

## Intercropping with soybeans and peas

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### Objectives

1. Gain experience in intercropping: observe and evaluate agronomic performance of intercropping compared to mono-cropping
2. Evaluate yield potential, land use equivalency and profitability of intercropping compared to mono-cropping
3. Overall, start a knowledge base on if and how intercrops can be utilized in cropping systems in the Interlake

### Trial information

Location: Arborg, MB (Prairies East Sustainable Agriculture Initiative research group)  
Soil type (series): Heavy clay (Fyala)  
Seeding date: May 14, 2019  
Background soil test levels: 38 lbs/ac N, 27 ppm P  
Preceding crop: Wheat (2018), Soybeans (2017)  
Row spacing and arrangement: 7.5 inches, all intercrops were seeded in the same, mixed row  
Fertility: 15 lbs P<sub>2</sub>O<sub>5</sub>/ac with seed (specific N rates for treatments are listed in Table 2)

### Summary

The first year of experimenting with intercropping in the Interlake region was successful. Treatments included two seeding rate combinations of soybean-flax, pea-canola, pea-flax and pea-oat compared to pea, canola, flax and soybean monocrops. Results of the experiment including treatment descriptions, agronomic practices, yield, gross and marginal revenues and general observations are listed in Table 2 and 3. Pea and flax monocrops yielded well compared to the soybean and canola monocrops, which were limited by agronomic challenges (Table 2). The growing season at Arborg was dry with 55% of normal growing season precipitation (Table 1). The below normal precipitation levels limited crop yields in the experiment.

Pea-canola was the only intercrop to over-yield, with a land equivalent ratio of 1.2. This occurred because in this intercrop, the peas yielded similar to the monocrop, in addition to a low canola yield. Despite the added cost of canola seed, the marginal revenue of the pea-intercrop was higher than the pea monocrop due to the higher herbicide cost in peas with the use of Authority 480. The soy-flax intercrop produced low flax yield compared to the monocrop and it also outcompeted the soybeans. Other research has shown that soy-flax should be seeded in alternating rows. The pea-flax intercrop performed well, resulting in a land equivalent ratio of 1.0 although marginal revenue was slightly lower than monocrop pea and flax. In early June there appeared to be less chlorosis in the pea-flax intercrops compared to the flax monocrop (Figure 1). The pea-oat intercrop also performed well although we cannot make a direct comparison because an oat monocrop was not included. The gross and marginal revenues, however, were among the highest in the experiment with lower herbicide cost (no in-crop herbicide). Images of the intercrop treatments throughout the season are included at the end of the report.

**Table 1.** Seasonal growing degree days, crop heat units and precipitation at Arborg in 2019.

	May	June	July	August	May-August
<b>Growing degree days (GDD)</b>	123	337	451	378	1292
Normal % growing degree days	60	100	104	98	95
<b>Crop heat units (CHU)</b>	249	548	714	608	2121
Normal % crop heat units	68	96	101	95	93
<b>Precipitation (mm)</b>	23	31	66	25	148
Normal % precipitation	44	41	110	32	55

Source: <https://web43.gov.mb.ca/climate/SeasonalReport.aspx>



**Figure 1.** Pea-flax intercrop (L) and flax monocrop (R) on June 13, 2019.

### **Soybean and Pulse Agronomy Research Team**

Brodie Erb (technician)  
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**Table 2.** Seeding rates, varieties, seed depth, plant stand, plant height, yield and profit of intercrop treatments in 2019 at Arborg, MB.

No.	Treatment	Crop	Seed rate strategy	Variety	Land Equivalent Ratio ¥	Seeding rate* (seeds/m <sup>2</sup> )	Plant stand** (plants/m <sup>2</sup> )	Height (cm)	Yield † (bu/ac)	Gross revenue ‡ (\$/ac)	Marginal revenue ‡ (\$/ac)
1	Pea	Pea	Full	CDC Amarillo	1.0	100	44 ↓	37	31.4	220	150
2	Canola	Canola	Full	5545 CL	1.0	165 *	56	81	17.7	186	49
3	Flax	Flax	Full	CDC Glass	1.0	592	246 ↓	40	19.9	238	147
4	Soybean	Soybean	Full	S007Y4	1.0	49	16 ↓	46	12.4	131	10
5	Pea-canola	Pea	Full	CDC Amarillo	1.2	100	31	35	29.6	248	163
		Canola	1/2	5545 CL		83 *	15	66	3.9		
6	Pea-canola	Pea	2/3	CDC Amarillo	1.2	67	21	34	32.5	258	183
		Canola	1/2	5545 CL		83 *	24	70	2.9		
7	Soy-Flax	Soybean	Full	S007Y4	0.6	49	18	24	0.1	132	-20
		Flax	1/2	CDC Glass		296	139	45	10.9		
8	Soy-Flax	Soybean	2/3	S007Y4	0.6	33	12	20	0.0	132	8
		Flax	2/3	CDC Glass		395	188	42	11.0		
9	Pea-Flax	Pea	Full	CDC Amarillo	1.0	100	41	29	16.1	235	142
		Flax	1/2	CDC Plava		592 *	205	34	10.2		
10	Pea-Flax	Pea	2/3	CDC Amarillo	1.0	67	23	33	13.6	226	141
		Flax	2/3	CDC Plava		395	173	35	10.8		
11	Pea-Oat	Pea	Full	CDC Amarillo	Cannot calculate (no monocrop oat treatment)	100	38	29	12.4	269	221
		Oat	Half	Souris		161	62	56	48.5		
12	Pea-Oat	Pea	2/3	CDC Amarillo	Cannot calculate (no monocrop oat treatment)	67	31	28	5.4	218	179
		Oat	2/3	Souris		215	77	58	48.1		

\*Seed packaging error led to actual seeding rate being higher than the target.

\*\*Arrows within the column indicate monocrop plant stands that are below optimum. Optimum plant stands based on monocrop recommendations are: peas (7-8 plants/ft<sup>2</sup> or 70-80 plants/m<sup>2</sup>), canola (5-7/ft<sup>2</sup> or 50-70 plants/m<sup>2</sup>), flax (37-56 plants/ft<sup>2</sup> or 396-599 plants/m<sup>2</sup>) and soybean (4 plants/ft<sup>2</sup> or 40 plants/m<sup>2</sup>).

† Average crop yields in the Bifrost-Riverton municipality are 36.8 bu/ac for peas, 30.1 bu/ac for canola, 17.8 bu/ac for flax and 31.3 bu/ac for soybean (Source: MASCS, 1993-2019).

‡ Profit margins were calculated as follows: *Gross revenue (\$/ac)* = Yield x Market price

*Marginal revenue (\$/ac)* = Gross revenue – Seed cost – Fertilizer cost – Herbicide cost

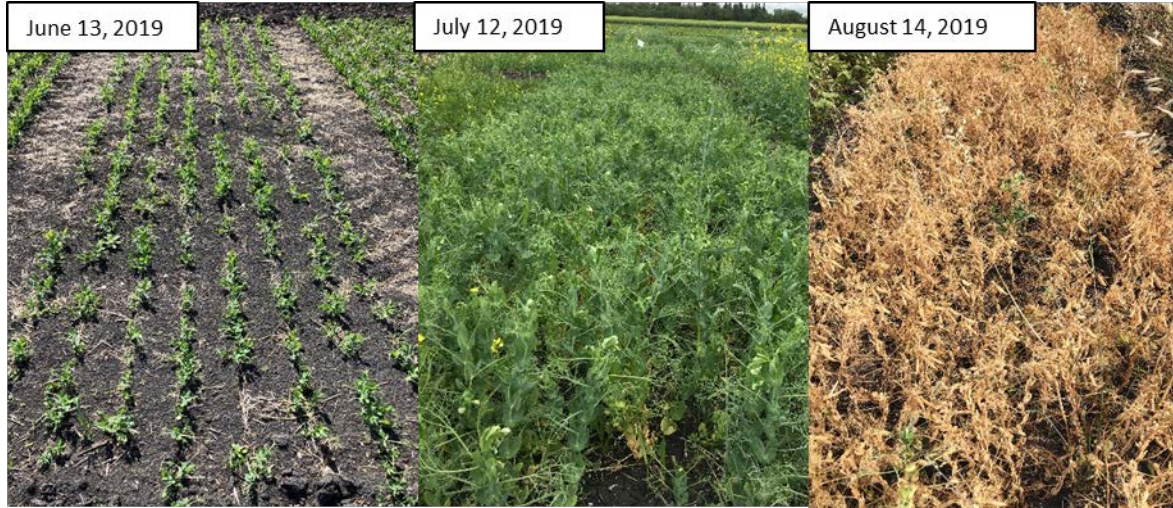
¥ Land equivalent ratio (LER) =  $\frac{\text{yield of intercrop species 1}}{\text{yield of monocrop species 1}} + \frac{\text{yield of intercrop species 2}}{\text{yield of monocrop species 2}}$

**Table 3.** Seeding depth, weed control, fertility and general notes/observations of intercrop treatments in 2019 at Arborg, MB.

No.	Treatment	Crop	Seed rate	Depth	Herbicides used/weed control	Fertilizer applied	General notes and observations
1	Pea	Pea	Full	1.5"	Pre-emerge: Authority 480 & Glyphosate In-crop: Odyssey	None	Short pea plants.
2	Canola	Canola	Full	¾"	Pre-emerge: Glyphosate In-crop: Odyssey	110 lbs N/ac	Flea beetles sprayed 2x.
3	Flax	Flax	Full	¾"	Pre-emerge: Authority 480 & Glyphosate In-crop: Basagran Forte	45 lbs N/ac	
4	Soybean	Soybean	Full	1"	Pre-emerge: Authority 480 & Glyphosate In-crop: Glyphosate	None	Below optimum plant population, drought stress
5	Pea-canola	Pea	Full	¾"	Pre-emerge: Glyphosate In-crop: Odyssey	None	Short pea plants. Canola was affected by flea beetles (sprayed 2x).
		Canola	1/2				
6	Pea-canola	Pea	2/3	¾"	Pre-emerge: Authority 480 & Glyphosate In-crop: Basagran Forte	None	Flax outcompeted the soybeans. Future studies will evaluate flax and soybean in separate, alternating rows as has shown to be more successful in other intercrop research from Melita and Carman, MB. An earlier maturing soybean variety is also required.
		Canola	1/2				
7	Soy-Flax	Soybean	Full	¾"	Pre-emerge: Authority 480 & Glyphosate In-crop: Basagran Forte	None	Flax outcompeted the soybeans. Future studies will evaluate flax and soybean in separate, alternating rows as has shown to be more successful in other intercrop research from Melita and Carman, MB. An earlier maturing soybean variety is also required.
		Flax	1/2				
8	Soy-Flax	Soybean	2/3	¾" ¾"	Pre-emerge: Authority 480 In-crop: Basagran Forte	None	Grew well throughout the season. Noticeable differences in flax chlorosis compared to the monocrop - flax appeared less chlorotic in the pea-flax intercrop. This observation warrants further investigation. From this first year of data, it appears that a full pea seeding rate should be maintained to compete with the flax.
		Flax	2/3				
9	Pea-Flax	Pea	Full	1"	Pre-emerge: Authority 480 In-crop: Basagran Forte	None	Grew well throughout the season. Noticeable differences in flax chlorosis compared to the monocrop - flax appeared less chlorotic in the pea-flax intercrop. This observation warrants further investigation. From this first year of data, it appears that a full pea seeding rate should be maintained to compete with the flax.
		Flax	1/2				
10	Pea-Flax	Pea	2/3	1"	Pre-emerge: Authority 480 In-crop: Basagran Forte	None	Grew well throughout the season. Noticeable differences in flax chlorosis compared to the monocrop - flax appeared less chlorotic in the pea-flax intercrop. This observation warrants further investigation. From this first year of data, it appears that a full pea seeding rate should be maintained to compete with the flax.
		Flax	2/3				
11	Pea-Oat	Pea	Full	1"	Pre-emerge: Glyphosate In-crop: none	None	Short pea plants. Weeds were suppressed well in this intercrop treatment. From this first year of data, it appears that a full pea seeding rate should be maintained to compete with the oats.
		Oat	Half				
12	Pea-Oat	Pea	2/3	1"	Pre-emerge: Glyphosate In-crop: none	None	Short pea plants. Weeds were suppressed well in this intercrop treatment. From this first year of data, it appears that a full pea seeding rate should be maintained to compete with the oats.
		Oat	2/3				



Treatment 1: Pea monocrop



Treatment 2: Canola monocrop



Treatment 3: Flax monocrop

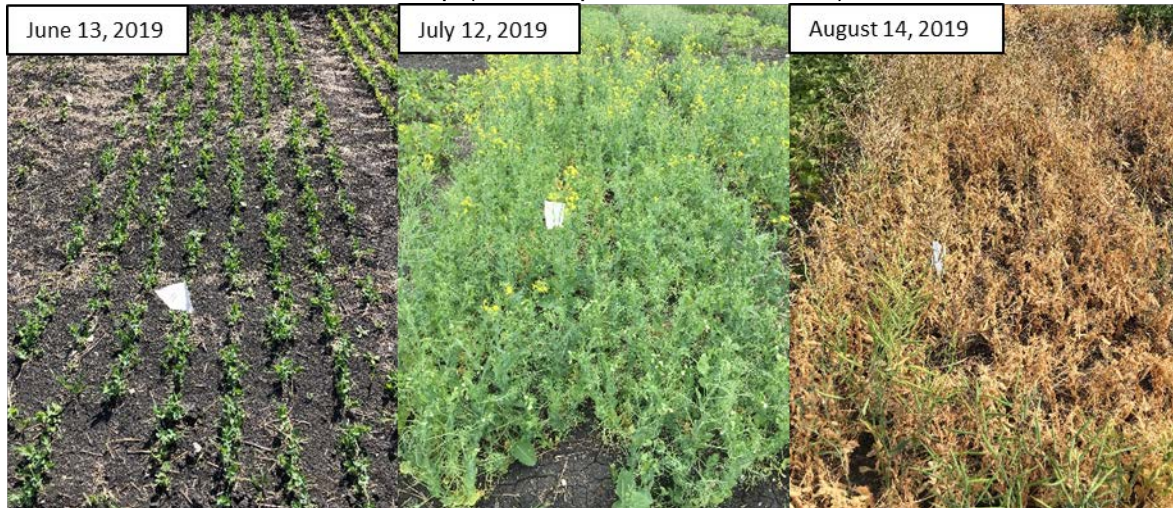




Treatment 4: Soybean monocrop



Treatment 5: Pea-Canola intercrop (full rate peas, 1/2 rate canola)

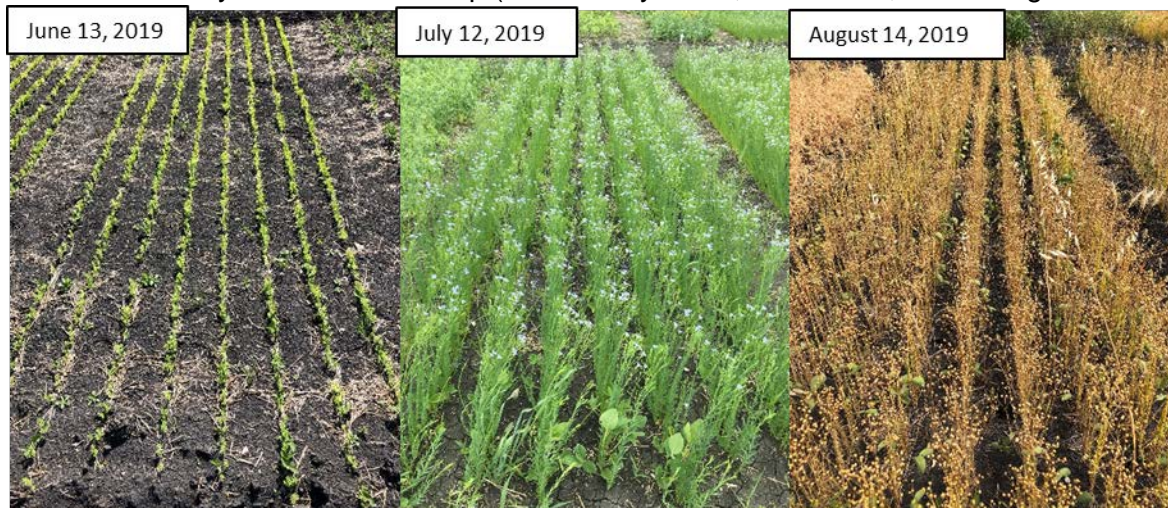


Treatment 6: Pea-Canola intercrop (2/3 rate of peas, 1/2 rate canola)





Treatment 7: Soybean-Flax intercrop (full rate soybeans, 1/2 rate flax, alternating or mixed rows)



Treatment 8: Soybean-Flax intercrop (2/3 seeding rate both crops, alternating or mixed rows)



Treatment 9: Pea-Flax intercrop (full rate peas, 1/2 rate flax, mixed rows)

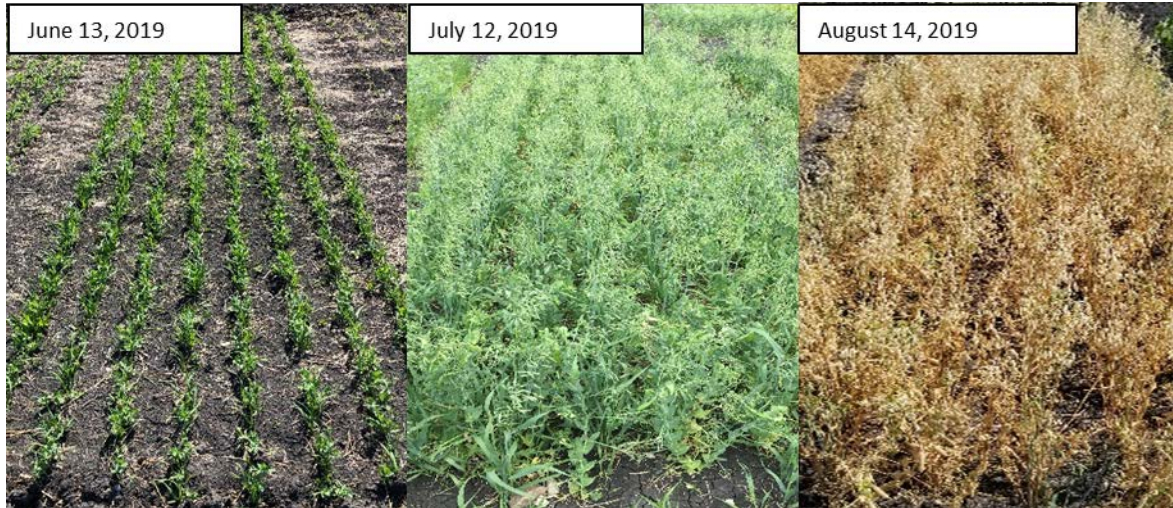




Treatment 10: Pea-Flax intercrop (2/3 seeding rate both crops, mixed rows)



Treatment 11: Pea-Oat intercrop (full rate peas, 1/2 rate oats, mixed rows)



Treatment 12: Pea-Oat intercrop (2/3 peas rate both crops, mixed rows)

