

Pea-Cereal Silage

Project duration: May 2019 – August 2022

Objectives: To evaluate pea-cereal intercrop mixes for silage production

Collaborators: PCDF, Manitoba Horticulture Productivity Enhancement Centre (MHPEC)

Background

Silage plays an important part in the Manitoba livestock industry. Corn silage provides high yields, relative to barley silage (14 t/ac, over 7.5 t/ac, [2021 Silage Cost of Production](#), MARD). In the Parkland area, the yield for corn silage is variable and many producers opt to produce a cereal silage, such as barley or oat. Some producers have explored pea-cereals mixtures as a means to increase silage protein content. PCDF is eager to explore options for cereals silage production.

Results

The silage was harvested at soft-dough stage (approximately 65% moisture). The PCDF 2019-2021 wet silage yields (t/ac) are shown in Figure 1, and dry yields (lb/ac at 15% moisture) are shown in Figure 2. The MHPEC 2020-2021 silage yields (t/ac) for treatments is shown in Figure 4, and dry yields (1500-lb bales/ac, 15% moisture) are shown in Figure 5.

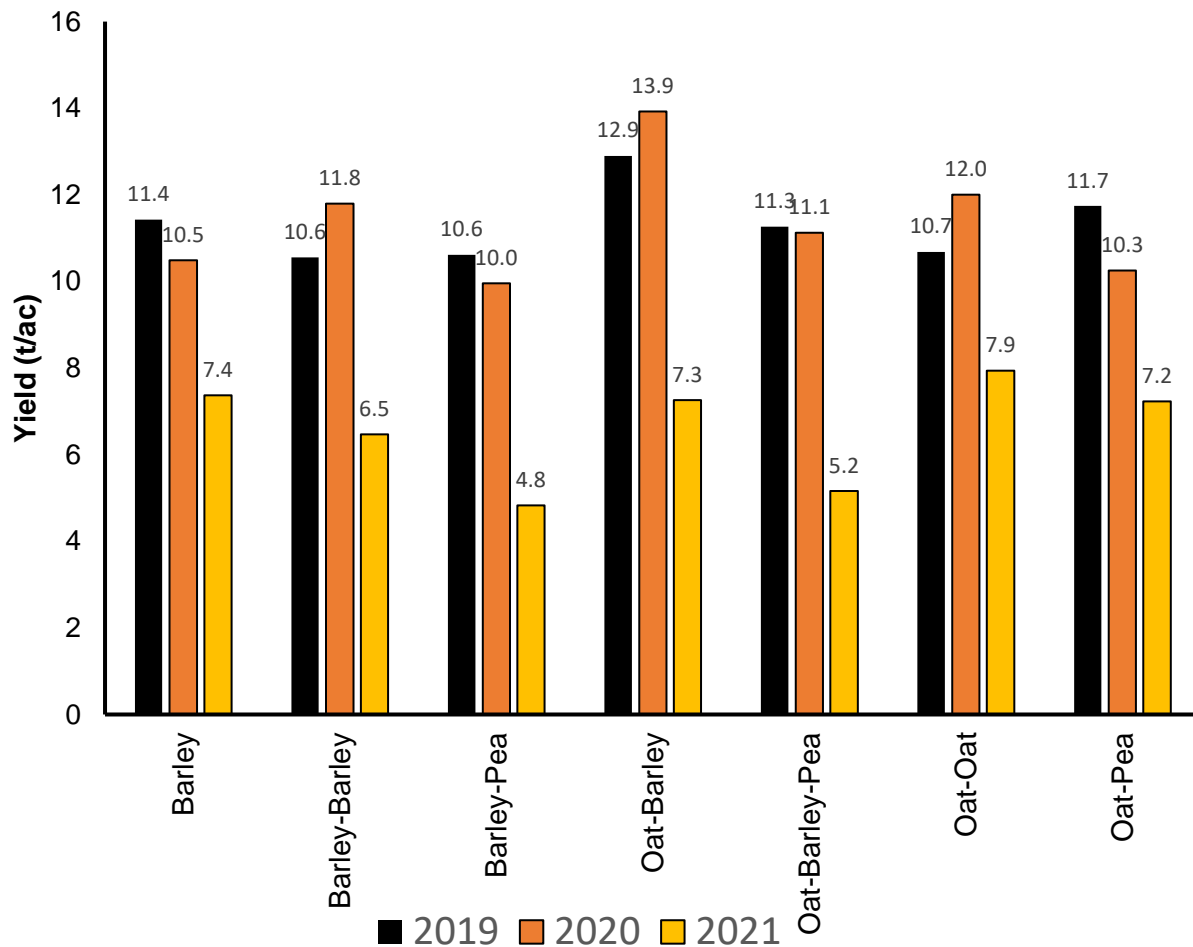


Figure 1: PCDF wet silage yield (t/ac, 65% moisture) by treatment.

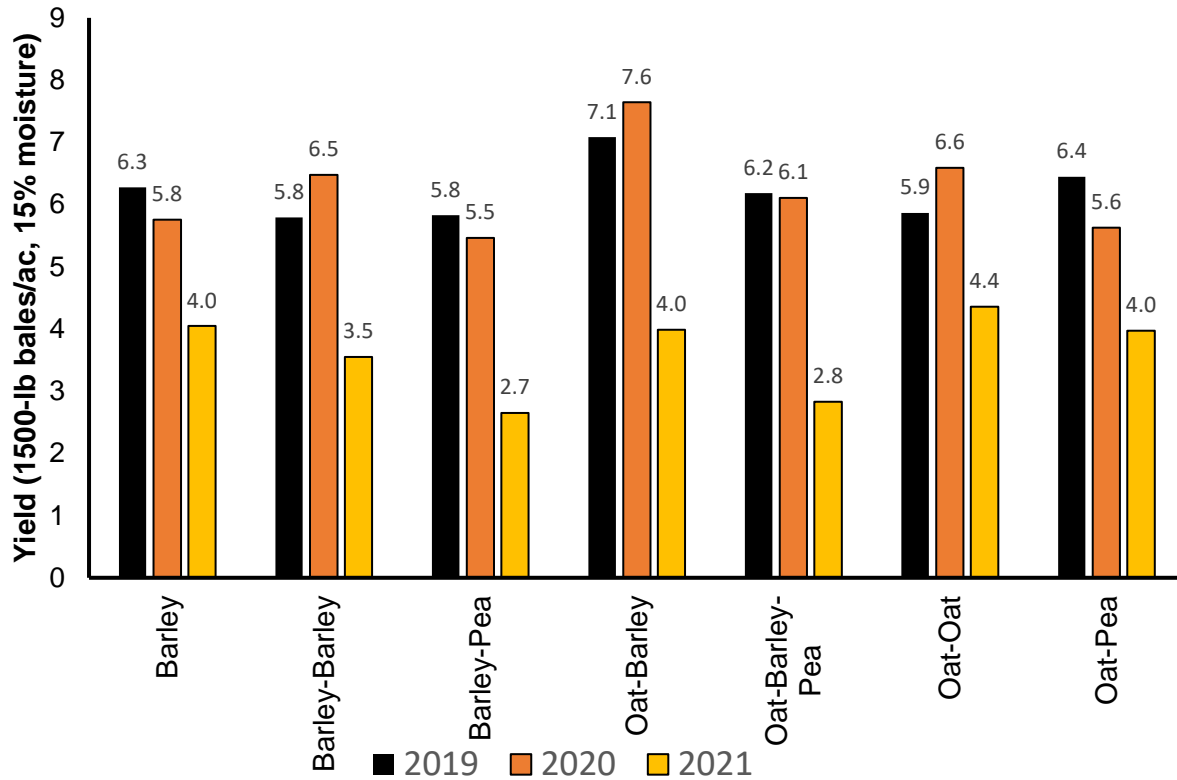


Figure 2: PCDF hay yield (1500-lb bales/ac, 15% moisture) by treatment.

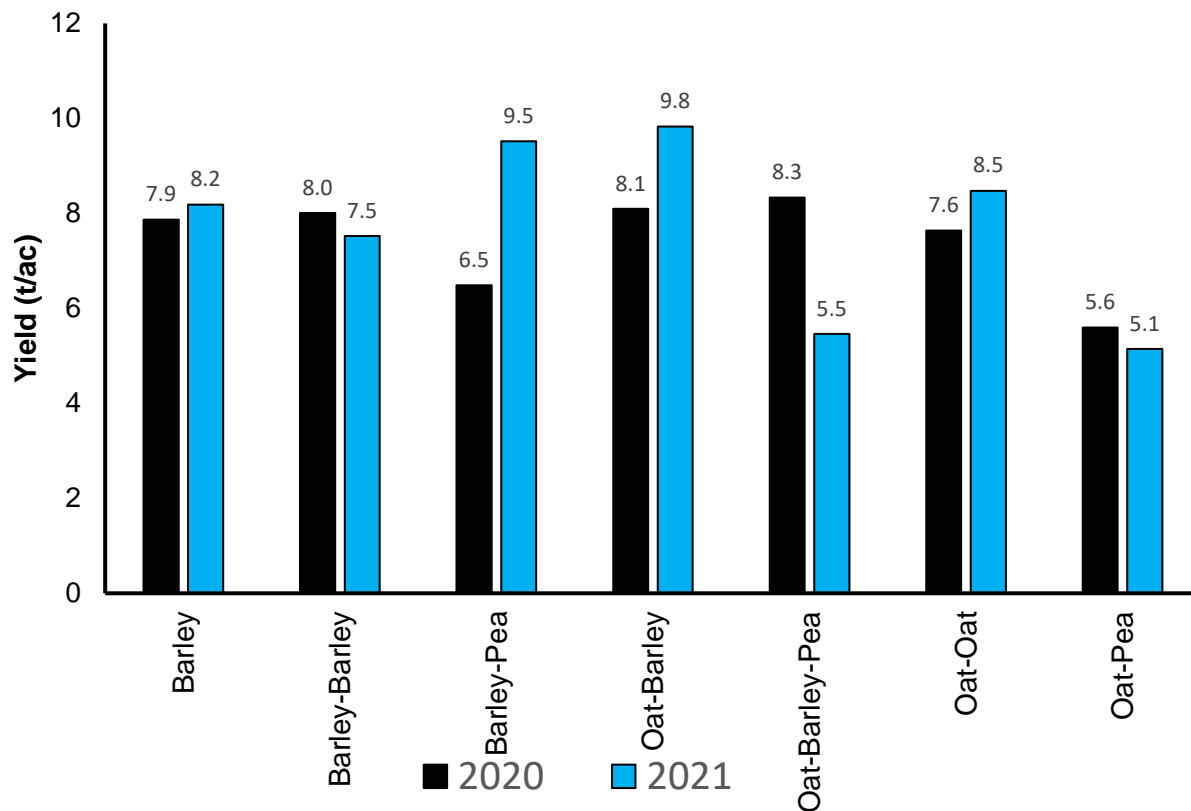


Figure 3: MHPEC wet silage yield (t/ac, 65% moisture) by treatment.

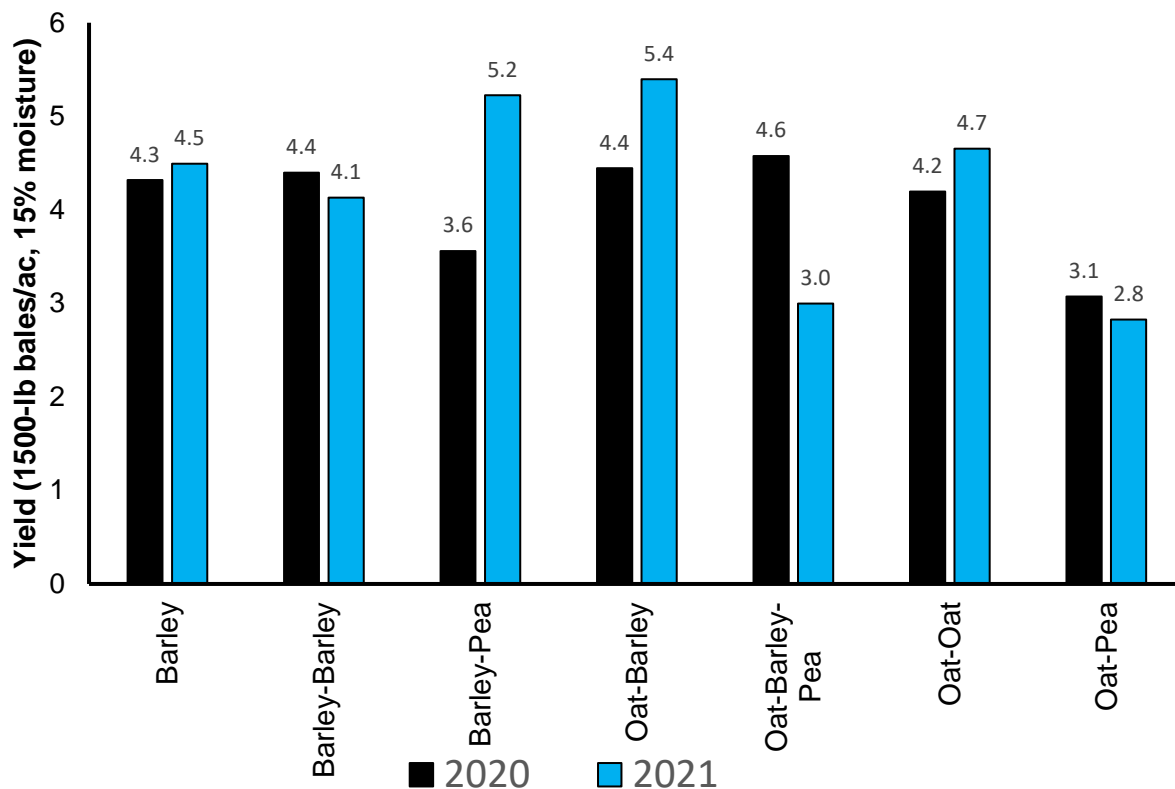


Figure 4: MHPEC hay yield (1500-lb bales/ac, 15% moisture) by treatment.

Table 1: PCDF summary of statistical information for silage yield

Entry	Silage yield (t/ac) wet yield			Statistical significance*				
	2019	2020	2021	2019	2020	2021		
Barley	11.4	10.5	7.4		A	B	A	
Barley-Barley	10.5	11.8	6.5		A		A	
Barley-Pea	10.6	10.0	4.8			B	A	
Oat-Barley	12.9	13.9	7.3				C	A
Oat-Barley-Pea	11.3	11.1	5.2		A	B	A	
Oat-Oat	10.7	12.0	7.9		A		A	
Oat-Pea	11.7	10.3	7.2		A	B	A	
LSD (0.05)		1.8	4.1					
% CV		13.8	34.1					

* Treatments not marked with the same letter are statistically different from other treatments.

Table 2: MHPEC summary of statistical information for silage yield

Entry	Silage yield (t/ac) wet yield		Statistical significance*		
	2020	2021	2020	2021	
Barley	7.9	8.2			B C
Barley-Barley	8.0	7.5			B
Barley-Pea	6.5	9.5			C
Oat-Barley	8.1	9.8		A	
Oat-Barley-Pea	8.3	5.5			B C
Oat-Oat	7.6	8.5			B
Oat-Pea	5.6	5.1			B C
LSD (0.05)		1.8			
% CV		13.8			

* Treatments not marked with the same letter are statistically different from other treatments.

The feed values and mineral content for each treatment for PCDF and MHPEC are shown in Table 3.

Table 3: PCDF and MHPEC feed values for silage by treatment compared to animal feed requirements*

Entry	% Crude Protein				% TDN			
	2019	2020	2021	Average	2019	2020	2021	Average
PCDF values								
Barley	10.2	8.2	10.7	9.7	67.6	58.9	70.3	65.6
Barley-Barley	11.0	8.2	11.0	10.1	68.6	60.5	71.2	66.8
Barley-Pea	10.6	10.9	11.4	11.0	72.9	60.7	70.0	67.9
Oat-Barley	12.1	7.1	11.2	10.1	71.3	63.2	70.1	68.2
Oat-Barley-Pea	12.2	8.8	11.7	10.9	69.0	60.4	62.9	64.1
Oat-Oat	10.8	7.8	10.9	9.8	69.8	61.5	65.8	65.7
Oat-Pea	13.4	9.1	12.8	11.8	66.0	59.3	60.0	61.8
MHPEC values								
Barley	-	10.4	10.1	10.3	-	66.7	73.3	70.0
Barley-Barley	-	10.7	10.7	10.7	-	73.1	77.5	75.3
Barley-Pea	-	12.0	12.2	12.1	-	54.9	72.7	63.8
Oat-Barley	-	9.4	11.0	10.2	-	61.1	72.1	66.6
Oat-Barley-Pea	-	12.8	11.3	12.1	-	60.3	65.6	63.0
Oat-Oat	-	9.0	10.2	9.6	-	58.2	67.5	62.9
Oat-Pea	-	12.5	13.8	13.2	-	61.1	69.9	65.5
Animal feed requirements								
Mature cows								
Mid gestation	7				50-53			
Late gestation	9				58			
Lactating	11-12				60-65			
Replacement heifers	8-10				60-65			
Breeding bulls	7-8				48-50			
Yearling bulls	7-8				55-60			

* Animal feed requirements developed by Elisabeth Nernberg (ARD).

Summary of statistical information and feed values

- At PCDF, yield for all silage mixtures fell in 2021, due to dry growing conditions (Table 4). However, yield at MHPEC did not drop substantially, or even increased, during the 2021 season.
- In 2021, the yields at PCDF did not differ significantly by treatment. At MHPEC, oat-barley silage provided significantly higher yields than other treatments.
- The trend across all years and sites is for crude protein to increase in mixtures containing pea. However, total digestible nutrients (TDN) tends to be less for these mixtures.

Table 4: Seasonal precipitation

Site	PCDF			MHPEC	
Year	2019	2020	2021	2020	2021
Precipitation*	156 (73%)	219 (100%)	160 (73%)	224 (102%)	148 (68%)

* mm (% normal), May 1 – August 15

Observations

The silage was prepared with a plant shredder. The oat-barley treatment appears to be a promising option, both for higher yields relative to other treatments (Tables 1 and 2) and high TDN values (Table 3). Oat-barley silage allows for good weed control, but there are no herbicides registered for barley-oat-pea silage intercrops. Good weed control prior to seeding is crucial. The trial was hand-weeded.

Materials and methods

The experimental is a random complete block design with seven entries and three reps. Seed costs for both PCDF and MHPEC are provided in Table 4. Agronomic data is summarized in Tables 5 and 6. Barley-barley and oat-oat treatments combine a forage- and grain-type variety to maximize biomass and energy production.

Table 4: Treatments, seeding rates and seeding costs

Treatments	Percent of Monocrop Seeding Rate	Seeding Rate (lb/ac)	Cost per acre
Barley (Maverick)	100	90	\$14.91
Barley-barley (Maverick-Austenson)	75-75	68-68	\$22.53
Barley-pea (Maverick-Lacombe)	25-100	22-150	\$34.89
Oats-oats (Haymaker-Summit)	75-75	68-68	\$28.40
Oats-barley (Haymaker-Maverick)	75-75	22-150	\$26.16
Oat-pea (Haymaker-Lacombe)	25-100	22-150	\$36.07
Oats-barley-pea (Haymaker-Maverick-Lacombe)	12.5-12.5-100	11-11-150	\$35.48

Table 5: Agronomic data

	PCDF			MHPEC	
	2019	2020	2021	2020	2021
Seeding date	May 16	May 25	May 20	May 25	May 24
Harvest date	Aug 9	Aug 12	Aug 11	Aug 19	Aug 16
Previous crop	Barley Silage	Barley silage	Oat silage	Soybean	Canola
Soil type	Erickson Loam Clay			Clay Loam	
Seedbed prep	Heavy harrow	Heavy harrow	Vertical tillage	No-till	No-till

Table 6: Fertility information

	PCDF		MHPEC	
	Available	Added	Available	Added
N				
2019	156 lb/ac	-		
2020	79 lb/ac	47 lb/ac	19 lb/ac	124 lb/ac
2021	151 lb/ac	10 lb/ac	24 lb/ac	113 lb.ac
P				
2019	9 ppm	20 lb/ac		
2020	22 ppm	10 lb/ac	14 ppm	11 lb/ac
2021	47 ppm	15 lb/ac	11 ppm	16 lb/ac
K				
2019	170	none		
2020	257 ppm	none	-	-
2021	143 ppm	none	-	-