Washington Oilseeds Commission Research Report for 2020-2021

Project Title: Peaola sowing rates for intercropping of peas and spring canola.

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Year Initiated 2021 **Current Year:** 2021 **Terminating Year:** 2021

Total Project Requested $10,250

Description: The goal of this project is to understand and determine the effects of growing peas and spring canola together. Though the origin is uncertain, this mix has been termed "peaola". Recent research has shown that growing these crops together can increase the yield of one or both of them and possible reduce inputs (Singh et al., 2010; Holzapfel and Chalmers, 2018). Several methods can be used to grow these two crops together. These include but are not limited to drilling in alternate rows, two pass drilling by cross seeding, broadcast seeding followed by harrow, or mixing the seed together and drilling. Work at Indian Head Research Center in in Saskatchewan has shown that among these methods mixed planting of seed shows the most potential (Holzapfel and Chamers. 2018). These researcher had mixed planting using 2/3 the rate of each species. There is very limited information on the proper combination sowing rate for intercropping these crops. Combining individual recommended sowing rates for these crops is likely to be too high and will cause significant inter-species competition and reduced yields of both crops. This project will grow peaola mixes at ratio combinations. The outcome of this project will be recommendations for best sowing rates for companion mixed cropping of these two crops.

Justification and Background:

Companion cropping is a strategy of growing various crop species together to benefit or co-exist for various reasons, and can include intercrops, relay and cover crops. Intercropping, which includes two or more crops growing at the same time in the same space, is a strategy to increase crop synergies. Peas and canola, which have similar seeding dates and complimentary growth habits have been grown in the Canadian Prairies. Intercropping of these crops helps growers save on nitrogen fertilizer and lowered disease and insect pests. The peas hold on to the canola, improving canola seed shatter tolerance, while keeping peas off the ground, reducing disease risk and making combining easier.

Other benefits include better utilization of available inputs and resources, improved fertilizer and water use efficiency, improved soil health and reduced weed pressure. Intercropping of these

species will require flexible seeding and harvesting equipment for managing both crops and more sophisticated seed cleaning systems to separate them. However, there are also considerations that may make companion crops less suited for some operations, such as harvest and labor considerations, rotations, markets and insurance.

The most fundamental question to determine the feasibility of intercropping peas and spring canola is: What is the proper sowing rate of each species? Sowing rates that are too high will lead to inter-species competition and likely lower yields. Imbalanced sowing rates, (rates where one species is too low and one is too high) will likely lead to underutilization of resources by the low rate crop and over utilization by the high rate crop. If sowing rates are both too low, yields will probably be lowered and weed competition increased. The proper combined sowing rate should allow both crops equal access to resources (light, water, and nutrients) and allow optimum synergies for the complete system. Too high, too low or imbalanced sowing rates will lead to lower profitability than growing the crops separately.

Recent work conducted on the Canadian Prairies in Manitoba and Saskatchewan has shown economic risk is less and yields are better. Pea-canola intercrop yields averaged 20 per cent higher than mono-cropping and the magnitude of benefit tends to follow growing season rainfall amounts. The intercrop also provided some buffer against early frost. Peas being more frost tolerant that canola will continue to grow even if frost kills the canola seedlings, eliminating reseeding and still having a crop to harvest.

The goal of this project is to plant peas and spring canola in different seed ratios to determine the optimum sowing rate for intercropping.

Objectives:

1. Plant peas and spring canola in various seed combinations to determine the optimum mix of seed to optimize resources, yields and economic return.
2. Develop sowing rate recommendations for mix intercropping peas and spring canola

Methodology:

Combinations of sowing rates of intercropped peas and canola were be studied. A randomized split block (strip plot) experiment with 15 treatments and 4 replications was used. Main plot treatments were 1X canola, 1X peas, 1/3X pea, ½X pea, and 2/3X pea, where 1X canola = 14 seed/ft^2 and 1X peas = 10 seeds/ft^2. Subplot treatments for canola were 1X, 2/3X and ½X rates. Subplot treatments for peas were 1X, 2/3X and ½X. Subplot for 1/3X pea were e 1/3X, ½X, and 2/3X canola. Subplot for 1/2X pea were 1/3X, ½X, and 2/3X canola. And subplot for 2/3X pea were 1/3X, ½X, and 2/3X canola.

The experiment was sown with a 6-inch spacing, 5 foot-wide, Hege double disk plot drill with fixed-pressure press wheels. Both pea and canola seed were in every row. Sowing depth was ¾ to 1 inch deep. Sowing date was 23 March 2021. The experiment was sown at the Columbia Basin Agricultural Research Center, Pendleton, Oregon on a Walla

Walla silt loam, coarse loamy, mixed, mesic, hyperactive Typic Haploxeroll. Individual plots had a nominal dimension of 5 X 40 feet. The previous crop was winter wheat.

Fertility rates were 68-8-0-16 as a blend of 46-0-0 and 16-20-0-14. The canola cultivar was Winfield United CP930RR. The pea cultivar was Banner. It was selected on the advice of Kurt Braunwurt, Progene Seed, Othello, WA. Pure stand pea strips were harvested on 2 July 2021 with a Hege 140 plot combine with draper pick-up and auger feed into the feeder housing. Pure stand canola strips were swathed with a 5-foot wide Swift Current plot swather on 2 July 2021. Mixed stand and swathed canola plots were combined on 8 July 2021 with the Hege 140 plot combine. Harvested seed was collected in cloth bags and later cleaned with a M2B clipper cleaner to separate canola and peas. Each crop was weighed and yield determined using harvested plot area. Oil content, percent protein, test weight and percent moisture of canola will be determined on equipment at Viterra at Warden, Washington. Economic returns will be determined using individual yields and prevailing crop prices at harvest. Weeds, insects and disease were monitored and plots were photographed weekly throughout the season to show specific crop stages and species interactions.

Results:

Available water for the crop was the major issue this season. The crop year precipitation from 1 September 2020 to 31 August 2021 was 10.4 inches and the growing season precipitation from 23 March (planting) to 8 July (harvest) was 1.4 inches. For conditions as dry as this, the trial performed remarkable well. Table 1. Shows the yields, plant heights and calculated gross revenue for the 15 seed ratio combination used in this trial. Pure stands of peas and canola yield both yielded nearly the same at 1X and 2/3X rates, but yielded lower at the 1/2X rate. The highest total yield was the 1X rate of peas and the lowest was the 1/2X of canola. The lowest grossing treatment was the 1/2X rate of canola at $283.23/acre and the highest was 1/2X pea, 1/2X canola at $339.97acre. Stand in the 1/2X canola was not sufficient for good yield. Five combination treatments had gross revenue greater than the 1X pea treatment. In increasing order of gross revenue these seed combinations are 2/3X pea, 2/3X canola; 2/3X pea, ½X canola; 2/3X pea, 1/3X pea, 1/2X pea, 2/3X canola; and 1/2X pea, 1/2X canola. Prevailing prices of $22/cwt for peas and $36/cwt were used for gross revenue calculation. The gross returns of various seed combinations will depend on the comparative price of peas to canola. If peas are closer in price to canola price, then combinations with great amounts of peas will be favored. Table 2 ranks the various seed combinations based on the relative price of peas to canola. When pea prices are low compared to canola, canola is favored in the mix. When pea price is closer to canola, peas are favored. Intermediate pea price favors mixes.

Table 1. Yield, height and gross revenue of intercropped peas and canola 2020-2021, CBARC Pendleton, Oregon.

Seed ratio*		Pea yield	Canola yield	Total yield	Height		Gross** revenue
Peas	Canola				Pea	Canola	
		----------lb/acre---------			------inches------		$
0	1	0	787	787	0.0	35.5	283.23
0	2/3	0	761	761	0.0	35.8	273.87
0	1/2	0	648	648	0.0	35.3	233.19
1	0	1545	0	1545	17.0	0.0	339.97
2/3	0	1528	0	1528	18.8	0.0	336.20
1/2	0	1126	0	1126	17.0	0.0	247.68
1/3	1/3	647	540	1187	18.8	34.5	336.63
1/3	1/2	636	488	1124	18.0	32.3	315.51
1/3	2/3	544	598	1142	18.3	33.8	334.82
1/2	1/3	767	458	1225	19.5	33.3	333.68
1/2	1/2	855	463	1318	19.0	33.5	354.66
1/2	2/3	672	559	1231	17.0	33.5	348.99
2/3	1/3	945	387	1332	18.5	33.3	347.08
2/3	1/2	890	409	1299	17.3	32.8	342.81
2/3	2/3	869	420	1289	18.0	32.0	342.38

*1X rate of peas = 10 PLS/ft^2; 1X rate of canola = 14 PLS/ft^2

** Based on prevailing prices of $22/cwt for peas and $36/cwt for canola

Table 2. Gross revenue ranking of seed ratio combinations by comparitive price of peas to canola

	Pea price as percent of canola price																	
rank	20		30		40		50		60		70		80		90		100	
	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
1	0	1	0	1	1/2	2/3	1/2	2/3	1/2	1/2	1	0	1	0	1	0	1	0
2	0	2/3	1/3	2/3	1/3	2/3	1/2	1/2	1/2	2/3	2/3	0	2/3	0	2/3	0	2/3	0
3	1/3	2/3	0	2/3	1/2	1/2	1/3	2/3	2/3	1/3	1/2	1/2	1/2	1/2	2/3	1/3	2/3	1/3
4	1/2	2/3	1/2	2/3	1/3	1/3	1/3	1/3	2/3	1/2	2/3	1/3	2/3	1/3	1/2	1/2	1/2	1/2
5	1/3	1/3	1/3	1/3	0	1	2/3	1/3	2/3	2/3	2/3	1/2	2/3	1/2	2/3	1/2	2/3	1/2
6	0	1/2	1/2	1/2	2/3	2/3	2/3	2/3	1/3	1/3	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3
7	1/2	1/2	1/2	1/3	1/2	1/3	2/3	1/2	1	0	2/3	2/3	1/2	2/3	1/2	2/3	1/2	2/3
8	1/3	1/2	2/3	2/3	2/3	1/3	1/2	1/3	1/3	2/3	1/2	1/3	1/2	1/3	1/2	1/3	1/2	1/3
9	1/2	1/3	1/3	1/2	2/3	1/2	1/3	1/2	1/2	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
10	2/3	2/3	2/3	1/2	0	2/3	0	1	2/3	0	1/3	2/3	1/3	2/3	1/3	2/3	1/3	2/3
11	2/3	1/2	2/3	1/3	1/3	1/2	1	0	1/3	1/2	1/3	1/2	1/3	1/2	1/3	1/2	1/2	0
12	2/3	1/3	0	1/2	0	1/2	2/3	0	0	1	1/2	0	1/2	0	1/2	0	1/3	1/2
13	1	0	1	0	1	0	0	2/3	0	2/3	0	1	0	1	0	1	0	1
14	2/3	0	2/3	0	2/3	0	0	1/2	1/2	0	0	2/3	0	2/3	0	2/3	0	2/3
15	1/2	0	1/2	0	1/2	0	1/2	0	0	1/2	0	1/2	0	1/2	0	1/2	0	1/2

= 100% pea = 100% canola

Literature Cited

Holzapfel, C. and S. Chalmers. 2018. Intercropping peas and canola: Row/crop configurations and N fertility. Indianhead Agricultural Research Foundation. https://mbdiversificationcentres.ca/wp-content/uploads/2018/11/Intercropping-Peas-Canola.pdf

Singh, R., H. Kumar, and A. Singh. 2010. Brassica based intercropping systems. Agric. Rev. 31:253-266