Performance of Camelina *(Camelina sativa L. Crantz)* Under Semiarid Conditions in Central Great Plains, USA

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Introduction

Camelina sativa is a short-seasoned oilseed crop adapted to water-limited environments. Planting time affects camelina yield potential due to variable soil moisture and temperature in the Great Plains (GP) region. Previous studies indicate that camelina responds to nitrogen (N) and sulfur (S) with high yields and seed quality. Planting time and fertilization are critical for successful camelina production in the GP.

Objectives

- Identify the most productive camelina varieties, and the best planting date to optimize production.
- Determine camelina yield response to fertilizer N and S application in the central GP region.

Materials and Methods

- Location: K-State Univ. Ag Research Center, Hays, KS
- Design: Randomized complete blocks with a split-plot arrangement

- **Study 1: Planting date**
  - ❖Main plot – Planting date (x 3)
    Early – (April 3, 2013; March 17, 2014; March 18, 2015)
    Mid – (April 16, 2013; April 1, 2014; April 1, 2015)
    Late – (April 30, 2013; April 15, 2014, April 15, 2015)
  - ❖Sub plot – camelina varieties (x 3)
    Blaine creek, Pronghorn, and Shoshone

- **Study 2: N and S**
  - ❖Main plot – Two sulfur rates (0 and 22 kg ha^{-1}) using elemental sulfur as fertilizer source.
  - ❖Sub plot – Four nitrogen rates (0, 22, 45, and 90 kg ha^{-1}) using urea as fertilizer source.

- Data collected included growing degree days (GDD) at 50% flowering and physiological maturity, plant height, stand count, harvest index, biomass, seed yield, oil and protein content all at physiological maturity.

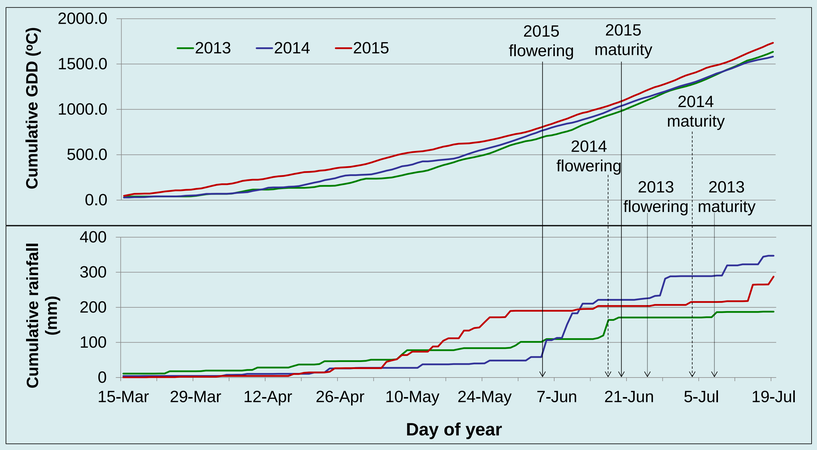

Fig. 1. Rainfall and GDD for 2013, 2014, and 2015 during camelina growth

Camelina at time of flowering

Planting Date Results

Table 1. Effect of planting date on accumulated growing degree days (GDD) of camelina varieties planted in 2014 and 2015

	Flowering time (GDD)					
	Blaine Creek		Pronghorn		Shoshone	
Planting date	2014	2015	2014	2015	2014	2015
Early	1099	732	1099	732	1099	732
Mid	870	683	870	708	870	708
Late	924	647	716	668	847	654
Standard error	41	35	41	35	41	35
	Physiological maturity (GDD)					
Early	1453	1123	1381	1123	1381	1123
Mid	1413	1092	1277	1106	1413	1106
Late	1342	1049	1125	1080	1125	1072
Standard error	37	32	37	32	37	32

- More GDD was accumulated in 2014 than 2015 for all varieties (Table 1). The short growth cycle in 2015 could be related to heat and drought after flowering (Fig. 1). The latter weather conditions hastened reproductive maturity. Average days to maturity in 2014 was 91, 91, and 88 days after planting (dap) for early, mid and late plantings, respectively. In 2015, days to maturity were 92, 80, and 67 dap for early, mid and late plantings, respectively.

- Yield differed among camelina varieties (*P = 0.002*). Blaine creek was the highest-yielding variety (Fig. 2).

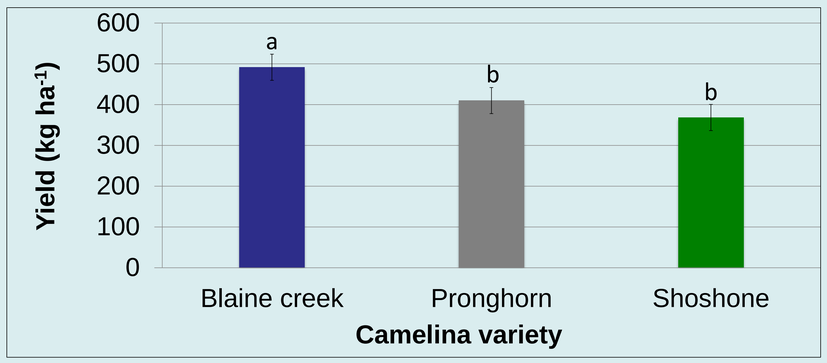

Fig. 2. Average seed yield of camelina varieties over the three years

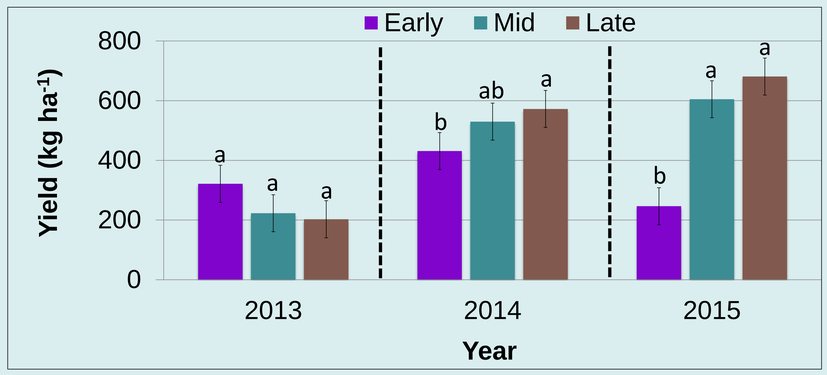

Fig. 3. Camelina yield as affected by planting date over the three years

- Planting date did not affect yield in 2013, but it had a significant effect (*P = 0.0001)* on yield in 2014 and 2015. Mid and late planting date produced more yield than early planting date (Fig. 3). This may be due to drought and high temperature after early planting(Fig. 1).

- Average oil content was 27.5% across planting dates and varieties, and was not significantly different across all treatments. Protein content differed among varieties: Blaine creek(30.2%)>Pronghorn(29.9%) >Shoshone(29.3%). Protein content was not affected by planting date.

N and S Results

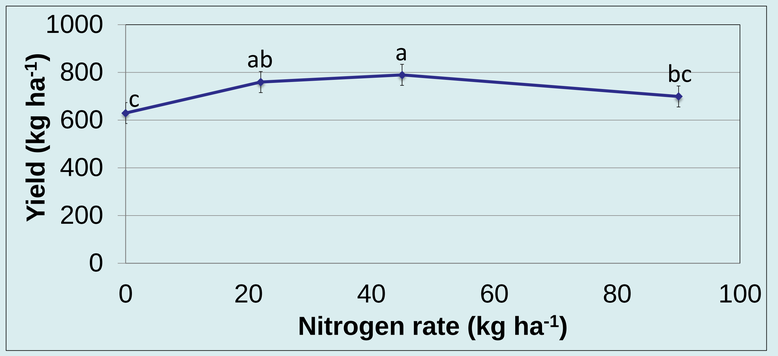

Fig. 4. Effect of nitrogen treatment on camelina yield

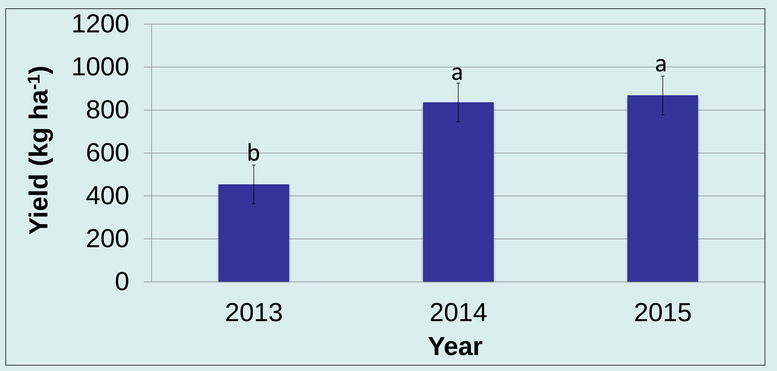

Fig. 5. Average seed yield of camelina treated with four nitrogen rates for the three years

- Fertilizer N application had a significant effect on yield (*P = 0.004*). Increasing N application did increase yield, but not beyond 45 kg N ha^{-1} (Fig. 4).

- Yield in 2014 and 2015 were not significantly different (*P = 0.002*), but they were different from yield in 2013 (Fig.5). This may be attributed to relatively high rainfall in those 2 years (Fig. 1).

Conclusions

- Planting date did not affect oil and protein content. But it affected GDD for the growth stages (flowering and physiological maturity), and camelina yield, depending on conditions such as temperature and rainfall.

- Preliminary data indicates that camelina does not respond to nitrogen above 45 kg N ha^{-1}. Suitable N range for camelina production in central Great Plains is 22 to 45 kg N ha^{-1}.

- Sulfur application had no effect on camelina yield, oil and protein content.

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Camelina at harvesting