Influence of Nitrogen and Phosphorus Application on Dryland Camelina Sativa Seed Yield

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Introduction

The desire for domestic energy security and a cleaner environment has stimulated public interest in biodiesel as an alternative fuel source. *Camelina sativa* has been reported to be a drought tolerant oilseed crop adapted to the semi-arid environments of the central Great Plains with oil qualities that make it attractive as a biodiesel crop. Compared to canola, camelina oil remains liquid even when placed under sub-zero temperatures (Fig. 1 & 2). Previous studies at the James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) have shown *C. sativa* to be an alternative dryland crop for partial replacement of summer fallow in winter wheat production systems in Wyoming. Growing camelina in the fallow period will avoid direct competition for land use with food crops in wheat-based production systems. Winter wheat-camelina rotation has potential to enhance the economic and ecological sustainability of farms through the production of biodiesel and bio-based jet fuels throughout the region. Unlike other oilseed crops like canola, information on fertilizer management in dryland camelina is limited.

Objectives

Our objective was to evaluate the effect of nitrogen and phosphorus application on C. sativa yields and oil content.

Materials and Methods

In the spring of 2011, a 12-treatment nitrogen/phosphorus (N/P) fertilizer trial was initiated on a portion of each block of an ongoing winter wheat-camelina (camelina replacing fallow) rotation on dryland strips at SAREC. This is part of a 2008 Western Sustainable Agriculture Research and Education-funded project comparing a traditional winter wheat-fallow system to a winter wheat-camelina rotation in field-scale replicated trials. Camelina was sown on April 7. There were four N application rates (0, 22.5, 45 and 90 kg N ha^{-1}) and three P rates (0, 34, and 68 kg P_2O_5 ha^{-1}). Both N and P were broadcasted on May 16. Phosphorus fertilizer used was monoammonium phosphate (11-52-0; MAP). Nitrogen fertilization was done with urea (46-0-0) after adjusting for N amount supplied from MAP application (example 68 kg ha^{-1} MAP supply 15 kg N ha^{-1}). Camelina was harvested on August 17 for seed yield using a small plot combine (Fig. 6). Total precipitation during the growing season (from sowing to harvest) was 278 mm.

Fig. 1. Camelina oil remains liquid after 2-yr of been kept in a freezer at -18^{O}C .

Fig. 2. Canola oil turns solid when kept in a freezer at -18 ^{O}C for 2-yr.

Fig. 3. Picture of camelina plot that received no fertilizer application.

Fig. 4. Picture of camelina plot fertilized with 45 kg N ha^{-1} and 34 kg P_2O_5 ha^{-1}.

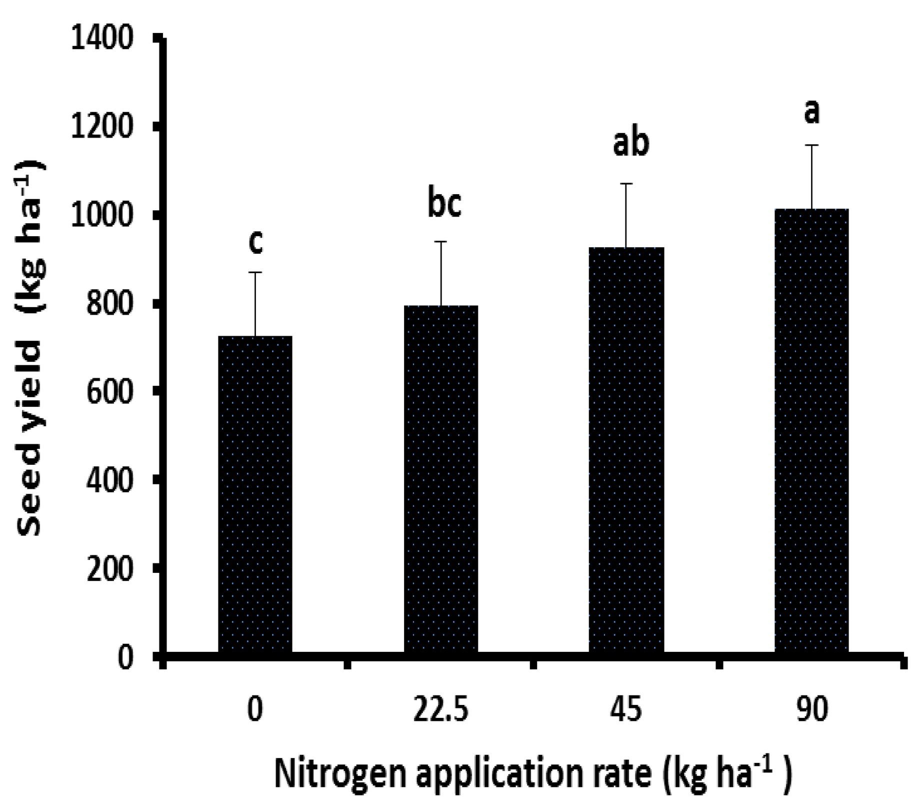

Fig. 5. Camelina seed yield response to different nitrogen application rates during the 2011 growing season at SAREC.

Fig. 6. Harvesting camelina with a small plot harvester. Jerry Nachtman drives the combine while Augustine Obour collects seeds.

Results

Oil content has not been analyzed yet so only seed yield data is presented in this report. Preliminary results in 2011 showed P fertilization had no significant effect on camelina seed yield. Seed yield was 784 kg ha^{-1} for treatments that received no P application and 896 kg ha^{-1} for the highest P application rate of 68 kg ha^{-1} when averaged across N rates. However, N application significantly increased camelina seed yield (Fig. 5). The addition of 22.5 kg N increased camelina yield by 10% (797 kg ha^{-1}) compared to plots that received no N application (727 kg ha^{-1}). Seed yields were 927 and 1015 kg ha^{-1} when N was applied at 45 and 90 kg ha^{-1}, respectively (Fig. 5). This represents a yield increase of 28 and 40%, respectively, compared to when no N was applied. It is worth mentioning that the yield differences between treatments that received 45 and 90 kg N ha^{-1} were not statistically different.

Conclusions

Our preliminary data suggest N fertilization at 45 kg ha^{-1} will be sufficient for camelina production on drylands in southeastern Wyoming and other central Great Plains regions with similar moisture regimes.

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