wheat	Barley	Oats	Canola	Flax	Field Peas	Soybeans	Sunflowers	Grain Corn
Winter Wheat	78	74	106	100	97	107	107	101	97	87
Spring Wheat	86	85	98	101	104	104	103	103	101	100
Barley	83	89	84	93	100	96	101	100	97	99
Oats	76	90	86	82	92	95	97	99	100	93
Canola	104	102	103	104	85	88	92	101	95	95
Flax	102	98	110	97	104	73	101	96	98	NSD
Field Peas	NSD	100	104	98	104	124	NSD	NSD	NSD	NSD
Soybeans	NSD	106	106	105	98	100	NSD	95	92	103
Sunflowers	NSD	99	102	96	NSD	NSD	NSD	99	88	99
Grain Corn	NSD	NSD	101	106	104	NSD	NSD	107	112	87
Yield (bu/ac)	65	47	62	95	34	20	37	32	1521lbs	95

Relative Yields (2008 - 2012)

Relative yield response (percent of average) of Manitoba crops sown on previous crops (stubble >120 acre)

Producers here in Manitoba need to look closely at these variations, consider their typical rotations and how legumes may or may not fit into their marketing program. Other factors that need to be considered are the benefits that adding a forage legume may have on soil health. One thing for sure is that there isn't a right or wrong answer. Adding forage legumes to your operation can provide some benefits but it's not for everyone.

Adapted from a Top Manager article - [Economics of short rotation legume forages](#)

Additional Information:

The Benefits of Including Forages in Your Crop Rotation

<https://www.gov.mb.ca/agriculture/crops/production/forages/benefits-of-including-forages-in-your-crop-rotation.html>

Manitoba Soil Fertility Guide

https://www.gov.mb.ca/agriculture/crops/soil-fertility/soil-fertility-guide/pubs/soil_fertility_guide.pdf

Economics of short rotation legume forages

<http://www.agannex.com/field-crops/economics-of-short-rotation-legume-forages>