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Evaluating canola (*Brassica napus*) as an alternative oilseed crop and enhancing winter cover in Iowa

Abstract

The viability of canola and winter cover crops as alternative 'third' crops in Iowa were studied. Though the alternative cropping systems were not as competitive on a production or economic basis, they did show tremendous promise in terms of reducing the potential for soil erosion and the leaching of nutrients into the water.

Keywords

Agronomy, Multi-year rotations low-external input

Disciplines

Agronomy and Crop Sciences



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Principal Investigator:

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Co-investigator:

Stefans Gailans
Agronomy
Iowa State University

Budget:

\$28,642 for year one
\$29,553 for year two
\$30,489 for year three

Q Is canola a viable alternative crop for Iowa?

A The project investigated winter canola’s winter hardiness, yield of winter and spring canola, and the ecological and economic performance of canola.



ECOLOGY

Background

The overall purpose of this research project was to provide demonstrations and information about practical, alternative and diverse cropping systems for Iowa farmers. Winter annual crops and perennial legumes ultimately can serve as ideal cover crops in a crop rotation, and the project examined several options for use in the upper Midwest.

Canola is a productive oilseed crop most commonly grown for the oil that is extracted from the seed for human consumption. It may have the potential to replace soybeans in the typical Iowa crop rotation. Because optimal planting dates for winter canola are in mid-September, it fits most easily into a crop rotation following a spring cereal grain that is harvested in mid-summer such as wheat (and vice-versa for winter wheat following spring canola in rotation).

The objectives of this research were to:

- investigate the viability of canola as an alternative oilseed or “third” crop in Iowa,
- explore the viability of winter annual crops/cover crops in Iowa, and
- assess the ecological and economic performance of alternative cropping systems.

Approach and methods

During the period from 2009 to 2013, the investigators compared the agronomic, economic, and ecologic performance of three distinct crop rotations at the Iowa State University Agronomy and Agricultural Engineering Research Farm in Boone County. One rotation represented the modern norm in Iowa, while the other two rotations included “alternative” crops, double-cropping, and legume inter-seeding. The rotations were a corn-soybean (C-Sb) system, a system common to contemporary Iowa farming operations; and two “alternative” systems: corn-spring canola-winter wheat + red clover (C-SC-WW/RC—spring canola system) and corn-spring wheat-winter canola + red clover (C-SW-WC/RC—winter canola system). All three rotations included transgenic crops, applications of liquid swine manure, synthetic fertilizers, and chemical pesticides. Biological N fixation by legumes and crop



Canola field.

competitiveness with weeds were relied on more heavily in the two alternative cropping systems.

Results and discussion

During the three growing seasons of 2011, 2012, and 2013 (2010 was considered an establishment year), corn yields were greatest in the Corn-soybean system system compared to the two alternative systems in 2011, but similar across all systems in 2013. In 2013, 33 percent less synthetic nitrogen fertilizer was applied to the corn in the two alternative systems. This is attributed to greater biological N fixation and release to the soil by the red clover in the alternative systems than by the soybean in the Corn-soybean system.

Canola yields were consistently greater in the winter canola system than in the spring canola system, primarily because of the greater yield potential of winter canola compared to spring canola. Similar trends were observed for wheat production between the two alternative systems with winter wheat (spring canola system) out-performing spring wheat (winter canola system). Oil content of oilseed crops generally was greatest in the winter canola system, intermediate in the Corn-soybean system, and lowest in the spring canola system.

On average, herbicide use was 40 percent lower in the two alternative systems compared to the Corn-soybean system, yet weed pressure was similar among all three systems. At-harvest weed biomass in the corn phase was consistently less in the two alternative systems compared to the Corn-soybean system. Financial returns generally were greatest in the Corn-soybean system, intermediate in the winter canola system, and lowest in the spring canola system. Corn yields and price were above average; spring canola did not perform as well as winter canola in regard to yield. These trends are based on the stronger average performance of corn in the Corn-soybean system and the poor performance of spring canola in the spring canola system. However, in 2013 the winter canola system outperformed the Corn-soybean system.

Conclusions

On average, the spring canola system and winter canola system rotations saw less herbicide applied per year than the Corn-soybean system. Average weed biomass among the systems, however, generally was no different. In the spring canola system and winter canola system rotations, herbicide usually was applied only during the corn phase. Researchers chose to rely on the natural competitiveness of the spring and winter annual crops with weeds commonly adapted to Iowa's corn-soybean production systems. Thus, farmers looking to reduce the amount of herbicide applied should look to cropping systems that include a diverse array of crop life cycles.

Financial returns generally favored the Corn-soybean system. In 2013, however, corn yields across the three systems were equivalent and returns to land and management were greatest in the winter canola system. This corresponded with more favorable environmental conditions for red clover green manure termination compared to the



Wheat.

two previous years. Corn emerged at a similar rate across all the treatments and red clover decomposition appeared to take place early in the growing season.

By design, the extended rotations provide greater ground cover over a longer period during the year, with the potential to reduce some of the negative effects of agriculture on the environment (i.e., nutrient leaching, soil erosion).

Across all systems, mean annual crop canopy duration was 33 percent greater in the alternative cropping systems compared to the contemporary Corn-soybean system. Put another way, the alternative systems provided more living ground cover during the year than the Corn-soybean system.

Furthermore, the alternative systems provided on average at least 70 percent living ground cover between May and October when more than 50 percent of precipitation occurs in central Iowa. By comparison, the Corn-soybean system provided only about 25 percent ground cover during that same period. From April to June, the Corn-soybean system was estimated to be 70 percent more prone to erosion than the alternative systems.

Impact of results

In terms of individual alternative or “third” crops, winter canola and winter wheat appear to show more promise in Iowa than their spring counterparts. Just where winter canola and winter wheat “fit” into contemporary cropping systems in Iowa requires further exploration. In this project, these winter annual crops were grown following a spring annual that is harvested in July. This allowed the fields to be consistently planted to winter canola in early September and winter wheat in early October. In a contemporary Iowa cropping system, however, a winter annual crop is likely to be planted after soybean harvest in the fall. This might provide more of an opportunity for winter wheat than winter canola as winter wheat planting can be pushed into mid-October. Planting winter canola in early or mid-October is prone to poor establishment or even winterkill.

Including canola, wheat and red clover in a cropping system significantly increased the length of survival time for living ground cover compared to the Corn-soybean system rotation. This was achieved by diversifying the number life cycles among the crops included in a cropping system.

Education and outreach

Presentations (by Stefans Gailans)

- Comparing N management and productivity of conventional and alternative cropping systems. Agronomy Society of America Annual Meetings. San Antonio, TX. October 2011.
- Canola and wheat double-cropping systems in central Iowa. Agronomy Society of America Annual Meetings. Tampa, FL. November 2013.

Poster sessions

- Evaluating the suitability of spring canola in an alternative cropping system in Iowa.

Agronomy Society of America Annual Meetings. United States Canola Association Research Conference. Long Beach, CA. November 2010.

- Canola and wheat double-cropping systems in central Iowa. Department of Agronomy Research Symposium. Iowa State University, Ames, IA. November 2012.

Field days

- FFA field day. Ackley, IA. September 2010. (with Mary Wiedenhoeft)
- Practical Farmers of Iowa field day. Sutherland, IA. August 2010.
- Practical Farmers of Iowa field day. Sutherland, IA. August 2011.

Media coverage

- *Ames (Iowa) Tribune*. April 2012.
- *The Agribusiness Report*, “ISU Canola Test Plot.” August 2011. Available at <https://www.youtube.com/watch?v=G497p3N67Ts>
- *The Furrow Magazine*. August 2013.
- *Iowa Farmer Today*, “Researchers seek alternatives for traditional crop rotations,” 2-28-2013. Available at http://www.iowafarmertoday.com/news/regional/researchers-seek-alternatives-for-traditional-crop-rotations/article_b9ea08b4-8116-11e2-ac30-001a4bcf887a.html
- Harvest Public Media, “Canola interest cropping up in Iowa, too,” 7-29-2011. Available at <http://harvestpublicmedia.org/blog/671/canola-interest-cropping-iowa-too/5>

Leveraged funds

Additional funds for two graduate research grants were received in 2010:

- NCR-SARE Graduate Student Grant Program: Evaluating canola and winter cover in alternative cropping systems in Iowa. \$9,922.
- ISU/PFI On-Farm Research and Demonstration Grant Program: Evaluating the viability of spring canola inter-seeded with a green manure/winter cover crop legume and the effect on a succeeding corn crop in two Iowa farming systems. \$4,954.
- Additional funding of \$6,000 from the ISU Department of Agronomy.

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