Optimizing Nitrogen Rates in *Camelina sativa*

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Abstract

Camelina is a new oilseed crop to western Canada with potential applications in cosmetics, human nutrition, and biofuel. Nitrogen recommendations for camelina production in Western Canada aren't available. Field studies were conducted in 2008 and 2009 for 10 site years at locations in western Canada to determine the effect of nitrogen rate on seed yield. Depending on the experiment, nitrogen rates ranged from 0 to 200 kg ha^{-1}. The join point (N rate at which yields plateau) for camelina were 111 to 116 kg ha^{-1}, which is similar to other *Brassica* oilseed species.

Introduction

Camelina (*Camelina sativa* (L.) Crantz) was first evaluated in Canada from 1958 to 1960 by Plessers et al. (1962), who reported that camelina matured 3 to 4 weeks earlier than flax in northern Alberta. Agronomic trials conducted on the Canadian Prairies by Gugel and Falk (2006) indicated that camelina was adapted to a range of environments. It appeared to be more drought tolerant than other *Brassica* oilseeds and it performed well at Beaverlodge in northern Alberta, where its early maturity was well-suited to the short growing season.

Camelina seed oil has a unique fatty acid profile with potential applications in industry, cosmetics, human nutrition, and biofuel (Putnam et al. 1993; Fröhlich and Rice 2005). Demand for camelina oil is increasing due to its potential as a component of jet fuel (Biello 2009). Camelina may serve as a plant bio-platform in which the fatty acid profile could be modified through mutagenesis (Büchsenschütz-Nothdurft et al. 1998) or unique industrial fatty acids could be produced by genetic transformation (Lu and Kang 2008).

Nutrient requirements for camelina on the Canadian Prairies are not known. Recommendations from Montana suggest that between 80 and 100 kg ha^{-1} of combined soil and fertilizer nitrate-

nitrogen are required for optimum production of camelina (Jackson 2008). Studies were initiated in 2008 to identify optimum nitrogen requirements for camelina.

Materials and Methods

Sites. The study was conducted at five locations in 2008: Scott, Melfort, Lethbridge (University of Alberta), Swift Current (Wheatlands), and Vanguard (Westwind Ag Research). The Vanguard site was badly hailed so the data was not included. In 2009, the study was conducted at Scott, Melfort, and Indian Head.

Experimental Design and Treatments. In 2008, two different experiments were set up. In experiment 1, nitrogen rates of 0, 40, 80, 120 and 160 kg ha^{-1} were applied to camelina (*cv.* Calena) in a RCBD design with 4 replicates. Another experiment (experiment 2) was conducted in conjunction with a graduate student from the Nova Scotia Agricultural College. This experiment was conducted at Scott only (2 seeding dates for camelina). Nitrogen rates of 0, 25, 50, 75, 100, 125, and 150 kg ha^{-1} were applied in a RCBD design. In 2009, it was decided to combine the two experiments and expand the range of N rates. Nitrogen rates of 0, 25, 50, 75,100,125,150 and 200 kg ha^{-1} were applied in a RCBD design. Crop yield is the only variable measured that will be reported. Data from experiment one were combined from all locations and analyzed separately from data from experiment two and 2009 data. Data from experiment two and 2009 experiments were combined from all locations as well. Both datasets were analyzed with PROC Mixed and a quadratic plateau response model was used to describe the response. The model calculates a join point, which is basically the nitrogen rate at which yields reach a plateau.

Results

In experiment 1, camelina responded to nitrogen rates and yields began to level off at 116 kg ha^{-1}, which is the join point (Fig. 1). The yield reached a plateau of 2035 kg ha^{-1}. Experiment 2 and 2010 data resulted in similar yields. A yield plateau of 2460 kg ha^{-1} was achieved at a rate of 111 kg ha^{-1}.

Studies by Gan et al. (2007) reported that other *Brassica* crops reached a plateau at nitrogen rates of 100 kg ha^{-1}. These studies indicate that N requirements for camelina are similar to and slightly higher than *Brassica napus* canola, *Sinapis alba*, and *Brassica juncea*.

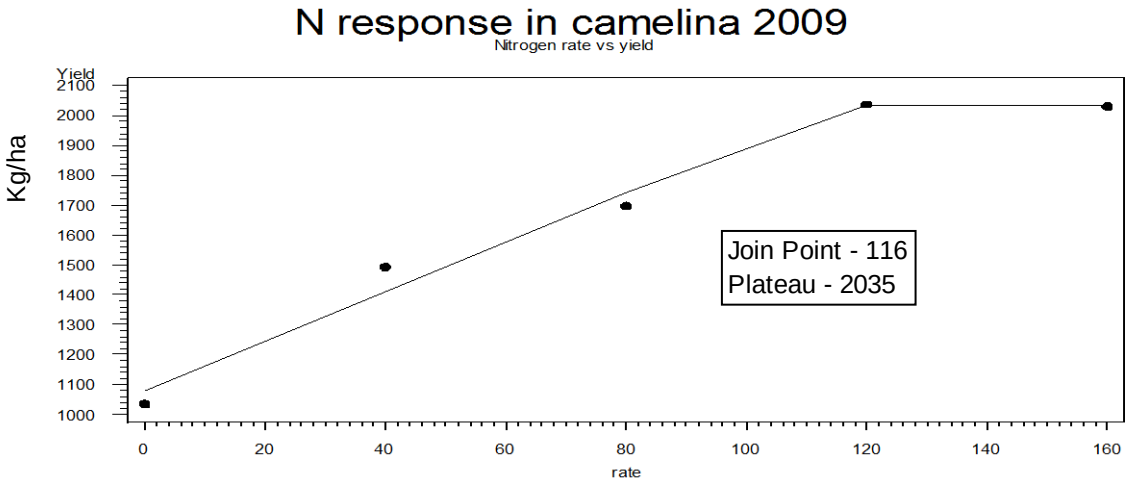

Figure 1: Response of *Camelina sativa* to nitrogen rate (Experiment 1). Data generated at 5 locations in Saskatchewan and Alberta. 2008.

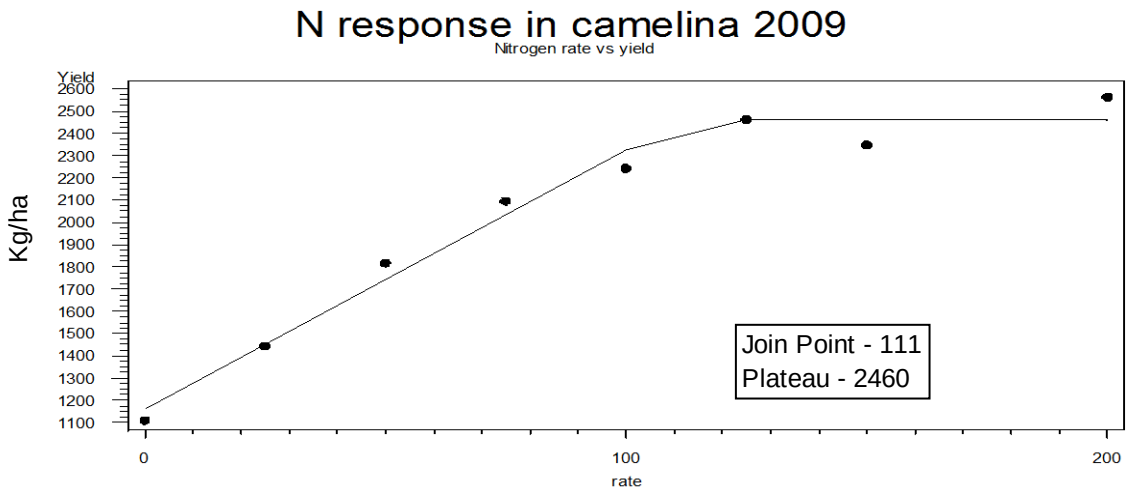

Figure 2: Response of *Camelina sativa* to nitrogen rate (Experiment 2 / 2009). Data generated at 5 locations in Saskatchewan. 2008-09.

Conclusion

Camelina is being promoted as a low-input crop; however, preliminary results from 2008 and 2009 indicate that the nitrogen requirements to achieve maximum yield are similar to other *Brassica* oilseeds.

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