Camelina:

A potential winter annual crop for the Northern Corn Belt

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Introduction

Camelina (*Camelina sativa* L.), a member of the mustard family (*Brassicaceae*) also known as false flax, is an ancient European oilseed crop that has good potential as a low input alternative for biodiesel and other industrial and food-use applications. Camelina's seed oil content ranges from 30 to 45% (wt/wt) with linolenic acid (18:3) comprising a large fraction of its fatty acids. Reports indicate that substantial yields can be obtained with minimal agricultural inputs (Robinson 1987) and that genotypes with both winter and spring growth habits exist (Zwinger 2000). Furthermore, fall-sown winter genotypes may be harvested early enough the following season to allow producing an early maturing food or forage crop. Little is known about the agronomic potential of winter camelina in west central Minnesota. The main objective of the present study (initiated in 2007) is to determine optimum planting time and evaluate the agronomics of two winter genotypes in no-till (wheat stubble) and chisel plowed soil. A secondary objective is to explore the potential of following camelina with a second crop consisting of soybean [*Glycine max* (L.) Merr.], sunflower (*Helianthus annuus* L.), and Siberian foxtail millet (*Setaria italica* L.).

Methods

- A split-plot RCBD was used with four replications. The main plots were split into either no-till or fall chisel plowed soil (spring wheat was the previous crop) with subplots as cultivar X planting date.
- Two cultivars, Joelle and BSX-WG1, were drill seeded at 6 kg ha^{-1} on 30 cm rows on Sept 14, Sept 24, Oct 2, and Oct 11.
- Plots were sprayed with glyphosate prior to planting and no herbicide was used thereafter.
- Total N in the top 30 cm of soil was approximately 37 kg ha^{-1} and P was 46 kg ha^{-1}. No additional fertilizer was added for camelina.
- Soybean (Croplan 06 MG), sunflower (Mycogen 8N-272), and Siberian foxtail millet were sown at conventional rates in both tillages following the earliest harvested camelina. Recommended practices were used for fertility and weed control.

Figure 1. Camelina on Oct 22, 2007 in no-till and chisel plowed soil.

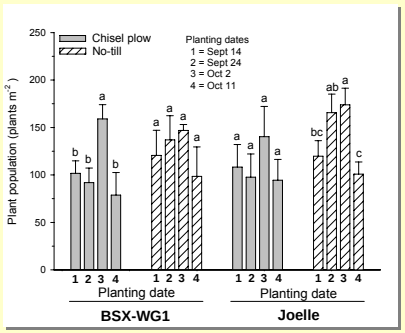

Figure 2. Plant population at harvest in 2008 (planted fall of 2007). Values are means ± SE, n = 4. For each cultivar and tillage, bars with a different letter are significantly different at the $P \leq 0.05$ level.

- Overall, plant stands were affected by planting date but not cultivar.
- Plant population tended to be greatest for the early Oct planting.
- Averaged across planting dates, final stands tended to be greater in the no-till (133 plants m^{-2}) than chisel plowed soil (114 plants m^{-2}), but the difference was only weakly significant ($P = 0.07$).

Table 1. Flowering and harvest dates for the two winter camelina cultivars planted during fall of 2007.

	50% Flowering		Harvest date		Flowering to harvest (d)	
Planting date	BSX	Joelle	BSX	Joelle	BSX	Joelle
Sept 14	May 22	May 25	Jun 26	Jun 30	35	36
Sept 24	May 27	May 27	Jun 30	Jul 11	34	45
Oct 2	May 29	Jun 1	Jul 11	Jul 11	43	40
Oct 11	Jun 3	Jun 7	Jul 15	Jul 15	42	38

- Planting date but not tillage affected 50% flowering date.
- BSX tended to flower about 3 to 4 d earlier than Joelle.
- Time from 50% flowering to harvest ranged from 34 to 45 d.

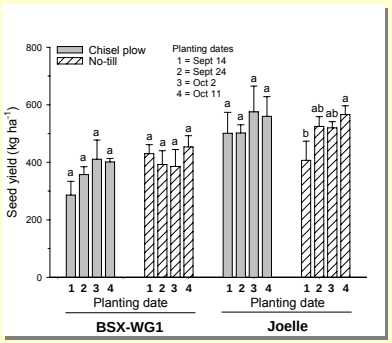

Figure 3. Seed yields for the two winter camelina cultivars planted during fall 2007 under no-till and fall chisel plowed soil. Values are means ± SE, n = 4.

- Planting date and cultivar, but not tillage, affected seed yields.
- Camelina planted in early to mid October tended to produce greater yields.
- Averaged across planting dates and tillage, seed yield was greater for Joelle (505 kg ha^{-1}) than BSX-WG1 (389 kg ha^{-1}).

Figure 4. Camelina in mid June 2008 that was planted mid September 2007. The crop was harvested the end of June.

Table 2. Yields of double cropped (DC) soybean, sunflower, and millet planted after harvesting camelina. Mean seed yields of full season (FS) soybean and sunflower are shown for comparison.

Double cropped (DC)	Planted	Harvested	DC yield (kg ha^{-1})	†FS yield (kg ha^{-1})	DC % of FS
Soybean	Jun 26	Oct 21	1870 ± 76	2667	70%
Sunflower	Jul 1	Oct 30	2555 ± 122	3359	76%
Millet (seed)	Jul 1	Nov 1	2377 ± 168	NA	NA
Millet (forage)	Jul 1	Nov 1	8888 ± 478	NA	NA

† Full season soybean and sunflower were planted May 9 and June 1, respectively.

Summary

- Winter survival of camelina in both no-till and chisel plowed soil was good and plant stands tended to be greater when sown in late Sept to early Oct.
- Yields were relatively low as compared to those reported by others (Robinson 1987; Zwinger 2000). This may have been caused by low soil fertility and very wet soil during late spring. In 2009 (2nd season of the study), an early spring application of N was made and yields averaged about 1200 kg ha^{-1} for plants sown in early Oct (data not shown).
- Data indicate good potential for double cropping a food or forage crop following winter camelina, even as far north as central MN. We plan to evaluate different strategies of double cropping (e.g., relay cropping) to optimize winter camelina and second crop yields, while minimizing agricultural inputs.

References

Robinson, R. G. 1987. Camelina: A useful research crop and a potential oilseed crop. University of Minnesota Agricultural Experiment Station, Station Bulletin 597-1987.

Zwinger, S. 2000. Camelina variety trials. Available at: http://www.ag.ndsu.nodak.edu/carringt/agronomy/2000_variety_trials.htm