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INTERCROPPING BRASSICA CARINATA WITH VARIOUS PULSE CROPS

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INTERCROPPING BRASSICA CARINATA WITH VARIOUS PULSE CROPS

SOUTH EAST RESEARCH FARM

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Introduction

Intercropping brassicas and pulses has been of interest to producers for some time, but there has been little research or investigation of the various possible combinations of mustards with pulses. Pea and canola combinations have been investigated previously at Melita, [1]and other locations with good success. In this trial, two very different species of mustard were evaluated as potential intercrop species with a range of different pulse crops. The pulse crops were paired with the mustards based on relative maturity. The original application suggested pairing B. cariata with some early maturing pulses, so the plan was altered and expanded to better match the relative maturities of the intercrops.

Brassica carinata is a new mustard biofuel crop being developed by Agrisoma. It is later than canola, prone to lodging, and has very limited herbicide options. It also generally has less shattering than canola. For these reasons, it may be of interest to those willing to intercrop to combine with pulses.

Yellow mustard (*Sinapis alba)* is not a new crop for Saskatchewan. It is earlier than canola, not prone to shattering, and has very limited herbicide options. The yellow mustard in this trial was paired with various lentils and peas that mature in close to the same time.

Both B. carinata and yellow mustard were evaluated in this trial for yield and crop value in small plots and a replicated trial. The aim is to demonstrate the wide array of options for intercropping and to evaluate the potential of the various combinations.

1. https://umanitoba.ca/faculties/afs/agronomists_conf/media/Chalmers_pea_canola_intercrop_poster.pdf

Photo: *Brassica carinata* intercropped with fababean. This treatment was the most productive intercrop treatment.

Materials and Methods

Trial 1: Yellow Mustard Intercrop Trial

Trt #	Crop	Seed Rate (lb/ac)	Crop	Seed Rate (lb/ac)
1	Yellow Mustard	4.9	Yellow Peas	68
2	Yellow Mustard	4.9	Maple Peas	68
3	Yellow Mustard	4.9	Large Green Lentil	58
4	Yellow Mustard	4.9	Small Green Lentil (Viceroy)	29
5	Yellow Mustard	4.9	Red Lentil (CDC Scarlett)	34
6	Yellow Mustard	8.2		

Trial 2: Brassica Carinata Intercrop Trial

Trt #	Crop	Seed Rate (lb/ac)	Crop	Seed Rate (lb/ac)
8	B. carinata	4.9	SSN Faba	85
9	B. carinata	4.9	Yellow Face Bean	136
10	B. carinata	4.9	Marmot Pinto Bean	136
11	B. carinata	4.9	Large Green Lentil	58
12	B. carinata	4.9	Maple Peas (Acer)	68
13	B. carinata	8.2		

The two trials shown in the table above were arranged as separate RCBD's with seven treatments each. There was a logistical problem with timely application of extra nitrogen to one of the monocrop mustard treatments for each of B. carinata and B. alba, so the monocrop plots ended up having the same low N rate. Only one monocrop brassica treatment is shown for each trial. Two treatments ended up being the same, so the results are combined for those treatments.

Both trials were seeded on May 16 with the cone seeder. The seed rates are listed in Table 2 along with the treatments. Seed rates for the pulses were calculated based on the seed size and were about 60% of monocrop seed rates for each. This trial did not include a monocrop for each type of pulse for comparison.

Both trials were seeded on May 16 with the cone seeder. The intercrops were seeded in mixed rows at 1 inch depth on soybean stubble. The fertilizer rate was 50 lb/ac N, 20 lb/ac P, 5 lb/ac S banded below and to the side of the seed row. Centurion was applied to the trial on June 13 and it was hand weeded to remove the larger broadleaf weeds. Plant counts were taken in mid-June for B. alba. Brassica alba intercrops and monocrops were harvested on August 27. Brassica carinata intercrops and monocrops were desiccated on August 30 and harvested on September 6. Heights were measured shortly before harvest. Trial 1 (yellow mustard treatments) was harvested on August 2. Trial 2 was harvested on September 6. Samples were separated soon after harvest and each crop type was tested for moisture content. Yields are adjusted for moisture content. The trial was not sprayed with fungicide. Biomass was not collected, but heights were collected due to the increase in the size of the trial.

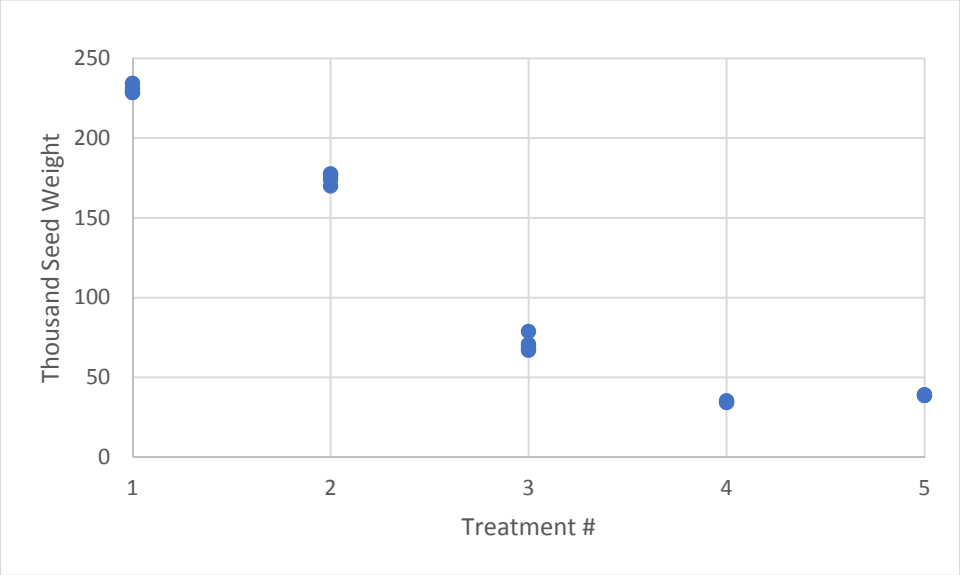
Results

The emergence on the trial was highly variable due to a problem of seed distribution within plots. Emergence was only counted for Trial 1. Yellow mustard had 45 plants/m^2 on average. Average plant population is listed below for each pulse crop.

Yellow Peas	22
Maple Peas	27.6
Large Green Lentil	41.2
Small Green Lentil (Viceroy)	57.6
Red Lentil (CDC Scarlett)	41.2

Thousand Seed Weight was measured for Trial 1 for the pulse crops.

Figure 1. Thousand Seed Weight for pulses in intercrops with yellow mustard (Trial 1, Treatments 1-5)



Thousand seed weight is shown in Figure 1. There was a large range in seed sizes for the pulses and these were consistent over replications.

Crop height is shown in Figure 1 and Figure 2 for Trial 1 and Trial 2. The mustard heights were not much affected by the presence of the intercrops. The figures give an indication of the differences in the canopy between the mustards and the pulse crops. The lentils and beans were far shorter than the mustards, but peas and fababeans had similar heights. Peas and fababeans are more competitive with the mustards for light.

The only intercrop that did not result in a higher overall yield than the mustard monocrop control was Marmot pinto bean (Table 1). All of the other intercrops resulted in higher productivity and value (Table 2). Maple peas matured earlier than the Carinata, which likely resulted in more yield reduction in the Carinata than the other intercrops.

Fababeans were very productive in the Carinata intercrop. Even though fababeans are currently a relatively low value crop, the total value of this crop was among the highest of 10 intercrop combinations. Relative maturity of the fababean and B. carinata was good.

Yellow mustard and maple peas, yellow mustard and yellow peas were also very productive intercrops in terms of value and were compatible in terms of maturity.

The intercrops with lentil were less productive than many of the other intercrops. However, the podding of the lentils was held off the ground, making them more harvestable than monocrop lentils tend to be. Intercrops may reduce risk from excess moisture, including high root and foliar disease pressure in lentil, which was a big problem in 2016 in the southwest and west central areas of Saskatchewan. Lentils also have a developing problem with weed control, and intercrops would likely lessen the impact of herbicide resistant weeds and tough perennial weeds.

Dry beans have never been a popular crop in Saskatchewan, even though they are a premium food pulse. There are many obstacles to efficient production of dry beans in this province and elsewhere. The seed is difficult to plant well with an airseeder. They are prone to high harvest losses when straight cut, but can be swathed. Seed damage in the combine usually results in high levels of cracking, since the seed is large and there is little vegetative plant material to cushion the seed. In an intercrop, the beans could either be swathed or straight cut. The brassica stalks may reduce cracking and improve combining effectiveness. Weed control is also an issue with beans, as they are not competitive. Beans are also prone to physical damage from wind and sunburn. Lodging of beans results in high white mold (sclerotinia) damage. These problems are likely to be lessened by intercropping, even though the yield of beans per acre may be relatively low.

Figure 2. Crop height of yellow mustard monocrops and intercrops.

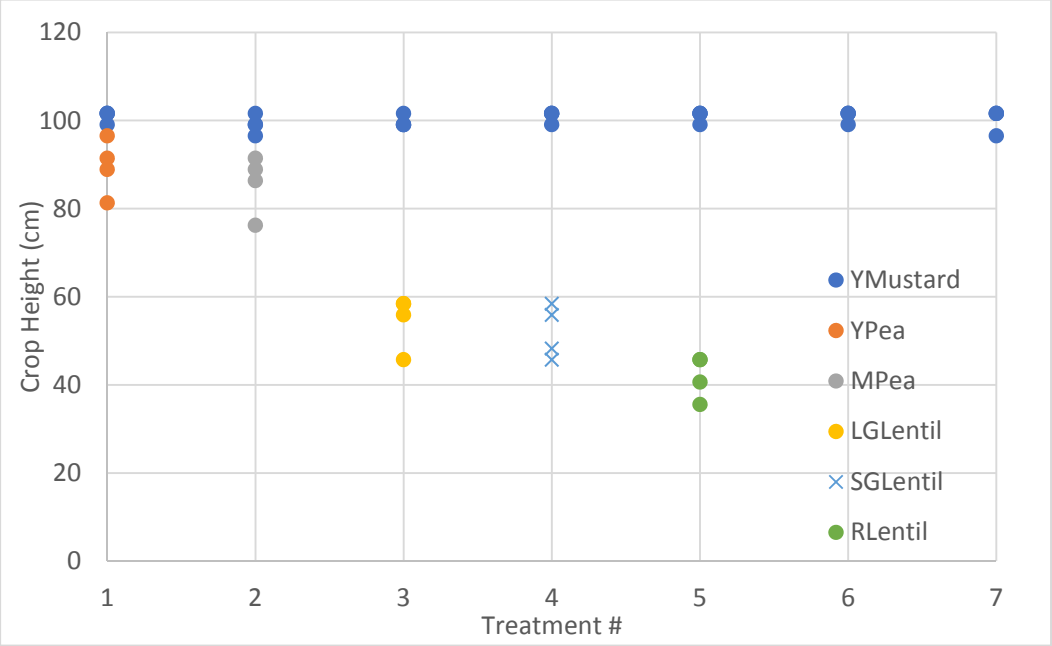


Figure 3. Crop height of Carinata monocrops and intercrops over four replicates.

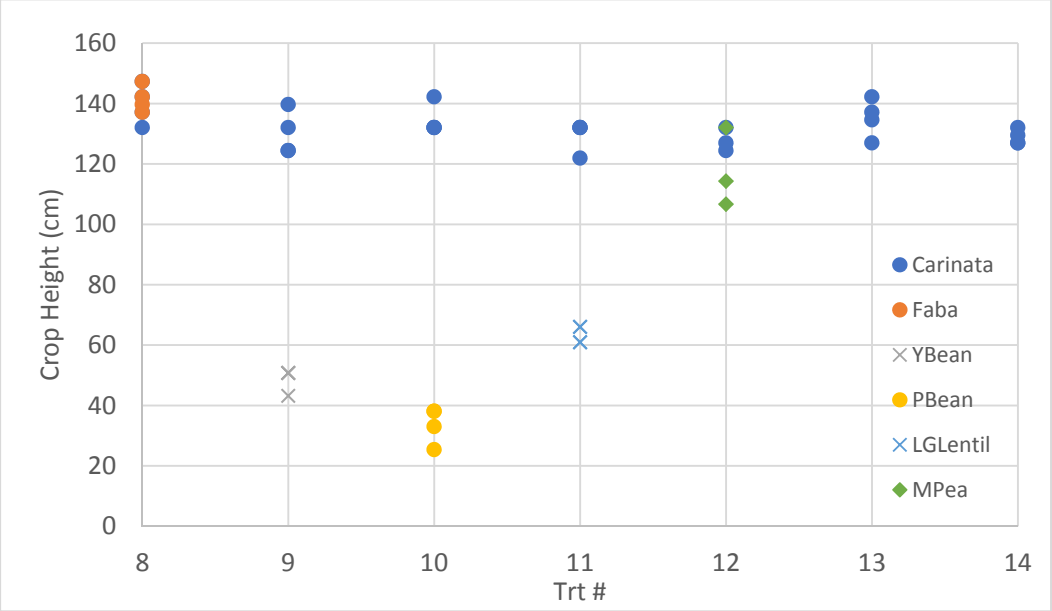


Table 1. Average Grain Yield and partial Land Equivalency Ratio of Trial 1 and Trial 2

Brassica Type	**Pulse Type**	Trt #	Total Yield lb/ac	Pulse Yield lb/ac	Mustard Yield lb/ac	Partial LER* Yield
Yellow Mustard	Yellow Peas	**1**	1862	1151	711	2.23
Yellow Mustard	Maple Peas	**2**	1840	1199	641	2.20
Yellow Mustard	Large Gr Lentil	**3**	1059	322	738	1.27
Yellow Mustard	Small Gr Lentil	**4**	1136	357	779	1.36
Yellow Mustard	Red Lentil	**5**	1093	400	693	1.31
Yellow Mustard	None	**6**	851	0	835	1
B. Carinata	SSN Fababean	**8**	4359	2862	1497	2.9
B. Carinata	Yellow Face Bean	**9**	1787	597	1190	1.19
B. Carinata	Marmot Pinto Bean	**10**	1472	231	1241	0.98
B. Carinata	Large Gr Lentil	**11**	1754	508	1247	1.17
B. Carinata	Maple Peas	**12**	2604	1611	993	1.73
B. Carinata	None	**13**	1502	0	1502	1

Table 2. Economic returns based on average yield.

Brassica Type	Pulse Type	Trt #	Pulse $/lb	Pulse $/ac	Mustard $/lb	Mustard $/ac	Total Value $/ac	Partial LER* Revenue
Yellow Mustard	Yellow Peas	1	0.14	161	0.39	277	438	1.35
Yellow Mustard	Maple Peas	2	0.17	204	0.39	250	454	1.39
Yellow Mustard	Large Gr Lentil	3	0.31	98	0.39	288	387	1.19
Yellow Mustard	Sm Gr Lentil	4	0.31	111	0.39	304	415	1.27
Yellow Mustard	Red Lentil	5	0.28	112	0.39	270	382	1.17
Yellow Mustard	None	6		0	0.39	326	326	1
B. Carinata	SSN Fababean	8	0.10	286	0.21	314	601	1.9
B. Carinata	Yellow Face Bean	9	0.3	179	0.21	250	429	1.36
B. Carinata	Pinto Bean	10	0.3	69	0.21	261	330	1.05
B. Carinata	Large Gr Lentil	11	0.31	157	0.21	262	419	1.33
B. Carinata	Maple Peas	12	0.17	274	0.21	209	482	1.53
B. Carinata	None	13		0	0.21	315	315	1

* Partial LER or Land Equivalency Ratio has been calculated using only one monocrop rather than two as Intercrop Total Yield divided by Monocrop Mustard Yield

Discussion

This set of two trials has served to show potential for a good number of intercrops with yellow mustard and B. carinata. Due to the fact that the trial was fertilized with nitrogen at 50 lb/ac, the competition from the mustard was quite high for the shorter pulse crops like lentils and beans. Peas, maple peas, and fababeans were certainly more competitive with both types of mustard. Any discussion of intercropping invariably comes around to the cost of separating the two crop. This cost is lower than most would expect. A new rotary screener can be bought for about $9000 and is often used to screen weed seeds out of crop. If a section (640 acres) is intercropped and separated for 5 years, the cost is about $3/ac, a negligible cost. There may be drying costs due to the possibility of the crops not being dry at the same time, but that is difficult to estimate. The intercrops were not sprayed with fungicide in this trial. It is still too early to be able to compare the production costs for each intercrop relative to the monocrops, so this is an area for further investigation. We don't yet know what effect the intercropping will have on disease and weed pressure. Given that the development of resistant weeds is causing problems in monocrops, investigation of intercrops may provide a partial solution to this problem. Producers who are intercropping generally do not apply fungicides, so that is a potential cost saving compared to monocrops.

Larger trials are needed to further evaluate these intercrops. Further trials need to include monocrops of each pulse crop so that a proper Land Equivalency Ratio can be calculated.

Conclusion

This trial has shown positive results in terms of both increased yields and increased revenue, which can help to justify the prioritization of these projects. Producers are already trying mustard – pulse intercrops in their fields, and they need research results to answer questions on things like seeding rates, variety selection, fertilizer rates, disease pressure, and weed competition.

Extension

This trial was visited during the SERF Field Day on July 20th. Patrick Mooleki, Blake Weiseth, and Dunling Wang from the Saskatchewan Ministry of Agriculture visited this trial on August 15 shortly before harvest. Two individual producers toured the trial in August.

Abstract

Yellow mustard (Sinapis alba) and Brassica carinata were evaluated in intercrops with several different pulse crops and as monocrops in a trial in Redvers, SK. One trial compared yellow mustard monocrop with intercrops of yellow pea, maple pea, and three types lentil. The other trial compared B. carinata monocrop with two types of dry bean, maple pea, fababean, and large green lentil. The most valuable and high yielding intercrops were B. carinata with fababean and maple pea, but all intercrops resulted in increased revenue compared with the monocrops. Intercrops with lentils were less impressive in terms of yield, but the total intercrop yield and value with lentil was higher than the monocrops. These results suggest that there are a large number of potential intercrops that should be evaluated further for productivity and agronomic benefits.