

Project Title: Nitrogen and sulfur fertility for camelina in Montana

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Objectives:

- i. To determine the effect of nitrogen and sulfur fertilizer rates, and their interaction effects on camelina seed yield and agronomic performance at the Northwestern, Northern and Central Agricultural Research Centers.
- ii. To investigate the effects of variety and fertilizer rate on camelina productivity in these same locations.

Materials and Methods:

Field trials were planted in 2009 and 2010 at three Montana State University agricultural experimental stations: Northwestern Ag Research Center (Kalispell, MT), Northern Ag Research Center (Havre, MT), and Central Ag Research Center (Moccasin, MT). Two camelina varieties (Blaine Creek and Suneson) were grown under rainfed conditions at each site. Nitrogen (N) fertilizer treatments and target N levels varied among locations, and were determined based on spring soil testing and suitability for the area (Table 1). Sulfur fertilizer treatments were combined with N treatments to create eight fertilizer treatment levels at each location. The experimental design at Kalispell was a split plot design with four replications and was a randomized complete block design with four replications at Havre and Moccasin.

Table 1. Soil analysis and target N levels for trials conducted at six Montana sites in 2009 and 2010.

Site Name	Location	Year	pH	OM	Pre-plant soil N (0-24")	N fertilizer treatment levels	Target N levels	Pre-plant soil S (0-24")	S fertilizer treatment levels
				%	lb N/ac	lb N/ac	lb N/ac	lb S/ac	lb S/ac
Hav09	Havre	2009	7.8	1.6	61	0,30,60,90	61,91,121,151	50	0,20
Kal09	Kalispell	2009	7.4	5.3	26	0,40,80,120	26,66,106,146	64	0,20
Moc09	Moccasin	2009	7.1	3.7	13	0,30,60,120	13,43,73,133	na	0,20
Hav10	Havre	2010	8.0	1.4	60	0,30,60,90	60,90,120,150	38	0,20
Kal10	Kalispell	2010	7.8	1.8	38	0,40,80,120	38,78,118,158	48	0,20
Moc10	Moccasin	2010	na	3.4	72	0,30,60,120	72,102,132,192	16	0,20

In 2009 and 2010, fertilizer treatments were broadcast and incorporated prior to seeding at Kalispell and were broadcast at the time of seeding at Havre and Moccasin. In all location-years, flowering and maturity date, and plant height were recorded. Plots were direct harvested using a plot combine, and plot yield, test weight, and seed moisture content were recorded. Grain oil and grain protein percentages were determined, and in 2010, soil sampling was conducted in each plot after harvest, and analyzed for nitrate-N and sulfate-S in order to assess crop nutrient uptake.

Results:

In 2009, camelina yields averaged 2,043 lb/ac at Havre, 2,123 lb/ac at Kalispell, and 755 lb/ac at Moccasin (Table 2). The low yields at Moccasin were due to low rainfall throughout the growing season (annual precipitation was nearly 5 in. less than the long term average of 15.3 in). Camelina seed yields were not affected by N fertilizer at Kalispell or Havre, but increased linearly with N fertilizer at Moccasin. In 2010, camelina yields averaged 1,447 lb/ac at Havre, 1,222 lb/ac at Kalispell and 1,681 lb/ac at Moccasin. At all three sites, seed yield increased with N fertilizer, up to 80 lb N/ac at Kalispell and up to 60 lb N/ac at Havre and Moccasin. When taking both fertilizer N and available soil N into consideration, camelina yields reached their maximum when soil N + fertilizer N reached 120 lb N/ac (Tables 1 and 2).

Table 2. The effect of nitrogen fertilizer on camelina seed yield at three Montana locations in 2009 and 2010.

Location	Havre 2009	Havre 2010	Kalispell 2009	Kalispell 2010	Moccasin 2009	Moccasin 2010		
Applied N (lb N/ac)	Seed yield (lb/ac)		Applied N (lb N/ac)	Seed yield (lb/ac)		Applied N (lb N/ac)	Seed yield (lb/ac)	
0	2010	1168	0	2033	756	0	407	1505
30	2000	1365	40	2190	1174	30	687	1694
60	2048	1582	80	2152	1592	60	840	1712
90	2114	1674	120	2116	1367	120	1087	1813
F test	ns	**	ns	**	**	**	**	
LSD (0.05)	157	153	277	188	316	107		
<b>Mean</b>	<b>2241</b>	<b>1419</b>	<b>2170</b>	<b>849</b>	<b>457</b>	<b>1569</b>		

Sulfur fertilizer did not affect seed yield of camelina at any of the location-years, except at Kalispell in 2010, where an additional 20 lb S/ac resulted in a yield increase of 315 lb/ac (Table 3). The large response to S at the Kalispell 2010 location may be in part due to the sandy soil texture at that site.

Table 3. The effect of sulfur fertilizer on camelina seed yield at three Montana locations in 2009 and 2010.

Fertilizer (lb/ac)	Havre 2009	Havre 2010	Fertilizer (lb/ac)	Kalispell 2009	Kalispell 2010	Fertilizer (lb/ac)	Moccasin 2009	Moccasin 2010
Sulfur								
0	2032	1460	0	2130	1060	0	832	1674
20	2054	1435	20	2114	1385	20	678	1688
P value	ns	ns		ns	**		ns	ns
LSD (0.05)	96	108		169	133		197	76
<b>Mean</b>	<b>2043</b>	<b>1447</b>		<b>2123</b>	<b>1222</b>		<b>755</b>	<b>1681</b>

Future Plans:

This experiment has been concluded and additional reports are forthcoming.