2022 Montana Cool-Season Spring Pulse Variety Evaluation Annual Report

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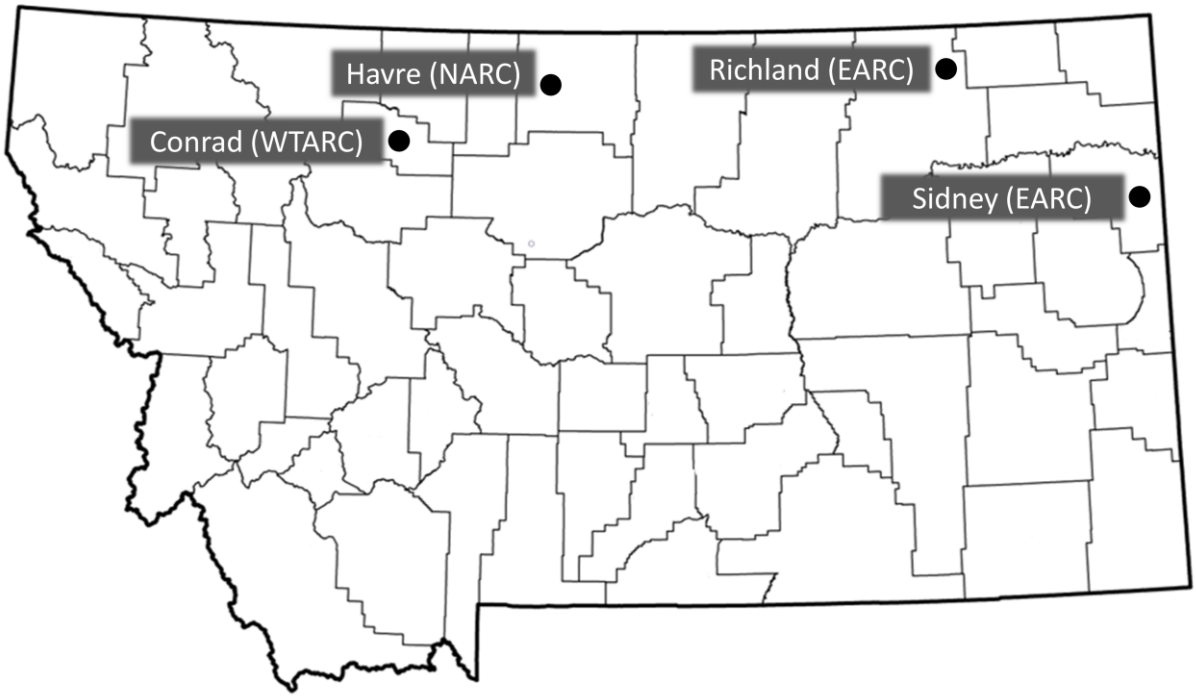

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ACKNOWLEDGEMENT

The Montana State University Eastern Agricultural Station in Sidney, MT coordinates an annual variety evaluation for cool season spring pulse crops (dry pea, lentil and chickpea) at multiple locations across the state of Montana. In 2022, funding for this project was obtained from the Montana Agricultural Experiment Station, the USA Dry Pea and Lentil Council, and testing fees from private entities submitting varieties and experimental lines for evaluation. The results provided in this report reflect the efforts of a large team of individuals from the Montana State University Agricultural Experiment Stations, Montana State University Extension, industrial partners from the seed industry and cooperating producers. The following list provides contact information for many of the individuals involved in the 2022 variety evaluation.

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PROJECT DESCRIPTION AND OBJECTIVE

Project Description

Cool season spring pulse crop (dry pea, lentil and chickpea) acreage in Montana has increased more than 10 fold in the past two decades. For more than a decade the Montana State University Agricultural Experiment Stations have conducted annual pulse crop variety evaluations across the state of Montana in an effort to improve yield and quality of these crops. The Montana State University Eastern Agricultural Research Center (EARC) in Sidney, MT is currently coordinating these efforts. In 2022, trials were conducted at three MSU Agricultural Research Centers and a cooperating producer's field south of Richland, Montana in the northeast corner of the state. The results reported herein are intended to aid producers, seed suppliers, breeders and the research community in variety development, selection and deployment. The report is available both in print and electronic formats and can be found at:
(http://agresearch.montana.edu/earc/annualreports.html).

Objective

The objective of this project is to evaluate yield and seed quality parameters for dry pea, lentil and chickpea cultivars and lines selected by stakeholder input across a broad range of Montana environments targeting the major pulse growing regions of the state.

METHODS

Procedures and Experimental Design

Seven dry pea, ten lentil and thirteen chickpea entries were selected by the EARC to trial at all locations. In addition, seed companies and pulse breeders with an interest in Montana pulse production were invited to submit cultivars or expermential lines for evaluation in 2022. Locations available for evaluation were indicated in the invitation letter and the selection of locations for each entry to be evaluated was determined by the submitting party. All three crops were planted at three dryland locations (Conrad, Havre, and Richland) and one irrigated location (Sidney). The trials at Conrad were lost to poor stand establishment and weed infestation.

Seeds for all entries were tested for germintation and treated with Obvius Fungicide (BASF Corporation, Research Triangle Park, NC) and Cruiser 5FS Insecticide (Syngenta Crop Protection, Inc., Greensboro, NC). Seeds were packaged on a per plot basis to obtain live seed rates of 8, 12 and 4 live seeds per ft^2 for pea, lentil and chickpea, respectively. Seeds were sent to the cooperating research centers with an appropriate commercial rhizobial inoculant to be applied at planting. Research plots were planted in a randomized complete block design with four replicates per entry. Plot size varied amongst locations and was dictated by the equipment available at each location. Management practices vary by location but are consistent with typical practices for that region. In season measurements and harvest data were collected by each cooperating center and sent to the EARC for analysis. Grain yield data was adjusted to 13% moisture content to facilitate comparison across locations. Dry pea protein concentrations were determined for all pea samples by near-infrared spectroscopy **(**NIR) at the EARC in Sidney. Analysis of variance was performed in R (version 4.2.1) and Fisher's LSD was performed from the agricolae package (version 1.3-5) for mean comparison whenever the F-test was significant at $P<0.05$.

List of collaborators and locations

The type of crop (pea, lentil and chickpea) and number of entries for each of these crops evaluated at the different locations varied from location to location depending on the interest of seed suppliers and availability of resources at the respective location. The list of locations, collaborators and the type of crops evaluated at each location is shown in Table 1.

Table 1. Collaborators, locations and crops evaluated in 2022.

Location	Collaborator	Irrigation	Crops evaluated at location			Observations
			Pea	Lentil	Chickpea	
Conrad	WTARC	No	X	X	X	Trials lost to poor stand establishment
Havre	NARC	No	X	X	X	
Richland	EARC	No	X	X	X	Wildlife damage to chickpeas
Sidney (Irrigated)	EARC	Yes	X	X	X	Wildlife damage to peas

†EARC = Eastern Agricultural Research Center, NARC = Northern Agricultural Research Center, WTARC = Western Triangle Agricultural Research Center, 'X' indicates the collaborator participated for the specific crop variety evaluation in 2022.

Precipitation and Cultural Practices

Precipitation, site information and agronomic management practices for the respective locations are summarized in Tables 2 and 3.

Table 2. Site characteristics for each trial location

	Conrad (WTARC)	Havre (NARC)	Richland	Sidney (EARC)
Soil Type	Scobey-Kevin Clay Loam	Joplin loam	Farnuf Loam	Savage Silty Clay Loam
Elevation (ft)	3700	2698	2950	2200
Seasonal Precipitation (April - August) (in)	5.6	6.1	8.4*	12.0
Average Precipitation (April - August) (in)	8.0	8.0	8.5*	9.6
Irrigation (in)				2.3

* Data from Opheim, MT weather station US00246238 approximately 12 miles from trial location

Table 3. Major agronomic management practices for each location in 2022

Location	Tillage	Seeding Date	Harvest Date	Previous Crop	Fertilizer	Pesticide Applications
Pea Trials						
Havre	No-Till	4/21	7/27	Spring Barley	None	Prowl H2O at 24 oz/a and RT3 at 28 oz/a - both preplant
Richland	No-Till	4/28	8/4	Durum	None	
Sidney	Conventional	5/5	8/3	Sugar beet	None	PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence
Lentil Trials						
Havre	No-Till	4/21	8/9	Spring Barley	None	Prowl H2O at 24 oz/a and RT3 at 28 oz/a - both preplant
Richland	No-Till	4/29	8/11	Durum	None	
Sidney	Conventional	5/5	8/23	Sugar beet	None	PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence
Chickpea Trials						
Havre	No-Till	4/22	8/22	Spring Barley	None	Prowl H2O at 24 oz/a and RT3 at 28 oz/a - both preplant
Richland	No-Till	4/29	8/22	Durum	None	
Sidney	Conventional	5/6	9/6	Sugar beet	None	PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence, Miravis Top at 13.7 oz/a (two applications) and Miravis Top at 14 oz/a (two applications)

List of Varieties

Table 4 includes the list of varieties and experimental lines evaluated in 2022. Additional information for these entries can be obtained by contacting the respective seed suppliers listed in the acknowledgements section. Entries listed in this table include varieties requested by seed suppliers, varieties selected as check varieties by the Montana Agricultural Experiment Station and experimental lines from the Montana State University, North Dakota State University and USDA-ARS pulse crop breeding programs.

Table 4. Dry pea, lentil and chickpea entries included in 2022 variety evaluation trials.

Crop	Entry	Seed color/size	Maturity
Dry Pea	AAC Asher	Yellow	Early/Medium
	AAC Carver	Yellow	Early
	AAC Chrome	Yellow	Medium
	AAC Julius	Yellow	
	AAC Profit	Yellow	Medium/Late
	Aragorn	Green	Medium
	Banner	Green	
	CDC Spectrum	Yellow	Medium
	CP5222Y	Yellow	
	CP5244Y	Yellow	
	DL Apollo	Yellow	Medium
	DS-Admiral	Yellow	Medium
	Fairway	Green	
	Ginny 2	Green	
	Goldenwood	Yellow	
	Hampton	Green	Medium
	Korando	Yellow	Early
	LG Stunner	Yellow	Medium
	MS GrowPro	Yellow	
	MS-20G1	Green	
	MS-20GP5	Green	
	MS-20Y1	Yellow	
	MS-20Y3	Yellow	
	MS-20YP4	Yellow	
	MS-22YP6	Yellow	

Table 4. Continued

Crop	Entry	Seed color/size	Maturity
Dry Pea	ND Dawn	Yellow	Early
	NDP150231Y	Yellow	
	NDP150412G	Green	
	Orchestra	Yellow	
	Pizzazz	Yellow	
	Pro 141-6258	Green	
	Pro 143-6220	Yellow	
	Pro 143-6230	Yellow	
	Pro 171-7665	Green	
	Pro 173-7406	Yellow	
	PS0877MT457	Green	
	PS0877MT632	Yellow	
	PS17100008	Yellow	
	PS17100022	Yellow	
	Salamanca	Yellow	Early
	SG-L-8318z	Yellow	
	Shamrock	Green	Early
Crop	**Entry**	**Seed color/size**	**Maturity**
Lentil	Avondale	Medium Green	Medium
	CDC Greenstar	Large Green	
	CDC Impala CL	Small Red	Early
	CDC Impress CL	Medium Green	
	CDC Imvincible CL	Small Green	
	CDC Kermit	Small Green	
	CDC Maxim CL	Small Red	
	CDC Richlea	Medium Green	Medium
	CDC Viceroy	Small Green	Early/Medium
	LC14600088R	Medium Green	
	NDL090204R	Medium Green	
	NDL120599R	Medium Green	
	Sage	Small Green	

Table 4. Continued

Crop	Entry	Type	Maturity
Chickpea	2510-2	Desi	
	Anna	Desi	
	CDC Consul	Desi	
	CDC Cory	Desi	
	CDC Frontier	Kabuli	Late
	CDC Leader	Kabuli	Medium
	CDC Orion	Kabuli	Late
	CDC Palmer	Kabuli	Medium/Late
	Kasin	Kabuli	
	Myles	Desi	
	Nash	Kabuli	
	ND Crown	Kabuli	
	NDC160236	Kabuli	
	New Hope	Kabuli	
	Royal	Kabuli	
	Sawyer	Kabuli	
	Sierra	Kabuli	

RESULTS

Dry Pea Variety Evaluation in 2022

Forty two dry pea varieties and experimental lines (30 yellow and 12 green) were evaluated in 2022 at three locations. Two yellow pea and two green pea cultivars were selected as check varieties and tested at all locations. Six experimental lines originate from university and government breeding programs. The remaining entries are cultivars and breeding lines from private entities and were tested at locations requested by the seed supplier. Results are presented in two groups based on cotyledon color (yellow and green).

Results of the 2022 dry pea variety evaluations are presented in Tables 5-8 for yellow peas and Tables 9-12 for green peas. Reported data include yield, protein, thousand kernel weight, test weight, plant height at harvest and days to flowering. Three year yield averages for 2020 through 2022 are presented for entries with three years of data. Two year protein averages are presented for 2021 and 2022 for the Richland and Sidney locations as these data were collected on a single instrument employing the same protein prediction model.

Yields in 2022 improved at all locations relative to 2021. Spring soil moisture was poor and early season precipitation short at the Havre and Richland locations. However, better midseason rainfall brought April-to-August precipitation numbers closer to normal resulting in near average yields at these locations. A severe July windstorm at the Richland location produced moderate lodging across the entire trial. Some harvest lost was incurred for those entries that experienced the most lodging. Entries with excellent standability were largely unaffected. The Sidney location received abundant moisture during the planting season resulting in above normal precipitation for the growing season and reduced irrigation requirements. Pea yields for several entries at Sidney were adversely affected by lodging leading to yield losses from pigeon feeding. However, excellent yields were observed for several yellow pea cultivars.

Seed protein levels averaged across all locations were 25.9% for yellow peas and 26.2% for green peas. The range of observed protein values was 21.9% to 28.9% for yellow peas and 23.1% to 28.5% for green peas. Average protein values for 2022 were similar to 2021 at the individual locations. All seed protein data for 2022 is presented on a dry matter basis and was obtained from a single instrument allowing direct comparisons across locations.

Table 5. Yellow Dry Pea Grain Yield (lb/a) with three year averages in parentheses

Yellow Pea Variety/Line	Havre Yield 2022	Havre Yield (3 yr avg)	Richland Yield 2022	Richland Yield (3 yr avg)	Sidney Yield 2022	Sidney Yield (3 yr avg)
AAC Asher	1749		2647	(3002)		
AAC Carver	2297	(2408)	2729	(3067)	5285	
AAC Chrome	2246	(2383)	2790	(3173)		
AAC Julius	2233		2795			
AAC Profit	1825	(2118)	2797		4846	
CDC Spectrum	2179	(2341)	2571	(2907)		
CP5222Y	2452		2836			
CP5244Y	2205		2667			
DL Apollo	1795	(2111)	2493	(2848)		
DS-Admiral	1779	(2250)	2451	(2846)	3874	(3624)
Goldenwood	2116	(2213)	2507	(2692)		
Korando	1990	(2226)	2612	(2746)		
LG Stunner	2102		2514			
MS GrowPro	2123		2429			
MS-20Y1	2070		2672			
MS-20Y3	1992		2648			
MS-20YP4	1484		2420			
MS-22YP6	2310		2623			
ND Dawn	2342	(2403)	2738	(2879)	4170	(3805)
NDP150231Y	1666		2196			
Orchestra	1802		2520	(2880)	4530	
Pizzazz	2297	(2437)	2809	(2946)		
Pro 143-6220	1915	(2184)	2262	(2364)		
Pro 143-6230	2046	(2247)	2381	(2541)		
Pro 173-7406	2140		2646			
PS0877MT632	2111	(2278)	2284	(2510)	1572	(2728)
PS17100008	2126		2736			
PS17100022	2111		2569			
Salamanca	2208	(2395)	2738	(2737)		
SG-L-8318z	2086		2355			
Mean	**2060**		**2581**		**4046**	
P-value	**<0.0001**		**0.0192**		**<0.0001**	
LSD	**171**		**369**		**970**	
CV(%)	**5.9**		**10.2**		**16.1**	

Table 6. Yellow Dry Pea Protein (% Dry Matter Basis) with two year averages in parentheses

Yellow Pea	Havre Protein	Richland Protein		Sidney Protein	
Variety/Line	2022	2022	(2 yr avg)	2022	(2 yr avg)
AAC Asher	24.4	24.1	(24.2)		
AAC Carver	23.6	23.4	(23.5)	21.9	
AAC Chrome	25.0	24.8	(24.5)		
AAC Julius	26.7	26.3	(25.7)		
AAC Profit	26.8	26.1	(25.7)	24.7	
CDC Spectrum	27.2	25.7	(25.5)		
CP5222Y	25.1	25.5			
CP5244Y	26.2	26.1			
DL Apollo	27.8	26.5	(26.9)		
DS-Admiral	26.2	24.4	(24.0)	23.1	(23.7)
Goldenwood	28.6	25.9	(26.9)		
Korando	27.0	24.6	(25.7)		
LG Stunner	28.0	26.2	(26.3)		
MS GrowPro	27.9	26.7	(27.1)		
MS-20Y1	26.9	26.4			
MS-20Y3	27.7	26.6			
MS-20YP4	28.9	26.3	(25.7)		
MS-22YP6	26.6	26.3			
ND Dawn	25.0	23.9	(24.0)	23.0	(23.5)
NDP150231Y	27.7	27.3			
Orchestra	28.3	27.4	(28.0)	27.8	
Pizzazz	25.3	25.4	(25.6)		
Pro 143-6220	27.0	26.6	(25.7)		
Pro 143-6230	27.1	26.3	(25.7)		
Pro 173-7406	25.4	24.3			
PS0877MT632	26.9	27.6	(26.8)	25.6	(25.7)
PS17100008	25.1	25.1	(26.1)		
PS17100022	25.5	26.2	(26.1)		
Salamanca	25.0	25.6	(25.5)		
SG-L-8318z	24.2	24.7			
Mean	**26.4**	**25.7**		**24.4**	
P-value	**<0.0001**	**<0.0001**		**<0.0001**	
LSD	**1.0**	**1.0**		**0.5**	
CV(%)	**2.8**	**2.8**		**1.4**	

Table 7. Yellow Dry Pea Thousand Kernel Weight (g) & Test Weight (lb/bu)

	Thousand Kernel Weight (g)			Test Weight (lb/bu)		
Yellow Pea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
AAC Asher	260	220		61.4	64.2	
AAC Carver	243	200	225	61.2	63.8	64.3
AAC Chrome	239	197		61.1	62.6	
AAC Julius	211	173		61.1	63.9	
AAC Profit	250	195	225	60.5	63.4	64.1
CDC Spectrum	232	207		60.5	63.7	
CP5222Y	264	229		61.2	63.9	
CP5244Y	237	193		61.2	64.2	
DL Apollo	229	195		60.8	64.6	
DS-Admiral	246	206	228	60.5	63.1	64.6
Goldenwood	164	170		60.6	64.9	
Korando	279	234		60.5	64.3	
LG Stunner	219	188		60.8	63.9	
MS GrowPro	269	257		60.4	63.1	
MS-20Y1	251	212		60.4	62.9	
MS-20Y3	266	223		60.3	62.9	
MS-20YP4	233	200		61.1	64.3	
MS-22YP6	220	176		61.9	63.5	
ND Dawn	242	208	223	60.1	63.6	64.1
NDP150231Y	197	177		60.7	64.3	
Orchestra	265	231	282	61.2	63.1	65.1
Pizzazz	298	235		61.3	64.2	
Pro 143-6220	235	193		60.2	63.0	
Pro 143-6230	227	187		60.5	63.2	
Pro 173-7406	246	202		60.5	63.4	
PS0877MT632	224	181	215	61.1	63.3	63.6
PS17100008	258	232		61.3	64.0	
PS17100022	254	228		61.8	64.3	
Salamanca	265	227		60.7	62.9	
SG-L-8318z	224	201		60.9	64.2	
Mean	**242**	**206**	**233**	**60.9**	**63.7**	**64.3**
P-value	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**0.006**
LSD	**12.2**	**8.6**	**5.7**	**0.7**	**0.6**	**0.7**
CV(%)	**3.6**	**3.0**	**1.7**	**0.8**	**0.6**	**0.7**

Table 8. Yellow Dry Pea Plant Height (cm) & Days to Flowering

	Plant Height (cm)			Days to Flowering		
Yellow Pea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
AAC Asher	40	56		62		
AAC Carver	56	60	70	61		54
AAC Chrome	46	55		62		
AAC Julius	53	59		63		
AAC Profit	54	65	74	63		57
CDC Spectrum	50	59		63		
CP5222Y	51	57		57		
CP5244Y	55	61		56		
DL Apollo	54	58		61		
DS-Admiral	51	64	64	61		54
Goldenwood	34	55		68		
Korando	47	62		54		
LG Stunner	52	65		60		
MS GrowPro	55	62		63		
MS-20Y1	52	61		61		
MS-20Y3	53	64		62		
MS-20YP4	50	66		66		
MS-22YP6	48	61		62		
ND Dawn	51	57	64	61		54
NDP150231Y	46	63		64		
Orchestra	47	61	69	61		53
Pizzazz	50	53		56		
Pro 143-6220	44	61		62		
Pro 143-6230	50	56		62		
Pro 173-7406	50	57		60		
PS0877MT632	40	56	66	58		51
PS17100008	44	52		60		
PS17100022	56	63		62		
Salamanca	59	62		61		
SG-L-8318z	58	66		65		
Mean	**50**	**60**	**68**	**61**		**54**
P-value	**<0.0001**	**0.0029**	**0.1247**	**<0.0001**		**<0.0001**
LSD	**5.4**	**7.3**	**NS**	**0.8**		**1.2**
CV(%)	**7.7**	**8.7**	**8.2**	**0.9**		**1.5**

Table 9. Green Dry Pea Grain Yield (lb/a) with three year averages in parentheses

Green Pea	Havre Yield		Richland Yield		Sidney Yield	
Variety/Line	2022	(3 yr avg)	2022	(3 yr avg)	2022	(3 yr avg)
Aragorn	2191	(2208)	2538	(2568)	3352	(3173)
Banner	2204					
Fairway	2184	(2344)				
Ginny 2	2192	(2296)	2556	(2499)		
Hampton	1947	(2142)	2666	(2882)	1816	(2994)
MS-20G1	1542		2242			
MS-20GP5	1831		2626			
NDP150412G	2085		2637			
Pro 141-6258	2148	(2354)				
Pro 171-7665	2230	(2417)				
PS0877MT457	1896	(2080)	2480	(2553)	3093	(3131)
Shamrock	1765	(2165)				
Mean	**2018**		**2535**		**2754**	
P-value	**<0.0001**		**0.0685**		**0.3246**	
LSD	**158**		**NS**		**NS**	
CV(%)	**5.5**		**7.4**		**52.8**	

Table 10. Green Dry Pea Protein (% Dry Matter Basis) with two year averages in parentheses

Green Pea	Havre Protein		Richland Protein		Sidney Protein	
Variety/Line	2022		2022	(2 yr avg)	2022	(2 yr avg)
Aragorn	25.1		25.4	(25.2)	24.2	(24.7)
Banner	23.1					
Fairway	26.9					
Ginny 2	25.5		25.2	(24.8)		
Hampton	27.4		27.3	(27.2)	27.2	(26.8)
MS-20G1	27.6		25.7			
MS-20GP5	27.0		26.5	(25.7)		
NDP150412G	28.5		27.1			
Pro 141-6258	24.6					
Pro 171-7665	24.0					
PS0877MT457	27.3		27.5	(27.6)	27.2	(27.2)
Shamrock	26.6					
Mean	**26.1**		**26.4**		**26.1**	
P-value	**<0.0001**		**0.0011**		**<0.0001**	
LSD	**0.8**		**1.2**		**0.6**	
CV(%)	**2.1**		**3.1**		**1.5**	

Table 11. Green Dry Pea Thousand Kernel Weight (g) & Test Weight (lb/bu)

	Thousand Kernel Weight (g)			Test Weight (lb/bu)		
Green Pea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
Aragorn	218	185	198	59.9	63.6	63.2
Banner	210			61.1		
Fairway	191			60.0		
Ginny 2	233	195		60.8	63.0	
Hampton	225	197	221	61.0	62.9	63.2
MS-20G1	233	214		61.0	64.2	
MS-20GP5	235	209		60.0	62.9	
NDP150412G	203	167		61.9	65.2	
Pro 141-6258	226			61.3		
Pro 171-7665	235			60.9		
PS0877MT457	241	203	227	59.9	62.8	63.4
Shamrock	239			61.7		
Mean	**224**	**196**	**215**	**60.8**	**63.5**	**63.2**
P-value	**<0.0001**	**<0.0001**	**0.0002**	**<0.0001**	**<0.0001**	**0.5962**
LSD	**6.6**	**7.9**	**9.7**	**0.7**	**0.5**	**NS**
CV(%)	**2.1**	**2.8**	**2.8**	**0.8**	**0.5**	**0.7**

Table 12. Green Dry Pea Plant Height (cm) & Days to Flowering

	Plant Height (cm)			Days to Flowering		
Green Pea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
Aragorn	47	57	58	54		51
Banner	43			55		
Fairway	46			62		
Ginny 2	46	57		58		
Hampton	43	58	54	61		57
MS-20G1	50	64		67		
MS-20GP5	50	63		64		
NDP150412G	45	61		62		
Pro 141-6258	39			57		
Pro 171-7665	48			56		
PS0877MT457	49	54	64	54		51
Shamrock	53			62		
Mean	**47**	**59**	**59**	**59**		**53**
P-value	**0.0006**	**0.0944**	**0.1844**	**<0.0001**		
LSD	**5.3**	**NS**	**NS**	**1.0**		
CV(%)	**8.0**	**8.3**	**11.1**	**1.2**		

Lentil Variety Evaluation in 2022

The 2022 lentil variety evaluation included thirteen lentil entries (two small red lentils and eleven green lentils with small, medium and large green entries represented) evaluated at three locations. Results of the 2022 lentil variety evaluations are presented in Tables 13-15. Reported data include yield, thousand kernel weight, test weight, plant height at harvest and days to flowering. Three year averages for 2020 through 2022 are presented for entries with three years of data. Grasshopper damage negatively impacted yields in Havre and Richland. In Sidney, wet conditions prior to and following planting resulted erratic plant emergence due to soil crusting. Efforts were made to break the crust prior to emergence with moderate but inconsistent success. Thus, yields in Sidney were adversely affected for all entries and those entries less able to cope with the crusts were more affected.

Table 13. Lentil Grain Yield (lb/a) with three year averages in parentheses

Lentil	Havre Yield		Richland Yield		Sidney Yield	
Variety/Line	2022	(3 yr avg)	2022	(3 yr avg)	2022	(3 yr avg)
Avondale	1470	(1651)	1638	(1862)	2037	(2549)
CDC Greenstar	1152		1261		2203	
CDC Impala CL	1239	(1292)	1505	(1679)	2135	(2474)
CDC Impress CL	1205	(1334)	1771	(1608)	2050	(2477)
CDC Imvincible CL	1359		1543		2376	
CDC Kermit	1382		1815		2361	
CDC Maxim CL	1227		1667		2046	
CDC Richlea	1294	(1619)	1683	(1786)	2167	(2584)
CDC Viceroy	1388	(1453)	1526	(1625)	2412	(2659)
LC14600088R	1306		1998		2308	
NDL090204R	1118		1616		2662	
NDL120599R	1173		1733		1687	
Sage	1383	(1416)	2076	(1893)	1543	(2485)
Mean	**1283**		**1679**		**2150**	
P-value	**<0.0001**		**0.0086**		**0.0004**	
LSD	**112**		**355**		**431**	
CV(%)	**6.1**		**12.6**		**14.0**	

Table 14. Lentil Thousand Kernel Weight (g) & Test Weight (lb/bu)

	Thousand Kernel Weight (g)			Test Weight (lb/bu)		
Lentil Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
Avondale	55	50	54	62.1	62.8	62.5
CDC Greenstar	73	76	76	60.2	60.6	59.8
CDC Impala CL	31	34	35	65.8	65.6	65.4
CDC Impress CL	56	53	59	62.7	63.0	62.1
CDC Imvincible CL	34	35	38	64.3	64.6	64.7
CDC Kermit	31	35	37	64.5	65.4	65.1
CDC Maxim CL	44	39	43	64.1	64.4	63.5
CDC Richlea	55	54	56	61.8	62.1	61.4
CDC Viceroy	35	37	39	64.6	65.2	64.8
LC14600088R	55	56	63	62.0	62.5	61.6
NDL090204R	54	56	59	63.7	63.3	63.0
NDL120599R	58	56	60	61.3	61.3	60.1
Sage	40	37	41	64.2	64.7	64.1
Mean	**48**	**48**	**51**	**63.2**	**63.5**	**62.9**
P-value	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
LSD	**2.1**	**3.5**	**1.6**	**0.4**	**0.5**	**0.4**
CV(%)	**3.0**	**4.4**	**2.2**	**0.5**	**0.5**	**0.4**

Table 15. Lentil Plant Height (cm) & Days to Flowering

	Plant Height (cm)			Days to Flowering		
Lentil Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
Avondale	26	40	36	60		54
CDC Greenstar	28	38	35	65		57
CDC Impala CL	24	40	39	66		56
CDC Impress CL	26	41	35	64		55
CDC Imvincible CL	24	36	35	65		55
CDC Kermit	24	38	35	65		56
CDC Maxim CL	22	37	33	62		54
CDC Richlea	27	40	37	63		55
CDC Viceroy	26	42	36	65		55
LC14600088R	26	41	39	63		54
NDL090204R	27	38	36	62		55
NDL120599R	26	43	37	60		51
Sage	23	36	32	58		51
Mean	**25**	**39**	**36**	**63**		**54**
P-value	**<0.0001**	**0.177**	**0.0146**	**<0.0001**		**<0.0001**
LSD	**1.2**	**NS**	**3.6**	**1.4**		**1.3**
CV(%)	**3.2**	**8.1**	**7.1**	**1.6**		**1.6**

Chickpea Variety Evaluation in 2022

The 2022 statewide chickpea variety evaluation included seventeen entries (twelve Kabuli type and five Desi type). Two entries were breeding lines and the remaining fifteen were cultivars. Data are presented for two dryland locations and one irrigated location in Tables 16-18. Average yield for the three year period spanning 2020 though 2022 is presented for those entries that were trialed in all three years.

Chickpea yields were excellent under irrigation in Sidney. Ascochyta pressure was modest in Sidney and four fungicide applications beginning at flowering effectively managed disease. Yields in Havre were average to slightly above average. All chickpeas entries at the Richland location were severely damaged by antelope early in the growing season resulting in lost yield potential. In addition, several entries (predominantly large sized kabuli chickpeas) were selectively grazed in Richland prior to harvest resulting in very low yields for those entries.

Table 16. Chickpea Grain yield (lb/a) with three year averages in parentheses

Chickpea Variety/Line	Havre Yield 2022	Havre Yield (3 yr avg)	Richland Yield 2022	Richland Yield (3 yr avg)	Sidney Yield 2022	Sidney Yield (3 yr avg)
2510-2	1595		859		4448	
Anna	2033		1607		4172	
CDC Consul	1847		1230		4559	
CDC Cory	1919		1227		4311	
CDC Frontier	1860	(1684)	1298	(1472)	4612	(4496)
CDC Leader	1516	(1487)	1148	(1622)	4610	
CDC Orion	2158	(1796)	579	(1439)	4483	(4568)
CDC Palmer	1698	(1727)	1606	(1728)		
Kasin	1676		1217			
Myles	1732	(1681)	1773	(1721)	3833	(3214)
Nash	1393		123		3787	
ND Crown	1666	(1461)	1172	(1133)	4228	(3962)
NDC160236	2340		1027		4787	
New Hope	1385		110			
Royal	1676	(934)	143	(351)	4109	(3858)
Sawyer	1541	(1482)	598	(989)	3940	(3690)
Sierra	1102	(823)	126	(374)	3995	(3623)
Mean	**1714**		**932**		**4277**	
P-value	**<0.0001**		**<0.0001**		**<0.0001**	
LSD	**182**		**505**		**380**	
CV(%)	**7.5**		**38.2**		**6.2**	

*Note: Antelope damage at Richland was significant throughout the growing season and several entries were stripped of pods prior to harvest resulting in very low yields for those entries.

Table 17. Chickpea Test Weight (lb/bu) & Seed Size (% greater than 8.73 mm)

	Test Weight (lb/bu)			Seed Size (% > 8.73 mm)		
Chickpea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
2510-2	60.7	63.7	64.9	1	4	3
Anna	62.1	64.2	65.5	0	0	0
CDC Consul	62.1	64.4	65.6	2	2	2
CDC Cory	60.2	61.9	63.4	2	2	1
CDC Frontier	61.2	63.8	63.4	14	14	21
CDC Leader	60.1	62.8	62.6	28	36	34
CDC Orion	59.2	61.0	61.9	46	48	55
CDC Palmer	60.2	62.3		18	37	
Kasin	62.4	64.9		1	0	
Myles	59.0	60.8	62.1	0	0	0
Nash	56.3	*	60.5	89	72	79
ND Crown	59.7	62.8	62.6	34	52	68
NDC160236	59.1	62.5	63.3	39	41	42
New Hope	59.5	*		21	75	
Royal	57.7	*	61.9	81	50	76
Sawyer	59.3	63.0	62.2	24	33	26
Sierra	56.6	*	60.4	50	50	81
Mean	**59.7**	**63.1**	**62.9**	**26**	**30**	**35**
P-value	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
LSD	**1.2**	**0.6**	**0.7**	**7.3**	**10.4**	**6.9**
CV(%)	**1.5**	**0.7**	**0.8**	**19.3**	**24.0**	**13.8**

* Note: Insufficient material was available to measure test weight for samples marked with an asterisk

Table 18. Chickpea Plant Height (cm) & Days to Flowering

	Plant Height (cm)			Days to Flowering		
Chickpea Variety/Line	**Havre**	**Richland**	**Sidney**	**Havre**	**Richland**	**Sidney**
2510-2	38	43	60	64		56
Anna	37	42	60	62		50
CDC Consul	37	43	60	63		55
CDC Cory	40	42	60	64		56
CDC Frontier	33	42	59	63		55
CDC Leader	32	38	50	61		54
CDC Orion	34	43	57	59		50
CDC Palmer	31	43		61		
Kasin	42	53		64		
Myles	34	42	58	59		50
Nash	36	38	61	64		56
ND Crown	39	42	65	61		54
NDC160236	39	47	61	63		56
New Hope	37	38		62		
Royal	41	43	58	63		56
Sawyer	35	44	54	61		50
Sierra	35	39	59	62		54
Mean	**36**	**42**	**59**	**62**		**54**
P-value	**<0.0001**	**0.0222**	**0.0251**	**<0.0001**		**<0.0001**
LSD	**1.9**	**6.9**	**6.4**	**1.3**		**0.8**
CV(%)	**3.7**	**11.4**	**7.6**	**1.3**		**1.0**

FUTURE PLANS

The EARC will continue to lead the statewide variety evaluations in the coming years as long as there is a need from pulse growers, seed industries, breeders, and there is funding to support the effort.

Note: The data and summaries presented in this report are for **informational purposes only.** Inclusion and or exclusion of any commercial variety in this summary does not constitute a recommendation by Montana State University Agricultural Experiment Station or EARC.

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