

## 2018 Intercropping Trial at Minot

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Intercropping, growing multiple crops together, is a farming practice that has been utilized by many cultures around the world for centuries. Native Americans grew corn, beans and squash together. They figured out the benefits of utilizing corn as a trellis for beans and the shading ability of squash to suppress weeds. In the 1920's, one half of the soybean crop grown in Ohio were intercropped with corn and more recently most beans grown in Africa were intercropped with maize or other crops. Current interest in intercropping has emerged from the cover crop and soil health movements where crop diversity is one of the primary objectives. More locally, some farmers are claiming a reduction in aschochyta blight in chickpeas interseeded with flax. Moreover, there is a plethora of anecdotal information and testimonials on the synergistic effects of intercropping in the Northern Great Plains, however, there are very few unbiased data driven studies to back up these claims. It would appear to make sense that growing a nitrogen fixing crop with a high nitrogen using crop may result in a beneficial symbiotic relationship. These types of relationships probably exist between some of our modern crops, however, those relationships are not well understood. Ultimately, there has to be a financial benefit to the farmer in order to make intercropping work. This study was initiated to provide some science to this topic. It is not "all inclusive" and at this point, results need to be viewed as a "starting point" and not as a "conclusion".

This trial was planted into minimally tilled wheat stubble that is a Williams loam soil on May 10. Individual plots were four 15" rows by 25 feet in length and intercropping was in alternating rows. Following planting, the trial was sprayed with 3 oz/A Spartan (sulfentrazone) + 22 oz/A Dual II (S/metolachlor). Although this herbicide combination is not registered on all of the crops included in this trial, it was quite effective at suppressing most weeds early in the growing season. There was some herbicide injury as noted below. The trial had a POST application of 8 oz/A Select (clethodim) in mid-July to control grassy weeds. Stand establishment for each crop was visually estimated and actual plant populations were tabulated early in the growing season. The growing season was dry, which deterred most foliar diseases, however, there was a concerted effort to evaluate aschochyta blight on all chickpea combinations. Monoculture dry pea plots were harvested on August 8. All of the other crop combinations were harvested on August 24 except for safflower combinations which were harvested on September 4. Combine settings were challenging but in general, all plots were harvested with low fan and cylinder speeds, collecting all harvested material and separating each crop component with a clipper mill.

Below are results for each individual crop grown as a monoculture and as an intercropping combination. With each growing season, some crops produce better depending on environmental conditions and management practices utilized with those growing conditions. Faba beans in this trial were planted later than optimum. This crop also performs better under cool and moist growing conditions which was not the case in 2018. Lentils in this trial had poor production, while canola had very good yields. These production yields are also reflected in the final gross financial return table below. That table does not explain actual production cost but shows a very simplistic economic comparison based on yield at a particular market price.

## Flax

Intercropping Combination	Visual Stand %	Flax Population plants/A	Disease %	Maturity Date July	Plant Height inches	Test Weight lbs/bu	Oil Content %	Flax Yield bu/A
Monoculture Flax	69 a	229,875 a	0 a	31 a	25 a	54.1 a	44.2 a	14.4 a
Flax + Chickpea	68 a	232,931 a	0 a	30 a	25 a	54.9 b	42.7 b	5.3 b
Flax + Lentil	78 a	327,388 b	0 a	31 a	26 a	54.6 b	42.8 b	9.0 c

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 28

Varieties: Omega and York

Planting Rate: 1 million seeds/A

**Growing Season Observations:** Flax and chickpea stands appear to be okay. Lentil stands are too light. Flax matures 2 weeks earlier than chickpeas. Flax and lentils have similar maturities. There have been reports from farmers of less chickpea ascochyta disease on flax + chickpea intercropping, however, this was not observed in this trial. There are also some reports of flax acting as a trellis to support lentil growth. This also was not observed in this trial.

**Summary:** Dry soils at planting hindered seedling establishment, however, flax stands appeared to be adequate. There were no diseases noted on the flax crop and intercropping did not affect flax maturity or plant height. Slight but statistically significant differences were noted between monoculture and intercropping for test weights and oil contents with the monoculture having a lighter test weight but higher oil content than both intercropping combinations. Yields of each flax treatment were very low but statistically different from each other. It would appear that chickpea is more competitive with flax growth than lentil when grown together.

Flax + Chickpea



## Canola

Intercropping Combination	Visual Stand %	Canola Population plants/A	Disease %	Maturity Date August	Plant Height inches	Test Weight lbs/bu	Oil Content %	Canola Yield lbs/A
Monoculture Canola	93 a	145,506 a	0 a	6 a	37 a	51.0 a	41.0 a	2361 a
Canola + Dry Pea	81 a	138,169 a	0 a	6 a	37 a	51.0 a	41.0 a	1409 b
Canola + Faba Bean	80 a	117,994 a	0 a	7 a	34 a	50.9 a	40.4 b	1370 b

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 28

Variety: Invigor 140P

Planting Rate: 400,000 seeds/A

**Growing Season Observations:** Dry conditions reduced seedling establishment, however, stands were adequate. Canola and dry pea have similar maturities but be aware of mismatched combinations i.e. early maturing canola varieties grown with a late maturing dry pea varieties or viceversa.

Dry peas had a tendency to climb onto adjacent canola plants later in the growing season.

Canola out competes faba bean growth and maturities are not in sync with each other.

**Summary:** Intercropping combination with dry pea and faba bean did not affect agronomic or seed quality characteristics of canola with the exception of a slight but statistically significant decrease in oil content for the canola + faba bean combination. Canola yields were significantly reduced when grown in combination with dry pea or faba bean.



## Carinata

Intercropping Combination	Visual Stand %	Carinata Population plants/A	Disease %	Maturity Date August	Plant Height inches	Test Weight lbs/bu	Oil Content %*	Carinata Yield lbs/A
Monoculture Carinata	57 a	50,132 a	0 a	17 a	27 a	52.4 a	32.7 a	725 a
Carinata + Dry Pea	52 a	56,857 a	0 a	17 a	27 a	53.7 b	31.8 a	362 a
Carinata + Faba Bean	43 a	33,625 b	0 a	18 a	24 a	52.1 a	33.8 a	394 a

\*Oil content was analyzed with a canola calibration.

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 28

Variety: AAC A120

Planting Rate: 400,000 seeds/A

**Growing Season Observations:** Dry conditions reduced seedling establishment resulting in poor and inconsistent stands. Carinata matures much later than dry pea so this combination is mismatched. Carinata and faba bean had similar maturities and should be considered as a good potential intercropping match. Possible herbicide injury.

**Summary:** Intercropping combination with dry pea and faba bean did not affect agronomic or seed quality characteristics of carinata with the exception of a slightly increased test weight for the carinata + dry pea combination. Wide variability between replications caused relatively large but statistically non-significant differences between intercropping combinations for oil content and yield.



## Safflower

Intercropping Combination	Visual Stand %	Safflower Population plants/A	Disease %	Maturity Date August	Plant Height inches	Test Weight lbs/bu	Oil Content %	Safflower Yield lbs/A
Monoculture Safflower	49 a	70,307 a	0 a	24 a	18 a	38.0 a	37.4 a	734 a
Safflower + Chickpea	38 a	53,189 a	0 a	24 a	17 a	39.3 a	37.4 a	417 b

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: September 4

Varieties: Finch and Nutrasaff

Planting Rate: 400,000 seeds/A

**Growing Season Observations:** Incorrect seeding plates resulted in very thin and inconsistent stand. Safflower and chickpea have similar maturities so this combination should be considered as a good potential intercropping match.

**Summary:** Agronomic and seed quality characteristics of safflower were not affected by intercropping with chickpea. Yields between treatment combinations were statistically different.

Safflower + Chickpea



## Chickpea

Intercropping Combination	Visual Stand %	Chickpea Population plants/A	Disease %	Maturity Date August	Plant Height inches	Test Weight lbs/bu	1000 KWT g	Chickpea Yield lbs/A
Monoculture Chickpea	93 a	116,771 a	0 a	11 a	15 a	63.4 ab	243 a	1290 a
Chickpea + Flax	94 a	116,771 a	1 a	12 a	16 a	63.6 a	237 a	817 b
Chickpea + Safflower	49 b	85,897 b	7 b	18 b	12 b	62.9 b	234 a	347 c

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 24

Varieties: B-90 and Frontier

Planting Rate: 175,000 seeds/A

**Growing Season Observations:** Chickpea stands were adequate for the monoculture and chickpea+ flax combination but were very poor for the chickpea + safflower combination. Both chickpea varieties grown in combination with safflower also appeared to be chlorotic. It is unknown if this was due to an adverse reaction to this intercropping combination or if it was due to a soil issue.

**Summary:** Agronomic and seed quality characteristics were not affected for chickpea intercropped with flax. Data on the chickpea + safflower combination is quite different from the monoculture and chickpea + flax combination, and as was stated above, the causes of these differences are not understood. Ascochyta blight was not prevalent at high levels but was observed in minor amounts on chickpea in both intercropping combinations but not on the monoculture crop.

Chickpea + Flax



## Lentil

Intercropping Combination	Visual Stand %	Lentil Population plants/A	Disease %	Maturity Date August	Plant Height inches	1000 KWT g	Lentil Yield lbs/A
Monoculture Lentil	48 a	223,149 a	0 a	4 a	14 a	33.1 a	389 a
Lentil + Flax	47 a	276,644 a	0 a	3 a	12 b	37.5 a	109 b

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 24

Varieties: CDC Richlea and CDC Viceroy

Planting Rate: 625,000 seeds/A

**Growing Season Observations:** Incorrect seeding plates resulted in thin and inconsistent stand.

Lentil + flax combination appears to have a good fit.

**Summary:** Agronomic and seed quality characteristics were not affected by intercropping with flax with the exception of plant height which was slightly shorter. Yields of both monoculture and intercropped treatments were very low and most likely caused by poor crop stands.

Lentil + Flax



## Dry Pea

Intercropping Combination	Visual Stand %	Dry Pea Population plants/A	Disease %	Maturity Date	Plant Height inches	Test Weight lbs/bu	1000 KWT g	Dry Pea Yield bu/A
Monoculture Dry Pea	85 a	175,463 a	0 a	27 a	26 a	63.9 a	200 a	29.9 a
Dry Pea + Canola	71 b	163,235 a	0 a	28 a	23 ab	63.9 a	180 b	14.9 b
Dry Pea + Carinata	80 ab	160,179 a	0 a	28 a	22 b	63.9 a	180 b	15.2 b

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: Monoculture = August 8, Intercropping = August 24

Varieties: Striker and Agassiz

Planting Rate: 250,000 seeds/A

**Growing Season Observations:** Dry pea stands were generally adequate. Dry pea and carinata maturities did not match.

**Summary:** Dry pea intercropped with canola and carinata produced shorter plants and lighter kernel weights than the monoculture dry pea. Diseases were not observed and test weights were identical for all dry pea treatments. The monoculture yield was significantly higher than both intercropping combinations, but yields between intercropping combinations were similar to each other.

Dry Pea + Canola





## Faba Bean

Intercropping Combination	Visual Stand %	Faba Bean Population plants/A	Disease %	Maturity Date August	Plant Height inches	Test Weight lbs/bu	1000 KWT g	Faba Bean Yield bu/A
Monoculture Faba Bean	79 a	85,592 a	0 a	10 a	24 a	63.3 a	358 a	10.8 a
Faba Bean + Canola	58 a	90,483 a	0 a	14 b	21 b	64.2 b	364 a	6.6 b
Faba Bean + Carinata	77 a	92,317 a	0 a	16 b	23 a	64.2 b	355 a	8.2 ab

Values followed by different letters are statistically different ( $p < 0.05$ )

Planting Date: May 10

Harvest Date: August 24

Varieties: Boxer and Tabasco

Planting Rate: 175,000 seeds/A

**Growing Season Observations:** Faba bean stands were on the lighter side and should be planted earlier. Canola tends to out-compete faba beans. Carinata may be a good fit with faba beans.

**Summary:** Intercropped faba beans established similar plant populations as faba beans in monoculture. Intercropping with either canola or carinata delayed faba bean maturity, produced slightly shorter faba bean plant heights and slightly heavier test weights than the monoculture. Faba bean yields of all treatments were very low but the faba bean + carinata treatment was statistically similar to the monoculture treatment.

Faba Bean + Canola



## Gross Financial Return Per Acre

Monoculture Flax	\$122
Monoculture Canola	\$366
Monoculture Safflower	\$141
Monoculture Chickpea	\$232
Monoculture Dry Pea	\$179
Monoculture Faba Bean	\$76
Monoculture Lentil	\$54
Flax + Chickpea	\$192
Flax + Lentil	\$92
Canola + Dry Pea	\$308
Canola + Faba Bean	\$259
Safflower + Chickpea	\$143

### Year 2019 Commodity Prices

Flax	\$8.50/bu
Canola	\$15.50/cwt
Safflower	\$19.25/cwt
Chickpea	\$0.18/lb
Dry Pea	\$6.00/bu
Lentil	\$14.00/cwt
Faba Bean	\$7.00/bu

no established market for carinata