

# Intercropping with Brassicaceae Oilseeds

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## Introduction

Intercropping the Brassicaceae oilseeds canola (*Brassica napus* L.), crambe, (*Crambe abyssinica* Hochst), and camelina (*Camelina sativa* L.) may improve grain yield, land equivalent ratio, and grain yield value, and simultaneously target edible and industrial oil markets that could improve on-farm sustainability.

## Objective

The study objective was to evaluate grain yield, land equivalent ratio, and grain yield value for two-crop intercropping with canola, crambe, and camelina.

## Materials and Methods

- RCBD experiment with four replicates conducted at Prosper, ND (Fig. 1)

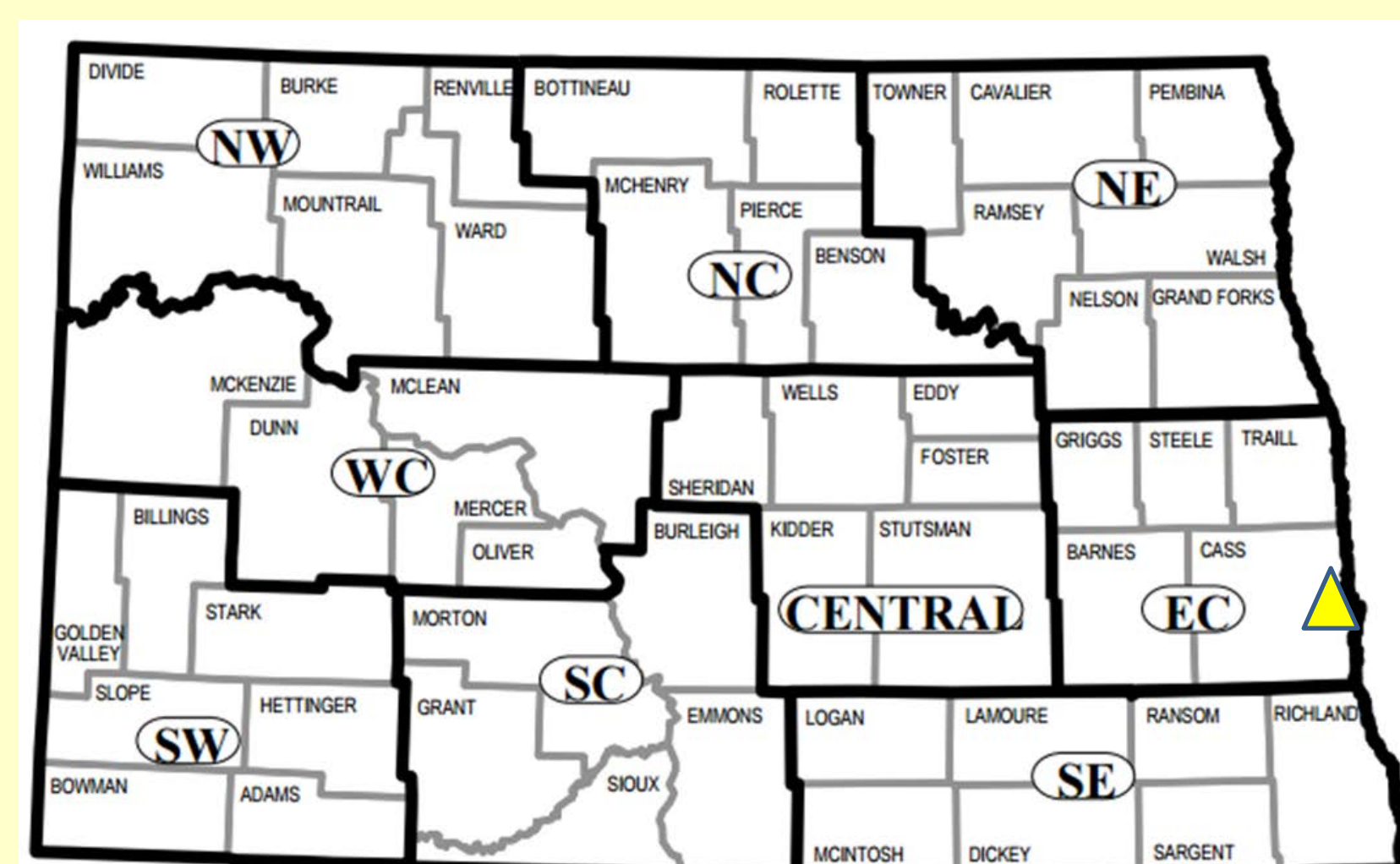


Fig. 1. Prosper, ND, located in Cass county at 47.002, -97.115 and elevation 284 m.

- Previous crop – Hard red spring wheat (*Triticum aestivum* L.)
- Seeding and harvest dates –
  - June 12, 2023 seeding
  - Sept. 28, 2023 direct harvest
- RCBD: with one cultivar of each crop
  - 'CS 2100' canola, 'Meyer' crambe, 'Pronghorn' camelina
  - Pure live seed (PLS) sole crop seeding rates
    - 150 plants/m<sup>2</sup> canola
    - 250 plants/m<sup>2</sup> crambe
    - 450 plants/m<sup>2</sup> camelina
  - Three two-crop intercropping studies
    - Canola / crambe
    - Camelina / crambe
    - Camelina / canola

'A'	'B'	Treatment code
100†	0	A100-B0
0	100	A100-B0
50	50	A50-B50 mixed
50	50	A50-B50 alternating

† Where values in columns A and B are the percent of sole crop PLS rate for each crop on a plot area basis.

- Experimental units (plots) were six rows, each spaced 0.30-m apart and 7.6-m in length where the four-center rows were recorded for traits and the outside rows were borders (Fig. 2).
- Grain price: \$0.528/kg canola, \$0.440/kg camelina, and \$0.396/kg crambe (Barry Coleman, personal communication, 10/18/23)
- Grain yield value (\$/ha) = (Grain yield (kg/ha)) X ((Grain price (\$/kg))
- Traits reported
  - Grain yield, land equivalent ratio (LER), and grain yield value



Fig. 2. Canola-camelina intercrop plots at Prosper, ND, July 25, 2023.

## Results and Discussion

- Yield was similar for the canola and crambe sole crops and combined mixed row and alternating row (CAN + CRA) treatments (Table 2).
- Mixed and alternating row treatments produced lower yield for canola and crambe than their sole crop yield.
- Mixed and alternating row treatments produce similar yield for each respective crop.
- Canola yield was 4 to 5 times greater than for crambe when comparing mixed and alternating row treatments.

Canola	Crambe	Row type	Canola	Crambe	CAN + CRA
100	0	Sole	2555	0	2555
0	100	Sole	0	2253	2253
50	50	Mixed	1832	414	2246
50	50	Alternating	1973	395	2368
LSD (0.05)			323	250	NS

- Land equivalent ratio (LER) was similar for the canola and crambe sole crops and combined mixed row and alternating row (CAN + CRA) treatments (Table 3).
- Mixed and alternating row treatments produced approximately four times higher LER for canola compared with crambe.

Canola	Crambe	Row type	Canola	Crambe	CAN + CRA
100	0	Sole	1.00	0	1.00
0	100	Sole	0	1.00	1.00
50	50	Mixed	0.72	0.18	0.90
50	50	Alternating	0.77	0.18	0.95
LSD (0.05)			0.13	0.11	NS

- Higher grain value for the canola sole crop treatment is primarily from a \$0.132/kg greater market price compared with crambe (Table 4).

Canola	Crambe	Row type	Canola	Crambe	CAN + CRA
100	0	Sole	1349	0	1349
0	100	Sole	0	991	991
50	50	Mixed	968	182	1150
50	50	Alternating	1042	174	1216
LSD (0.05)			170	110	169

- Crambe sole yielded greater than the camelina sole treatment and similar to the mixed and alternating row treatments (Table 5).
- Mixed and alternating row treatments produced lower yield for camelina and crambe than their sole crop yield.
- Mixed and alternating row treatments produce similar yield for each respective crop.
- Yield was approximately 45% greater for crambe than camelina when comparing mixed and alternating row treatments.

Camelina	Crambe	Row type	Camelina	Crambe	CAM + CRA
100	0	Sole	1833	0	1833
0	100	Sole	0	2312	2312
50	50	Mixed	904	1286	2191
50	50	Alternating	860	1279	2138
LSD (0.05)			380	306	429

- Land equivalent ratio (LER) was similar for the camelina and crambe sole crop and combined mixed row and alternating row (CAM + CRA) treatments (Table 6).
- Mixed and alternating row treatments produced similar LER for each respective crop.
- LER mixed and alternating row treatment means among crops ranged from 0.47 to 0.56 and are generally similar.
- LER mixed and alternating values for crambe are approximately three times greater than those for crambe in the canola/crambe intercrop study (Table 3).

Camelina	Crambe	Row type	Camelina	Crambe	CAM + CRA
100	0	Sole	1.00	0.00	1.00
0	100	Sole	0.00	1.00	1.00
50	50	Mixed	0.49	0.56	1.05
50	50	Alternating	0.47	0.55	1.02
LSD (0.05)			0.17	0.13	NS

- Grain value for the camelina and sole crop and mixed and alternating row treatments were similar (Table 7).
- Grain value for the mixed and alternating row treatments was approximately 30% more for crambe than camelina due to greater crambe yield (Table 5) although camelina grain price is \$0.044/kg higher.

Camelina	Crambe	Row type	Camelina	Crambe	CAM + CRA
100	0	Sole	806	0	806
0	100	Sole	0	916	916
50	50	Mixed	398	509	907
50	50	Alternating	378	506	885
LSD (0.05)			135	122	NS

- Yield was lowest for the camelina sole crop treatment compared with the canola sole crop, mixed and alternating row treatments (Table 8).
- Sole, mixed and alternating row treatments produced similar yield for canola.
- Mixed and alternating row treatments produced approximately 20% of sole crop yield for camelina.
- Yield was approximately six times greater for canola than camelina when comparing mixed and alternating row treatments.

Camelina	Canola	Row type	Camelina	Canola	CAM + CAN
100	0	Sole	2035	0	2035
0	100	Sole	0	2984	2984
50	50	Mixed	409	2753	3162
50	50	Alternating	415	2457	2873
LSD (0.05)			374	1068	794

- Land equivalent ratio (LER) was similar for the camelina and canola sole crop and combined mixed row and alternating row (CAM + CAN) treatments (Table 9).
- Mixed and alternating row treatments produced similar LER for each respective crop.
- LER mixed and alternating values for canola are approximately four times greater than those for camelina.

Camelina	Canola	Row type	Camelina	Canola	CAM + CAN
100	0	Sole	1.00	0.00	1.00
0	100	Sole	0.00	1.00	1.00
50	50	Mixed	0.20	0.92	1.12
50	50	Alternating	0.20	0.82	1.03
LSD (0.05)			0.18	0.36	NS

- Lowest grain value for the sole crop camelina treatment is due to approximately 34% less yield (kg/ha) compared with the canola treatments (Tables 8 and 10).
- 88% of the grain value for mixed and alternating row treatments was from the canola grain value (Table 10).

Camelina	Canola	Row type	Camelina	Canola	CAM + CAN
100	0	Sole	895	0	895
0	100	Sole	0	1576	1576
50	50	Mixed	180	1453	1633
50	50	Alternating	183	1298	1480
LSD (0.05)			165	564	440

## Conclusions

- Canola, crambe, and camelina ranked 1, 2, and 3, respectively, from high to low for grain yield in these studies.
- The LER for the intercropping treatments was similar and does not indicate overyielding of mixed and alternating row treatments with their respective sole crop production.
- Comparing crop LER within mixed and alternating row treatments indicated crop competitiveness greatest for canola followed by crambe and then camelina.
- Grain yield value was largely determined by grain yield for each of the intercropping treatments.
- However, the highest yielding crop (canola) also had the higher grain price (\$0.528/kg) as compared with camelina (\$0.440/kg) and crambe (\$0.396/kg).

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