

Camelina Cover Crop for Corn and Soybeans

In a Nutshell:

- Winter cover crops in corn-soybean production systems in Iowa are mostly limited to small-grains species like cereal rye or winter wheat because of their ability to successfully overwinter when seeded in early fall.
- Bill Frederick, Wendy Johnson and Rob Stout seeded strips of camelina, a winter-hardy brassica species, to determine its ability to overwinter and any effect on corn and soybean yields.

Key Findings:

- The camelina cover crop successfully overwintered at Frederick's and Stout's but suffered winterkill at Johnson's.
- Soybean and corn yields were not affected by the camelina cover crop.

BACKGROUND

Winter cover crops in Iowa corn-soybean systems are mostly limited to small-grains species like cereal rye or winter wheat because of their abilities to 1) germinate under soil temperatures occurring near or after corn and soybean harvest in the fall; and 2) overwinter to the following spring.^[1] Cover crop variety trials conducted by PFI cooperators from 2013-2017 bear this out: Cereal rye, winter wheat and winter triticale routinely outperformed brassica and legume species in terms of fall and spring groundcover when overseeded into standing corn and soybeans in early fall.^[2-5] Even so, farmers who have used cereal rye cover crops for over five years have begun to express interest in finding alternative, successful, non-small-grains cover crops for corn-soybean production systems. Dr. Andy Lenssen, professor of agronomy at Iowa State University, has recently been experimenting with camelina, a winter-hardy brassica species that has shown promise as a cover crop in experiments conducted on university research stations. In 2018, Dr. Lenssen presented an opportunity for PFI cooperators to try camelina as a cover crop on their farms. He offered the seed and in exchange the cooperators planted strips of camelina following corn or soybean harvest.

"I am interested in finding different cover crop species that will help my succeeding corn crop perform better than following a cereal rye cover crop," Rob Stout said about his motivation



Strips of camelina cover crop and no cover crop at Bill Frederick's farm near Jefferson on May 4, 2019. The camelina was seeded Oct. 5, 2018.

for conducting this trial. "I've wanted to see camelina in action for a couple years," Bill Frederick said. Wendy Johnson echoed both Stout's and Frederick's sentiments: "I am interested in alternative crops and cover crops to use in Iowa. Depending on this trial's data, we might use camelina on our farm."

METHODS

Design

All three cooperators seeded a camelina cover crop in Fall 2018 with seed provided by Dr. Andy Lenssen, Iowa State University

Department of Agronomy. Frederick seeded the camelina into corn residue; Johnson and Stout seeded into soybean residue. Cover crop and crop management details for each farm are provided in **Table 1**.

To test the effect of the camelina cover crop on cash crop yield, each cooperator compared two treatments:

1. Camelina cover crop
2. No-cover-crop (control)

Each cooperator implemented at least four replications of the two treatments in

Cooperators

Bill Frederick – Jefferson
Wendy Johnson – Charles City
Rob Stout – Washington

Collaborator

Dr. Andy Lenssen, professor of
agronomy, Iowa State University

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randomized strips (**Figure A1**). Strips at each farm were as wide as at least one combine pass and ran the length of the field.

Measurements

After the camelina emerged from the soil, Dr. Lenssen travelled to each farm to determine stand densities within one month of the seeding dates. This occurred on Oct. 17, 2018 at Frederick's; Nov. 8, 2018 at Johnson's; and Oct. 18, 2018 at Stout's. The following spring, each farmer estimated the height of the camelina prior to termination and cash crop planting. In Fall 2019, the cooperators harvested the cash crop from each individual strip; corn was corrected to 15.5% moisture and soybeans were corrected to 13% moisture.

Data analysis

To evaluate any effects of the camelina cover crop on crop yield, we calculated the least significant difference (LSD) using a t-test. If the difference in yield resulting from the two treatments was *greater than or equal to* the LSD, we considered this a statistically significant effect. On the other hand, if the difference resulting from the two treatments was *less than* the LSD, we considered the treatments to be statistically similar. We used a 90% confidence level to calculate the LSDs, which means that we would expect our findings to occur 9 times out of 10. We could make these statistical calculations because the cooperators' experimental designs involved replication and randomization of the camelina cover crop and no-cover-crop treatments (**Figure A1**).

RESULTS AND DISCUSSION

Cover crop stand densities in fall

Camelina stands in Fall 2018 varied in terms of average stands and the evenness of the stands. Average stand at Frederick's was 260,000 plants per acre; at Johnson's was 302,500 plants per acre; and at Stout's was 777,000 plants per acre. All farms seeded the camelina at the same rate: 8 lb/ac.

Cover crop height in spring

The camelina was roughly 6 in. tall at Frederick's on May 4, 2019 prior to chemical termination and subsequent soybean planting. At Stout's, the camelina was roughly 11 in. tall on Apr. 24, 2019 prior to chemical termination and subsequent corn planting (see photos). The camelina did not successfully overwinter at Johnson's (the most northern location of all farms involved). "We had cold rain and freezing conditions during much of November [after the camelina germinated]. We didn't get snow cover until mid-January [2019]," Johnson said. Dr. Andy Lenssen, who collaborated on this project, reported that camelina has survived winters in experimental plots in central, southwest and northwest Iowa: "Snow cover seems to become

TABLE 1. Field operations at Bill Frederick's, Wendy Johnson's and Rob Stout's.

FARM (LOCATION)	FREDERICK (JEFFERSON)	JOHNSON (CHARLES CITY)	STOUT (WASHINGTON)
Previous crop (2018)	Corn	Soybeans	Soybeans
Camelina seeding date	Oct. 5, 2018	Oct. 21, 2018	Sept. 28, 2018
Camelina seeding rate	8 lb/ac	8 lb/ac	8 lb/ac
Camelina seeding method	Drill, 7.5-in. row-widths	Drill, 8-in. row-widths	Drill, 7.5-in. row-widths
Camelina termination date	May 4, 2019	Winterkill	Apr. 22, 2019
Cover crop termination method	Roundup (32 oz/ac); 2,4-D (12 oz/ac); Sonic (5 oz/ac); Prowl (3 pt/ac)	n/a	Roundup Powermax (22 oz/ac); TripleFlex II (2 pt/ac); atrazine (1.5 lb/ac)
Cash crop (2019)	Soybeans	Corn	Corn
Planting date	June 5	May 5	Apr. 26
Row-width	20 in.	30 in.	30 in.
Planting population	160,000 seeds/ac	34,700 seeds/ac	36,000 seeds/ac
N program	n/a	Apr. 17: 110 lb N/ac as anhydrous ammonia (with N-serve); Apr. 24: 60 lb N/ac as UAN	Nov. 21, 2018: 135 lb N/ac as liquid swine manure; Apr. 22, 2019: 30 lb N/ac as UAN(32); May 31: 46 lb N/ac as urea
Weed control	July 1	Apr. 24: Surestart (3 pt/ac); June 19: Laudis (3 oz/ac); atrazine (0.7 lb/ac)	June 8: Acetochlor ATZ (2 pt/ac); Callisto (3 oz/ac); Roundup Powermax (32 oz/ac)
Crop harvest date	Oct. 18	Oct. 24	Oct. 7



At left, the camelina cover crop at Bill Frederick's on May 4, 2019. On the right, the camelina cover crop at Rob Stout's on Apr. 24, 2019.

important when temperatures get colder than -20° F, especially if seedlings were exposed to

comparatively warm conditions that caused some loss of dormancy."

Compared to the no-cover-crop control, the camelina cover crop had no effect on soybean yield at Frederick’s nor did it have any effect on corn yields at Johnson’s or Stout’s (**Figure 1**).

Soybean yields at Frederick’s and corn yields at Stout’s far exceeded their respective five-year county averages of 57 bu/ac and 207 bu/ac.^[6] Corn yields at Johnson’s fell below the five-year Floyd County average of 189 bu/ac.^[6]

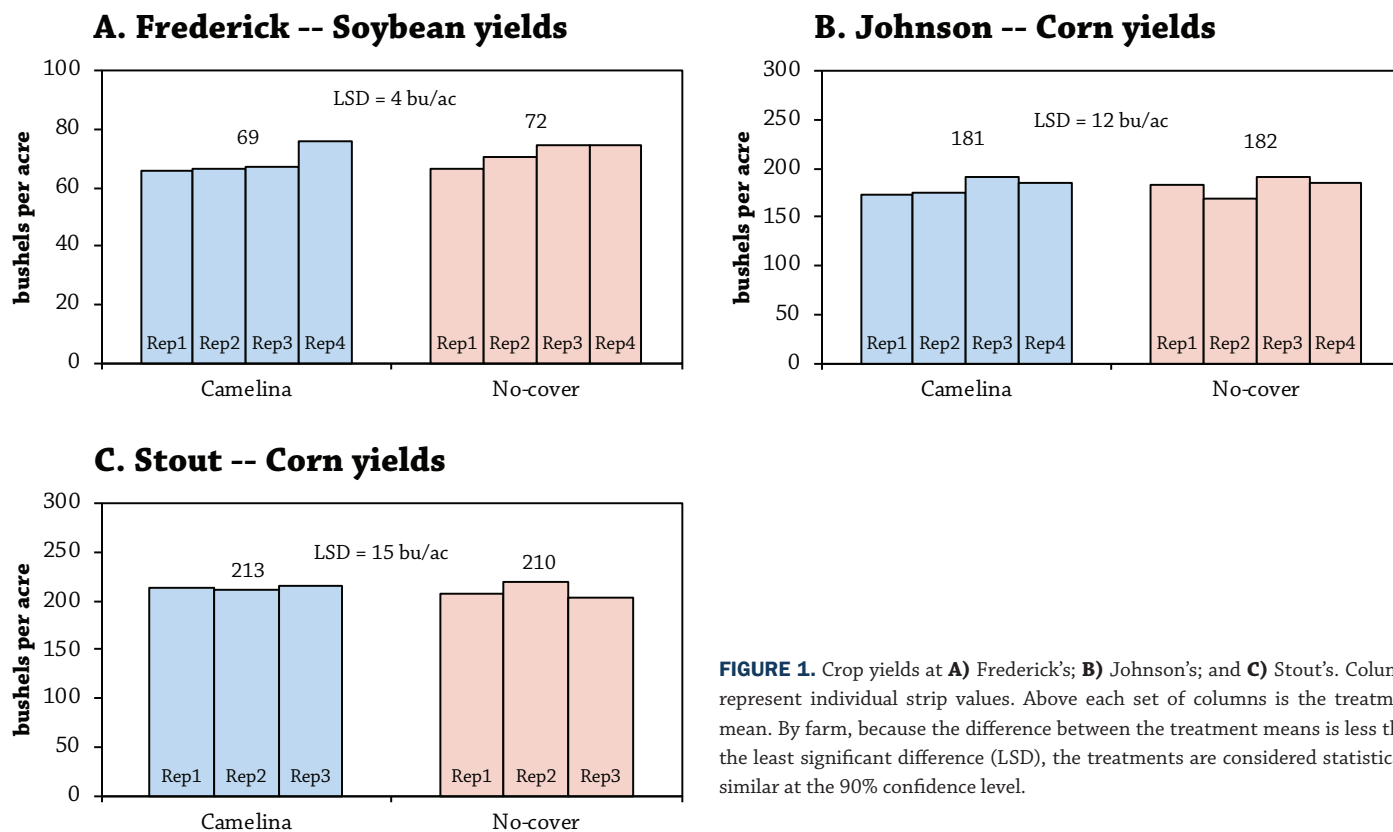


FIGURE 1. Crop yields at **A)** Frederick’s; **B)** Johnson’s; and **C)** Stout’s. Columns represent individual strip values. Above each set of columns is the treatment mean. By farm, because the difference between the treatment means is less than the least significant difference (LSD), the treatments are considered statistically similar at the 90% confidence level.

CONCLUSIONS AND NEXT STEPS

Across the three farms, the camelina cover crop had no effect on soybean or corn yields. This is an important finding that echoes the results of a long-term on-farm project coordinated by Iowa Learning Farms and PFI. The cereal rye cover crop in that study had a mostly neutral effect on corn and soybean yields.^[7] It is also important for those who might desire diversifying their fall-sown cover crops instead of solely relying on cereal rye. “I think camelina has a lot of potential as a cover crop,” Bill Frederick said. “Low seeding rates because of its small seed size will lower application costs.” The camelina successfully overwintered on Frederick’s farm near Jefferson in west-central Iowa. Though, because the camelina cover crop failed to overwinter at one farm in this trial (Wendy Johnson’s near Charles City), more work on best management practices should probably be conducted before broader adoption of camelina as a cover crop in Iowa.

APPENDIX – TRIAL DESIGN AND WEATHER CONDITIONS

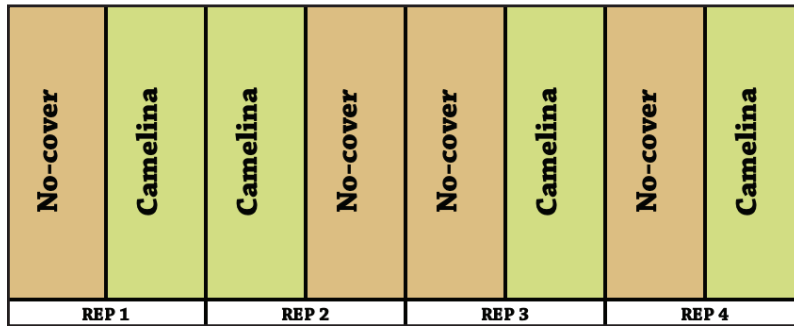


FIGURE A1. Sample experimental design used by the cooperators. The design includes randomized replications of the camelina cover crop and no-cover-crop treatments. This design allowed for statistical analysis of the results.

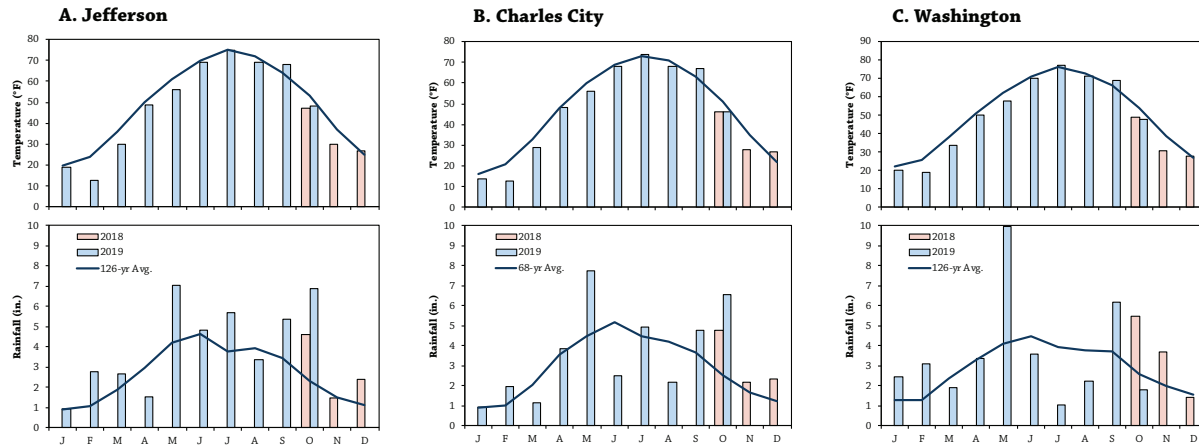


FIGURE A2. Mean monthly temperature and rainfall for Oct. 1, 2018 through Oct. 31, 2019 and the long-term averages at the nearest weather stations to each farm.^[8] **A)** Jefferson (Frederick); **B)** Charles City (Johnson); **C)** Washington (Stout).

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