

Project Title: Quantifying the nitrogen benefit of legumes in a crop rotation

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Objective: To quantify the amount of nitrogen supplied by legumes to subsequent spring wheat and canola crops

Materials and Methods:

A three-year crop sequence study was initiated in 2009 at Northwestern Agricultural Research Center in Creston, MT. In 2010, another site was initiated and the crop sequence was continued at the 2009 site. The table below outlines the timeline of the proposed crop sequence at the two sites.

Table 1. Project years, crops and sites to be used in the evaluation of crop sequence on wheat and canola in northwestern Montana.

Project Year	Crop Sequence	Site 1	Site 2
0	Alfalfa	2006	2007
0	Alfalfa	2007	2008
0	Barley	2008	2009
1	Initial Crops	2009	2010
2	Spring Canola/Spring Wheat	2010	2011
3	Wheat	2011	2012

Site 1

In 2009, Initial Crops included pea ('Universal', 'Aragorn'), lentil ('Richlea', 'Brewer'), and wheat ('Jedd'), as well as a fallow treatment. Following the production of the Initial Crops in Year 1 of the study, Year 2 of the crop sequence was initiated. Vertical fertilizer treatments were broadcast and incorporated prior to planting, at rates of 0, 40, 80 and 120 lb N/ac. On May 7, 2010, spring wheat ('Jedd') and canola ('Python 2') were seeded into sub-plots at 80 and 5 lb/ac, respectively. Soil N and moisture content (24" depth) were collected in the 0 and 80 lb N/ac plots to 24" depth just after planting, and again at harvest. Time to flowering and maturity, plant stand, weed biomass, disease and insect incidence, seed yield, test weight, moisture content were collected. Grain protein, seed oil content and plant tissue N analysis is presently being conducted.

Site 2

Initial Crops pea ('Universal', 'Aragorn'), lentil ('Richlea', 'Merritt'), and wheat ('Jedd') were planted on April 27, 2010. Time to flowering and maturity, plant height, canopy height, grain yield, test weight and moisture content were recorded. Peas were harvested August 19, lentils were harvested August 27, and wheat was harvested Sept 8, 2010.

Results:

Initial findings indicate that canola yields were highest following fallow (2215 lb/ac) and pea (1985 lb/ac), and were lowest following wheat (1630 lb/ac) (Table 2). Spring wheat yield did not differ according to previous crop, except in the case of continuous wheat, which resulted in a yield reduction. Spring wheat and canola yields correspond closely with spring soil N, which was highest following fallow (130 lb N/ac) and pea (100 lb N/ac) (Table 3).

Table 1. Effect of previous crop on canola and wheat yield.¹

2009 Crop	Canola yield (lb/ac)	Canola yield (bu/ac)		Wheat yield (lb/ac)	Wheat yield (bu/ac)	
Fallow	2215	44.4	a	3604	63.5	a
Pea	1985	40.4	ab	3721	65.1	a
Lentil	1797	36.5	bc	3702	64.8	a
Wheat	1630	33.5	c	3256	57.1	b
Mean	1908	38.7		3571	62.6	
P>F	0.03	0.04		0.05	0.03	
LSD (0.05)	344.5	6.84		329.0	5.23	

¹within crops, canola and wheat yields with the same letter do not differ at the $\alpha=0.05$ level.

Table 3. Effect of previous crop of spring soil nitrogen levels.¹

Previous Crop (2009)	Spring 2010 soil N (lb/ac)	
Fallow	129.8	a
Pea	99.8	ab
Lentil	95.5	b
Wheat	70.0	b
P>F	0.05	
LSD (0.05)	30.9	

¹spring soil N levels with the same letter do not differ at the $\alpha=0.05$ level.

Data from this site also suggest that pea variety may impact the yield of a subsequent canola crop. Canola yields were higher following 'Aragorn' pea (2323 lb/ac) compared to when canola followed 'Universal' pea (1648 lb/ac), however there was no significant difference in the concentration of soil N or moisture in 'Aragorn' or 'Universal' pea plots prior to the planting of the canola crops in the spring of 2010. 'Universal' peas were higher yielding in 2009 than 'Aragorn' at 3987 lb/ac compared to 3532 lb/ac. Further study is required to determine if this trend continues in other location-years.

Future plans:

The third year of the study at Site 1 will continue in 2011, with wheat planted into all plots. At Site 2, spring wheat and canola will be planted into plots where pea, lentil, wheat, and fallow treatments stood in 2010. Nitrogen fertilizer treatments will be applied at 0, 40, 80 and 120 lb N/ac, and data on yield, and soil and plant N status will be collected.