

Response of Camelina to Nitrogen, Phosphorus, and Sulfur

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Introduction

Consumption of biodiesel is expected to increase in the United States. An issue with biodiesel has been cost, and a substantial portion of that cost is in the base oil ingredient. By using a crop with relatively low inputs, production costs would be lowered, decreasing the overall cost of biodiesel. Camelina shows considerable promise as an oilseed suitable for bio-products and for low-input cropping systems since it can be planted very early in the spring.

Methods

Nitrogen (N) rates of 0, 30, and 60 lb N/acre, P₂O₅ rates of 0, 15, and 30 lb/acre, and sulfur (S) rates of 0, 10, and 20 lb/acre (0 and 15 lb S/acre in 2006) were applied to camelina (Selena) at several locations in 2005 and 2006. Due to funding cuts, only N treatments of 0, 30, 60, and 90 lb N/acre were applied in 2007 at one location. Treatments were arranged in a randomized complete block design. Nitrogen as urea, 25 lb/acre of potassium (K) as KCl, and S as potassium sulfate were applied while seeding in a band approximately one inch above and to the side of the seed row or broadcast. Phosphorus (P) fertilizer as 0-45-0 was applied with the seed. Previous crops were tilled fallow or chemical fallow in 2005 and 2006, and barley in 2007. All plot areas were planted no-till except at the Western Triangle Ag. Research Center (WTARC) in 2005. Soils were sampled initially for water, nitrate-N, and sulfate-S in one foot increments to a depth of three feet. Surface soil samples (0-6 in.) were collected for standard soil analyses (Table 1). Plots were swathed and threshed with small plot equipment, and the seed weighed and tested for N, P, K,

and S content, oil content, and fatty acid composition of the oil.

Results

The effects of N on camelina seed yield and oil content are shown in Figures 1 and 2. The Kalispell location was the only site that did not exhibit a positive or neutral yield response to N fertilization. These data indicate that producers need to apply about 80 lb N/acre for optimum yield and oil content. Seed oil content usually averaged about 40% except during 2007 and generally declined slightly with increasing N rate.

The effect of P and S fertilization on camelina seed yield is shown in Table 2. Since there were no significant interactions, only the main effects of P and S are shown. Four of the five locations responded to P, but P soil tests at the responsive sites were 12 ppm or less. The non-responding site had a very high soil test of 46 ppm. When P soil tests are low or very low, growers should apply about 15 lb P₂O₅/acre and expect a yield increase of about 100 lb/acre. Sulfur fertilization did not affect seed yield in these experiments. Seed oil content was unaffected by P or S fertilization (data not shown).

Fertilizer Facts:

- Camelina needs about 70 to 90 lb N/ac (soil N + fertilizer N) for optimum seed yield and oil content, although more soil fertility trials are needed to establish a state-wide lb N/lb seed yield guideline.
- Camelina will likely respond to P fertilizer when P soil tests are 12 ppm or less.
- Camelina did not respond to S fertilization.

Fertilizer

F a c t s

Fertilizer \checkmark off

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Table 1. Soil test results by location.

Test	Cut Bank 2005	Joplin 2005	WTARC 2005	Cut Bank 2006	Kalispell ¹ 2006	WTARC 2007
pH	8.4	8.2	8.3	8.8	5.4	7.8
O.M. (%)	2.2	1.5	2.2	0.7	1.9	2.3
P (ppm)	7.4	10	12.1	5	46	28
K (ppm)	343	326	290	174	108	435
EC (mmhos/cm)	0.21	0.15	0.18	0.42	0.11	0.31
NO ₃ -N (lb/acre)	39	70	58	68	60	14
SO ₄ -S (lb/acre)	531	1476	2823	94	78	--

¹Results from this location are from an 18 inch soil sample for all analyses.

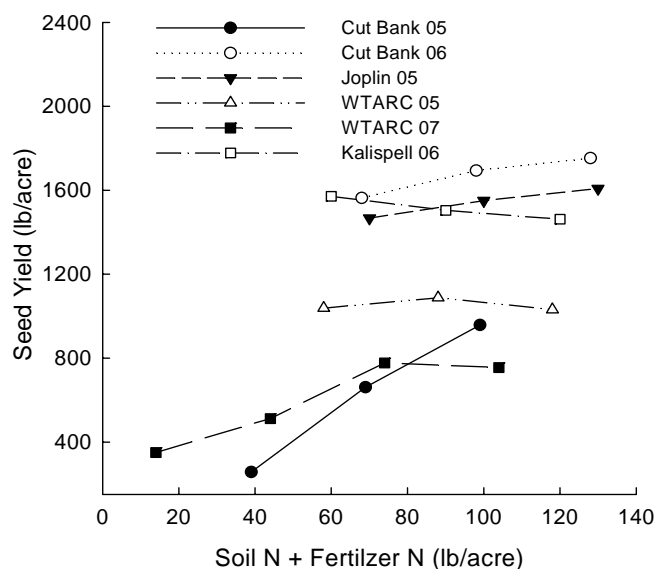


Figure 1. Effect of nitrogen on camelina seed yield. 2005-2007.

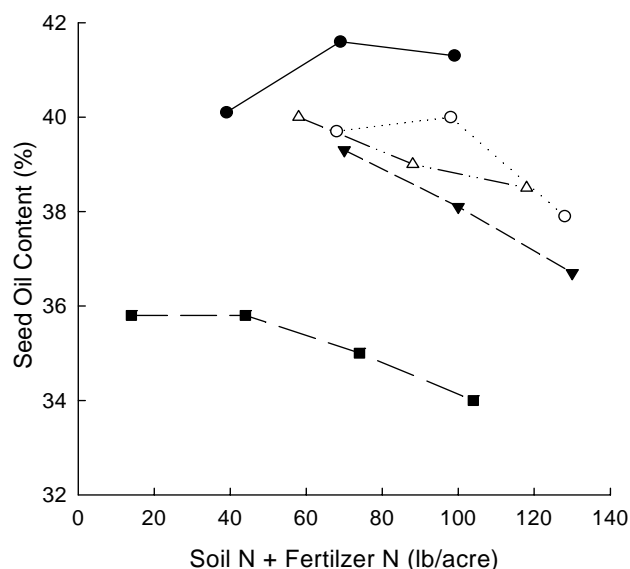


Figure 2. Effect of nitrogen on camelina seed oil content. 2005-2007.

Table 2. Effect of phosphorus and sulfur on camelina seed yield.

Treatment P ₂ O ₅ or S	Cut Bank 2005	Joplin 2005	WTARC 2005	Cut Bank 2006	Kalispell 2006
lb/acre					
Phosphorus Summary					
0	529 a	1391 ab	959 a	1582 a	1508 a
15	614 b	1386 a	1045 b	1757 b	1531 a
30	647 b	1524 b	1058 b	1670 ab	1497 a
Sulfur Summary					
0	577 a	1430 a	1047 a	1644 a	1537 a
10	612 a	1437 a	1014 a	ND	ND
15	ND	ND	ND	1695 a	1487 a
20	601 a	ND	1001 a	ND	ND

Yield means with the same letter are not significantly different according to the LSD (p=0.05). ND = Not Determined.

Edited by Clain Jones, Extension Soil Fertility Specialist, and Elizabeth D'Imperio, Research Associate