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Seeding Date Effects on Camelina Seed Yield and Quality Traits


E. Obeng

Kansas State University, eobeng@ksu.edu

A. Obour

aobour@ksu.edu

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Abstract

Identifying crops that are adapted to dryland environments of the central and northern Great Plains (GP) has been a major challenge. An alternative crop with potential for dryland crop production in the GP is camelina (*Camelina sativa* L. Crantz). Time of planting is an important management consideration that can affect camelina production. Early planting allows camelina to mature before the onset of hot summer temperatures in the central GP that can affect seed yield. A study was carried out in the spring of 2013 and 2014 to evaluate planting date effects on spring camelina varieties grown under dryland conditions in western Kansas. In this study, three spring varieties (Blaine Creek, Pronghorn, and Shoshone) were planted at three seeding dates (early, mid, and late). Parameters collected included plant height, harvest index, seed yield, and oil and protein content. Our findings indicate that seeding date affected time of flowering and physiological maturity ($P < 0.05$) but had no effect on oil content. Year \times camelina variety interaction had a significant effect on seed yield. Similarly, protein content differed among the varieties (Blaine Creek > Pronghorn > Shoshone). Blaine Creek consistently produced the highest yield in both years and had a protein content of 30%.

Keywords

camelina, seeding date, quality traits

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Seeding Date Effects on Camelina Seed Yield and Quality Traits

E. Obeng and A.K. Obour

Summary

Identifying crops that are adapted to dryland environments of the central and northern Great Plains (GP) has been a major challenge. An alternative crop with potential for dryland crop production in the GP is camelina (*Camelina sativa* L. Crantz). Time of planting is an important management consideration that can affect camelina production. Early planting allows camelina to mature before the onset of hot summer temperatures in the central GP that can affect seed yield. A study was carried out in the spring of 2013 and 2014 to evaluate planting date effects on spring camelina varieties grown under dryland conditions in western Kansas. In this study, three spring varieties (Blaine Creek, Pronghorn, and Shoshone) were planted at three seeding dates (early, mid, and late). Parameters collected included plant height, harvest index, seed yield, and oil and protein content. Our findings indicate that seeding date affected time of flowering and physiological maturity ($P < 0.05$) but had no effect on oil content. Year \times camelina variety interaction had a significant effect on seed yield. Similarly, protein content differed among the varieties (Blaine Creek > Pronghorn > Shoshone). Blaine Creek consistently produced the highest yield in both years and had a protein content of 30%.

Introduction

Conditions in western Kansas make camelina a potential candidate to intensify the wheat (cereal) cropping system. The crop has been reported to have low demand for water, fertilizer, and pesticides compared with other oilseed crops. It has several uses, including biofuel production and as an ingredient in animal rations, lubricants, adhesives, and other industrial applications. The crop is short-seasoned and resilient in water-limited environments, making it a suitable alternative in locations where it is not economical to grow high-value crops such as soybean, corn, and sunflower. Spring planting of camelina would fit in the winter wheat rotation system; it can be harvested early to allow for the planting of winter wheat, thereby increasing profitability of the whole system.

Efforts through the years have been targeted at characterizing the agronomic potential of camelina. In these efforts, planting date has been crucial because it affects crop yield potential. Research on camelina planting date has been conducted in different parts of the Great Plains. Early planting of winter camelina in October has been found to result in high yields and oil contents. In Nebraska, research indicates that yields are high when camelina is planted in late March through late April. In west central Minnesota, mid-

April to mid-May has been conducive, depending on field conditions. Information on agronomic performance of camelina varieties in Kansas is scarce; as a result, this study was carried out to identify the most productive varieties and the best planting date to optimize production.

Procedures

In spring 2013 and 2014, planting date effects on camelina varieties were studied at the Kansas State University Western Kansas Agriculture Research Center, Hays, KS. The varieties used in this study were Blaine Creek, Shoshone, and Pronghorn. These varieties were planted at three different dates in a split-plot design with three replications. Plot dimension was 25 ft × 10 ft, and seeds were planted at 5 lb/a. Planting date was the main plot, and varieties were the subplot. In both years, early seeding was March 17–23, mid-seeding was April 1–7, and late seeding was April 15–21. The crops were rain-fed in both years. Urea was applied as broadcast to each plot at 50 lb/a. In 2014, data were collected on plant height, date of physiological maturity, yield, and harvest index. After harvest, the seeds were analyzed for oil and protein content using the Antaris II FT-NIR spectrophotometer Analyzer. All data were subjected to statistical analysis. Analysis was done with the ANOVA MIXED procedure in the SAS 9.3 software package (SAS Institute Inc., Cary, NC). Yield data collected for both years were analyzed together, with variety and sowing date treated as fixed effects in the model.

Results

Seeding date had a significant effect on time to flowering and physiological maturity. In general, early and mid-seeded camelina varieties flowered and reached physiological maturity earlier than late seeding (Figure 1). The camelina varieties differed in number of days from planting to maturity ($P = 0.001$). Blaine Creek reached physiological maturity at 93 days after planting (DAP) and differed significantly from Pronghorn (87 DAP) and Shoshone (89 DAP). Plant height at maturity was different for the three varieties. Blaine Creek produced the shortest plants exceeded by Shoshone and Pronghorn (Table 1). Average plant height was 0.45 m for Pronghorn and Shoshone, whereas Blaine creek was 0.41 m tall. On the other hand, seeding date did not affect plant height ($P > 0.05$). Harvest index was not significant for the three varieties and was not affected by planting date.

Seeding date did not affect yield; on the contrary, there were differences ($P < 0.05$) in yield among varieties in both years. Blaine Creek was the most consistently high-yielding variety in both years. Average yield for Blaine Creek was 337 lb/a and 268 lb/a in 2013 and 2014, respectively (Figure 2). Average oil content was around 27.5% across planting dates and varieties and was not significant across all treatments (seeding date and variety). Protein content differed among varieties (Table 1). Blaine Creek had the highest protein content, followed by Pronghorn, then Shoshone. Protein content was not affected by seeding date.

Table 1. Time of physiological maturity, plant height, and protein content of camelina varieties planted in spring 2014

Variety	Physiological maturity, days after planting	Plant height at maturity, m	Protein content, %
Blaine Creek	93.0 ^a	0.41 ^b	30.18 ^a
Pronghorn	87.8 ^c	0.45 ^a	29.92 ^b
Shoshone	89.4 ^b	0.45 ^a	29.32 ^c
Standard error (SE)	0.87	0.01	0.13

^{a,b,c} Treatment means within the same column followed by same letter(s) are not significantly different ($P < 0.05$).

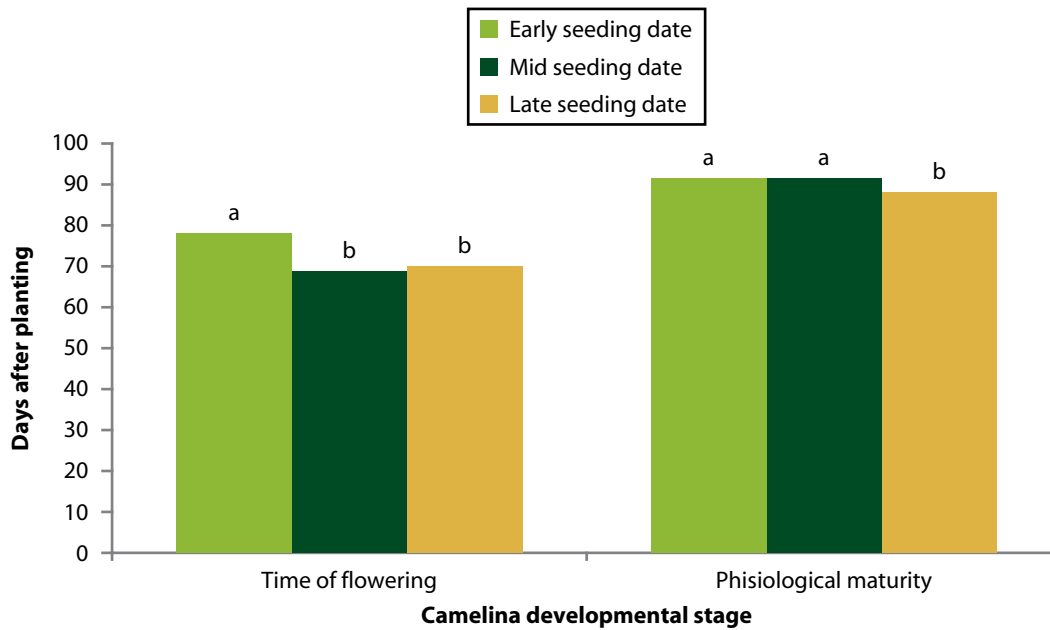


Figure 1. Effects of seeding date on time of camelina flowering and physiological maturity in 2014, Agricultural Research Center–Hays.

Within developmental stage, means followed by the same letter(s) are not significantly different at $P > 0.05$.

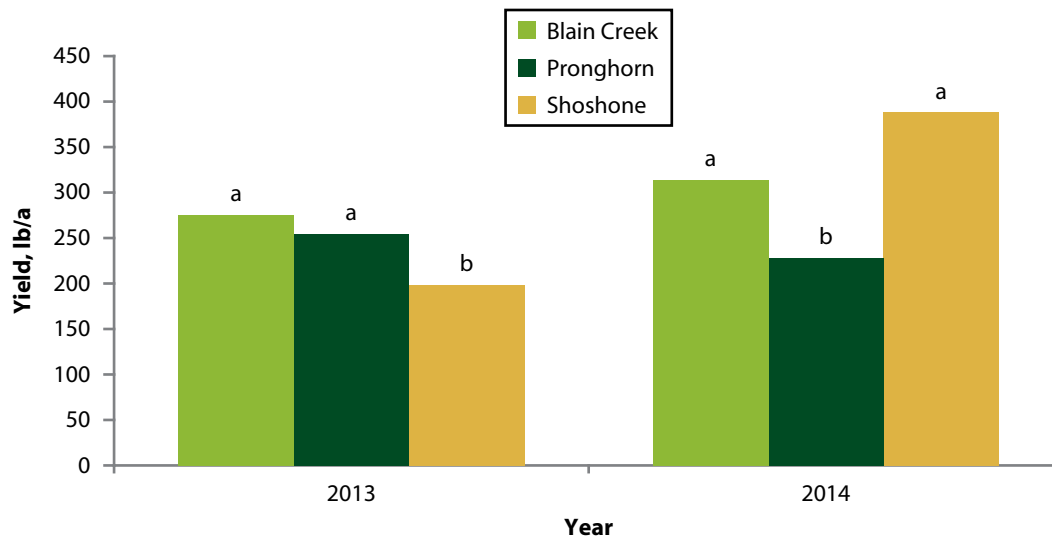


Figure 2. Camelina variety yield in year 2013 and 2014, Agricultural Research Center–Hays; comparison is among varieties within year.
 Within years, means followed by the same letter(s) are not significantly different at $P > 0.05$.