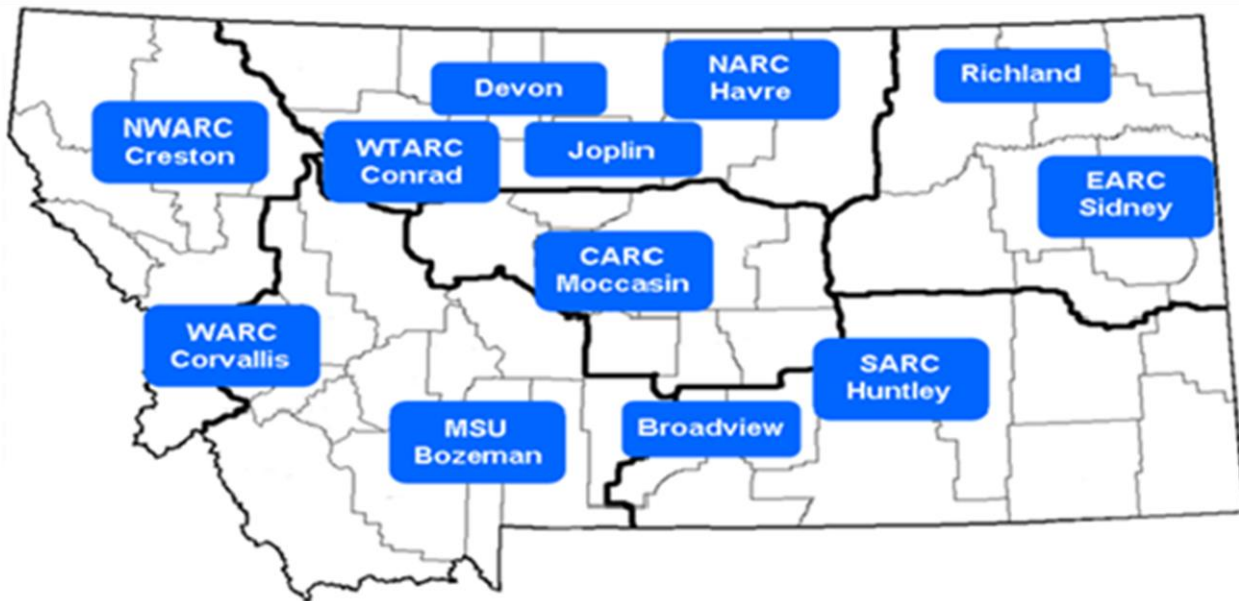


# 2018 Montana Cool-Season Spring Pulse Variety Evaluation Annual Report

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Montana Agricultural Experiment Stations

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# Table of Contents

<b>ACKNOWLEDGEMENT .....</b>	<b>2</b>
<b>LIST OF SEED SUPPLIERS .....</b>	<b>4</b>
<b>PROJECT DESCRIPTION AND OBJECTIVE .....</b>	<b>7</b>
PROJECT DESCRIPTION .....	7
OBJECTIVE .....	7
<b>METHODS.....</b>	<b>7</b>
PROCEDURES AND EXPERIMENTAL DESIGN .....	7
LIST OF COLLABORATORS AND LOCATIONS .....	8
PRECIPITATION AND CULTURAL PRACTICES .....	9
<i>Precipitation</i> .....	9
<i>Agronomic practices</i> .....	9
<b>RESULTS.....</b>	<b>12</b>
<b>DRY PEA.....</b>	<b>12</b>
<i>Dry Pea Variety Evaluation in 2018</i> .....	12
<i>Multi-Year and Multi-Location Statewide Dry Pea Variety Evaluation Summary</i> .....	27
<b>LENTIL .....</b>	<b>34</b>
<i>Lentil Variety Evaluation in 2018</i> .....	34
<i>Multi-Year and Multi-Location Statewide Lentil Variety Evaluation Summary</i> .....	41
<b>CHICKPEA .....</b>	<b>44</b>
<i>Chickpea Variety Evaluation in 2018</i> .....	44
<i>Multi-Year and Multi-Location Statewide Chickpea Variety Evaluation Summary</i> .....	47
<b>FUTURE PLANS.....</b>	<b>49</b>

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The information given herein is supplied with the understanding that no discrimination is intended and no endorsement by the Montana Agricultural Experiment Station is implied. The results of individual trials and studies are considered to be of a **PRELIMINARY** nature and should **NOT** be considered as a product endorsement or recommendation for commercial use.

**List of Seed Suppliers**

Table 1 shows the lists of seed companies who submitted seeds for 2018 variety evaluation in Montana. The seed suppliers could be contacted for more information about the respective crops, varieties and experimental lines if needed. This table is not exhaustive in listing seed suppliers for all varieties and experimental lines evaluated in 2018 since some of these entries received from breeders are not yet released, and lack of adequate information for others.

Table 1. Dry pea, lentil and chickpea entries included in 2018 variety evaluation trials and seed suppliers. Other entries not listed in this Table are either checks used for the trials or entries from Montana State University.

<b>Crop</b>	<b>Entries</b>	<b>Seed supplier</b>	<b>Seed color/size</b>
Dry Pea	AAC Asher	Legume Logic	Yellow
	AAC Carver	Meridian Seeds	Yellow
	AAC Chrome	Legume Logic	Yellow
	AAC Comfort	Meridian Seeds	Green
	AAC Profit	Birdsall Grain and Seed LLC; Great Northern Ag.	Yellow
	AC Agaziz	Meridian Seeds	Yellow
	AC Earlystar	Meridian Seeds	Yellow
	Aragorn	Pulse USA	Green
	Bannner	ProGene Plant Research	Green
	Bluemoon	JB Farms	Green
	Bridger	Great Northern Ag.	Yellow
	CDC Amarillo	Meridian Seeds	Yellow
	CDC Dakota	Legume Logic	Yellow
	CDC Greenwater	Meridian Seeds	Green
	CDC Inca	Meridian Seeds	Yellow
	CDC Saffron	Meridian Seeds	Yellow
	CDC Spectrum	Meridian Seeds	Yellow
	DS Admiral	Pulse USA	Yellow
	Durwood	Pulse USA	Yellow
	Empire	Great Northern Ag.	Green
	Ginny	ProGene Plant Research	Green
	Greenwood	ProGene Plant Research	Green
	Hyline	Great Northern Ag.	Yellow
	Jetset	Meridian Seeds	Yellow
	Korando	Pulse USA	Yellow
	LG Amigo	Pulse USA	Yellow
	LG Sunrise	Pulse USA	Yellow
	LL-1	Legume Logic	Yellow
	LL-2	Legume Logic	Yellow
	Majestic	JB Farms	Yellow
	Majoret	Pulse USA	Green
	Navarro	Great Northern Ag.	Yellow
	Nette 2010	Pulse USA	Yellow
	Pro 093-7410	ProGene Plant Research	Yellow
Pro 112-7127	ProGene Plant Research	Green	
Pro 121-7126	ProGene Plant Research	Green	
Pro 131-71213	ProGene Plant Research	Green	
Pro 133-6243	ProGene Plant Research	Yellow	
Pro 143-6230	ProGene Plant Research	Yellow	

	Pro 143-6236	ProGene Plant Research	Yellow
	Pro 153-7405	ProGene Plant Research	Yellow
	PS07100925	USDA-ARS- Pullman, WA	Yellow
	PS08101022	USDA-ARS- Pullman, WA	Yellow
	Salamanca	Great Northern Ag.	Yellow
	Shamrock	Great Northern Ag.	Green
	Spider	Great Northern Ag.	Yellow
	SW Arcadia	Pulse USA	Green
Lentil	Avondale	Pulse USA	Medium green
	CDC Invincible CL	Pulse USA	Small green
	CDC Maxim CL	Pulse USA	Small red
	CDC Impala CL	Pulse USA	Small red
	CDC Richlea	Cahill Seeds	Medium green
	LC08600113P	USDA-ARS- Pullman, WA	Small red
	LC14600088R	USDA-ARS- Pullman, WA	Small green
	LC14600100L	USDA-ARS- Pullman, WA	Medium green
Chickpea	CDC Orion	Meridian Seeds	Kabuli type
	CDC Leader	Meridian Seeds	Kabuli type
	CDC Palmer	Meridian Seeds	Kabuli type
	GNC-18010	Great Northern Ag.	Kabuli type

## **PROJECT DESCRIPTION AND OBJECTIVE**

### **Project Description**

Cool season spring pulse crops (dry pea, lentil and chickpea) production in Montana is increasing rapidly. In order to enhance yield and quality of these crops, information on varietal testing and improved agronomic management practices are needed. The Eastern Agricultural Research Center (EARC) of Montana State University (MSU) is currently coordinating a statewide dry pea, lentil and chickpea variety evaluation project across Montana.

This project is designed to work together with pulse breeders and researchers from Montana State University, North Dakota State University, USDA-ARS Pullman, WA, Saskatchewan University, Canada, seed trading companies and pulse growers. In 2018, the trials were conducted at seven Agricultural Research Centers and Bozeman Post Farm of MSU plus two cooperating producers' fields near Broadview and Richland, Montana. The research results from the project will provide unbiased information to stakeholders with decision making. This annual report contains the results from 2018 and a summary from multiple years. The report is available both in print and electronic (<http://agresearch.montana.edu/earc/annualreports.html>) to promote pulse production and crop diversification in Montana.

### **Objective**

The objective of this project was to evaluate spring dry pea, lentil and chickpea commercial varieties and experimental lines for adaptability and yield potential across Montana State.

## **METHODS**

### **Procedures and Experimental Design**

The Eastern Agricultural Research Center (EARC) invited individual private seed trading companies and breeders to submit dry pea, lentil and chickpea varieties and experimental lines for 2018 evaluation. Available locations for evaluation were indicated in the invitation letter. All locations were dry land plus three locations with supplemental irrigation at Corvallis, Huntley and Sidney. The EARC (coordinating center) tested the seeds, received from the different sources, for germination to adjust seeding rate. Then, all seeds were treated with fungicide, Apron MAXX<sup>®</sup> RTA<sup>®</sup> (Syngenta Crop Protection, Inc.) to protect soil borne diseases. Furthermore, the seeds were



additionally treated with thiamethoxam insecticide, Cruiser® 5FS (Syngenta Crop Protection, Inc.) to minimize pea leaf weevil damage. Then, seeds were packaged per plot and shipped to testing locations together with appropriate rhizobium inoculant and research protocol. The seed rates were 8, 12 and 4 live seeds per ft<sup>2</sup> for pea, lentil and chickpea, respectively. The experiments were carried out in randomized complete block design in four or three replications per location based on availability of land. Plot size varied from site to site depends on land availability and equipment used for seeding and harvesting. Best management practices were followed during trial management in the field using available resources at each location. The researchers at the respective location managed the trials and recorded and submitted the data to the coordinating office. Grain yield data was adjusted to 13% moisture content before statistical analysis when grain moisture data were available. Analysis of variance were done using GLM of SAS statistical package (SAS 9.4). The LSMEANS (@  $\alpha = 0.05$ ) procedure was used to differentiate treatments' effects.

### 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 location and collaborators, the type of crops evaluated at each location is shown in Table 2.

Table 2. Summary table showing list of collaborators, locations and type of pulse crops evaluated at each location in 2018.

Location	Collaborators <sup>†</sup>	Dryland/irrigated	Crop included in the evaluation		
			Pea	Lentil	Chickpea
Moccasin	CARC	Dry land	X	X	X
Richland	EARC	Dry land	X	X	X
Sidney	EARC	Dryland	X	X	X
Sidney	EARC	Irrigated	X	X	X
Bozeman, Post Farm	PSPP	Dry land	X	X	X
Havre	NARC	Dry land	X	X	
Creston	NWARC	Dry land	X	X	
Broadview	SARC	Dry land	X		
Huntley	SARC	Dry land	X	X	X
Huntley	SARC	Irrigated	X	X	X
Corvallis	WARC	Irrigated		X	X
Conrad	WTARC	Dryland		X	X

<sup>†</sup>CARC = Central Agricultural Research Center, EARC = Eastern Agricultural Research Center, PSPP = Plant Sciences and Plant Pathology, NARC = Northern Agricultural Research Center, NWARC = Northwest Agricultural Research Center, SARC = Southern Agricultural Research Center, WARC = Western Agricultural Research Center,

WTARC = Western Triangle Agricultural Research Center. ‘X’ indicates the collaborator participated in for the specific crop variety evaluation in 2018.

## Precipitation and Cultural Practices

Precipitation, site information and agronomic management practices for the respective locations are summarized in Tables 3 and 4.

### Precipitation

The total amount of precipitation received from April 1, 2018 to Aug 31, 2018 varied from location to location as shown in Table 3. Generally, Huntley followed by Moccasin received more precipitation during this crop growing period compared to other locations. Among the different location, Havre received very low precipitation during this growing period but still produced significant yield. This could be due to stored residual moisture available at planting.

Table 3. Growing season and long term average precipitation and irrigation amount applied at each location

	<b>Bozeman (LRES)</b>	<b>Conrad (WTARC)</b>	<b>Corvallis (WARC)</b>	<b>Creston (NWARC)</b>	<b>Havre (NARC)</b>	<b>Huntley (SARC)</b>	<b>Moccasin (CARC)</b>	<b>Sidney (EARC)irri</b>	<b>Sidney (EARC)Dry</b>
Seasonal precipitation (Apr. – Aug, 2018) (“)		5.69	7.35	6.2	4.52	13.99	11.4	9.53	9.43
Site Average (“)		8.35			7.99		10.2	9.56	9.56
Irrigation applied (“)								2.68	

### Agronomic practices

The previous crops, seeding and harvesting dates, fertilization and weed management were different for the different testing locations. The summary of these practices and soil types by locations are shown in Table 4.

Table 4. Major agronomic management practices for each location in 2018

	<b>Bozeman (LRES)</b>	<b>Conrad (WTARC)</b>	<b>Corvallis (WARC) Irri.</b>	<b>Creston (NWARC)</b>	<b>Sidney dry and Irri. (EARC)</b>	<b>Havre (NARC)</b>	<b>Huntley (SARC) Dryland, Irri. and Broadview</b>	<b>Moccasin (CARC)</b>
<b>Tillage</b>	None	Chemical fallow		Conventional	No-till at ddryland and conventional for irrigated	No-till	no till- disk for irrigated and no-till for dryland and Broadview	No-till
<b>Soil Type</b>	Bozeman silt loam	Clay loam		Creston silt loam	Williams clay loam	Fort Benton Loam for Peas; Telstad Clay Loam for Lentils		Judith clay
<b>Elevation (ft)</b>	4775	3700		2950	2200	2699		4250
<b>Pea Trial</b>								
<b>Dates:</b>								
<b>Seeding</b>	4/27/2018	4/30/2018		5/8/2018	4/25 dryland and 4/27 irrigated	4/28/2018	5/4, 5/2, and 4/27 irrigated, dryland and Broadview	4/25/2018
<b>Harvest</b>	8/29/2018	Different based on cultivars 7/28 – 8/7		8/22/2018	7/25 dryland and 7/30 irrigated	7/30/2018	8/10, 8/2, and 8/9 irrigated, dryland and Broadview	8/7/2018
<b>Previous crop</b>	Barley	Barely		Spring wheat	Wheat @ dryland and Sugar beet @ irrigated	Fallow - Winter Wheat	Wheat	Forage barley
<b>Fertilizer</b>	none	11-22.5-20; 11-52-0 applied with the seed and 0-0-60 side shot		0/50/0	None	None	None	20-30-20-10 @ 50 lb/ac
<b>Herbicides and insecticide</b>	2 pints Prowl H <sub>2</sub> O, 1 ounce Sharpen, 1 quart Round-up RT3 per ac	3 oz/ac Spartan and 32 oz/ac applied on 4/28/2018; 1.5 qt/ac Sevin XLR Plus applied on 6/9/2018 for pea leaf weevil		Insecticide/fungicide (warrior2) 1.9floz/ac	Prowl H <sub>2</sub> O, roundup and outlook @2.5 pt/ac, 22 oz/ac and 21 oz/ac, respectively.	Prowl H <sub>2</sub> O, 2 pt/ac, 10/26/17; Mustang Maxx, 4 oz/ac, 5/25/18 Raptor, 4oz/ac, 6/9/18 Basagran, 16 oz/ac, 6/9/18	RT3 24 oz/a + Prowl H <sub>2</sub> O 2 pint/ac + 1 pint/ac outlook; For dryland and irrigated and none for Broadview	pre-plant RT3 @ 32 oz/ac; Grizzly Too @ 1.9 oz/ac

Lentil Trials								
<b>Dates:</b>								
Seeding	4/27/2018	5/3/2018		5/8/2018	4/25 dryland and 4/27 irrigated	4/29/2017	5/4 irrigated and 5/2 dryland	5/9/2018
Harvest	8/15/2018	8/14/2018		9/7/2018	8/7 dryland and 8/13 irrigated	8/15/2018	9/4 irrigated and 8/24 dryland	9/7/2018
Previous crop	Barley	Barley		Spring wheat	Wheat @ dryland and Sugar beet @ irrigated	Fallow - spring barley	Wheat	Forage barley
Fertilizer	None	11-22.5-20; 11-52-0, Applied with seed, 0-0-60 side shot		0/50/0	None	None	None	20-30-20-10 @ 50 lb/ac
Herbicides and insecticide	2 pints Prowl H <sub>2</sub> O, 1 ounce Sharpen, 1 quart Round-up RT3 per ac	3/4 oz Sharpen/ac and 32 oz/ac RT3 on 4/28/2018		None	Prowl H <sub>2</sub> O, roundup and outlook @2.5 pt/ac, 22 oz/ac and 21 oz/ac, respectively.	Prowl H <sub>2</sub> O, 2 pt/ac,	RT3 24 oz/a + Prowl H <sub>2</sub> O 2 pint/ac + 1 pint/ac outlook both irrigated and dryland	Pre-plant RT3 @ 32 oz/ac
Chickpea Trials								
Tillage	None			Not applicable	No-till at dryland and conventional for irrigated		No-till disk irrigated and no-till dryland	No-till
Seeding date	4/27/2018	Chem-fallow barley stubble		Not applicable	4/25 dryland and 4/27 irrigated		5/4 irrigated and 5/2 dryland	5/9/2018
Harvest date	9/6/2018	5/3/2018		Not applicable	8/7 dryland and 8/25 irrigated		9/4 irrigated and 8/24 dryland	9/7/2018
Previous	Barley	8/24/2018		Not applicable	Wheat @ dryland and Sugar beet @ irrigated		Wheat	Forage barley
Fertilizer	None	Barley		Not applicable	None		None	20-30-20-10 @ 50 lb/ac
Herbicides and insecticide	2 pints Prowl H <sub>2</sub> O, 1 ounce Sharpen, 1 quart Round-up RT3 per ac	40 oz RT3/ac on 5/3/2018 and 5.7 oz/ac Praline on 7/1/2018 for Aschocyta		Not applicable	Prowl H <sub>2</sub> O, roundup and outlook @2.5 pt/ac, 22 oz/ac and 21 oz/ac, respectively.		RT3 24 oz/a + Prowl H <sub>2</sub> O 2 pint/ac + 1 pint/ac outlook both irrigated and dryland	Pre-plant RT3 @ 32 oz/ac

## **RESULTS**

The results presented in this report include for dry pea, lentil and chickpea variety evaluation trials from different locations. First, results from dry pea (yellow and green) are presented followed by lentil and chickpea.

### **Dry Pea**

#### **Dry Pea Variety Evaluation in 2018**

A total of 54 dry pea varieties and experimental lines (35 yellow and 19 green) were evaluated in 2018 at 11 locations (Bozeman, Broadview, Conrad, Creston, Havre, Huntley dryland, Huntley irrigated, Moccasin, Richland, Sidney dryland and Sidney irrigated) across Montana. Some entries submitted by private companies on a fee basis were tested at select locations only. Therefore, the number of entries varied from location to location depends on the interest of seed companies and breeders. Some entries from the pea line advancement trial were included in the statewide pea variety trial. The most common data collected and presented include grain yield, thousand kernel weight, test weight, plant height and number of days to flowering and the report is limited to these data. There is inconsistency of data collection due to limited resources even if research protocol was provided. This makes comparison of entries across environments difficult. Generally, yellow pea produced more grain yield than green pea. Therefore, we reported these results into two groups based on cotyledon color (yellow and green) first for yellow pea followed by green pea.

#### ***Yellow dry pea grain yield***

The yellow dry pea grain yield varied greatly from location to location probably due to differences in environmental conditions and management practices. Mean grain yield for yellow dry pea for the different locations ranged from 1462 lb/ac at Broadview to 5761 lb/ac at Creston (Table 6). The low yields recorded at Sidney dryland was due to low moisture stress at this location. Application of supplemental irrigation at this site increased mean yield to 3049 lb/ac (Sidney irrigated site). Average yellow dry pea yields were 3139 lb/ac at Bozeman, 1462 lb/ac at Broadview, 2147 lb/ac at Conrad, 5761 lb/ac at Creston, 2555 lb/ac at Havre, 3285 lb/ac Huntley dryland, 4136 lb/ac Huntley irrigated, 2858 lb/ac at Moccasin, 2736 lb/ac at Richland, 1887 lb/ac Sidney dryland and 3049 lb/ac at Sidney irrigated (Table 6). The grain yields from irrigated locations (Huntley and Sidney) were substantially higher than yields from their respective dryland locations. This demonstrated the possibility to increase grain yield of pea with supplemental irrigation. The grain yield differences among varieties were statistically significant in most of the different locations with LSD (0.05) values ranged from 322 lb/ac to

555 lb/ac. The grain yield at Creston was substantially higher than any other locations and was consistent for all entries tested.

### ***Yellow dry pea thousand kernel weight (TKW)***

In 2018, TKW data were collected from limited locations and it is difficult to make conclusion which location has more TKW. From the collected information, the highest mean TKW was recorded from Creston (252 g/1000 seeds) and the lowest (216 g/1000 seeds) was from Havre. There was significant difference among entries for these locations (Table 7).

### ***Yellow dry pea test weight***

Test weight data were recorded in most of the location as shown in Table 8. The mean test weight for locations ranging from 61.05 lb/bu to 68.28 lb/bu. The lowest mean test weight was recorded at Havre (61.05 lb/bu) and the maximum (68.28 lb/bu) was recorded at Conrad site (Table 8). The differences in test weight were significant for the different entries within a location except at Broadview and Huntley dryland.

### ***Yellow dry pea plant height***

The mean plant height ranged from 44 cm to 100 cm. The lowest mean plant height was recorded from Sidney dryland site due to low soil moisture stress and the highest was recorded from Huntley site (Table 9). Those entries that are tall and upright are important for harvesting. In addition, they produce more residue that will be left in the field after harvest. This will have substantial contribution to improve soil health in the long run.

### ***Yellow dry pea days to flowering***

The number of days to flowering were recorded for most of the locations and ranged from 51 to 62 days. From those locations, the mean number of days to flowering was longer at Bozeman and Moccasin, and was shorter at Huntley irrigated and Sidney dryland than other locations (Table 10).

### ***Green dry pea grain yield***

Some characteristics of the green pea entries are shown in Table 11. The mean grain yield for green pea ranging from 1419 lb/ac to 5120 lb/ac. The average yields for green pea were 2716 lb/ac at Bozeman, 1419 lb/ac at Broadview, 2098 lb/ac at Conrad, 5120 lb/ac at Creston, 2544 lb/ac at Havre, 3381 lb/ac at Huntley (dryland), 3408 lb/ac at Huntley (irrigated), 2702 lb/ac at Moccasin, 2696 lb/ac at Richland, 1686 lb/ac at Sidney dryland and 2866 lb/ac at Sidney with irrigation (Table 12). The mean grain yield both for green and yellow pea was

higher at Creston site than other locations. The grain yield differences among entries were significant within a location for all locations except at Broadview, Creston, and Huntley dryland.

### ***Green dry pea thousand kernel weight (TKW)***

The TKW data for green pea was recorded only for few locations and ranged from 193 gm per 1000 seeds to 228 gm per 1000 seeds (Table 13). The differences in TKW for the different entries within a location were significant at all locations except Creston.

### ***Green dry pea test weight***

The mean test weight for green pea ranging from 60.84 lb/bu to 67.78 lb/bu (Table 14). The differences in test weight among entries were significant within a location for most of the locations.

### ***Green dry pea plant height***

The mean plant height ranging from 42 cm to 97 cm (Table 15). The mean green pea plant height was shorter at Havre and taller at Huntley under supplementary irrigation compared with other locations.

### ***Green dry pea days to flowering***

The mean number of days to flower ranging from 50 days to 64 days (Table 16). The mean number of day for flowering was shorter at Sidney irrigated and dryland and was longer at Bozeman and Moccasin. The number of days to flowering was significant among entries within a location for all locations except Huntley dryland.

## **Summary**

In 2018, the mean grain yields both for yellow and green pea entries were higher at Creston than other locations. Compared to all yellow pea entries, the maximum mean grain yield (6349 lb/ac) was recorded from variety Jetset at Creston. Similarly, among the green pea color entries, PSO877MT076 and PSO826MT190 produced the highest grain yield compared with other entries. The grain yield differences among entries were significant for most of the locations (Tables 6 and 12). On average, yellow dry pea entries yielded 10% more grain yield than green dry pea. Several entries have performed well in certain locations. However, none of the entries consistently out yielded in all locations. In other words, the entry that resulted in maximum mean grain yield varied from location to location. This may suggest the importance of considering the release of site specific variety, due to the diverse ecologies of Montana, for better agronomic performances and economic returns.

Table 5. Yellow Dry Pea Variety Sources and Characteristics

Variety*	Size	Maturity	Height	Breeding Program	Release Date
AC Agassiz	M	Late	Mod	AC	2007
Bridger	M	Mod	Mod	LL	2011
CDC Treasure	M		Tall	CDC	2009
Delta	M	Mod	Short		1995
DS Admiral	L	Mod	Tall		2000
Jetset	L	Late	Mod		
Korando	L	Late	Mod		
Navarro	VL	Early	Mod		
Pro 127-2	M	Mod	Mod	PG	
Pro 793	VL	Early	Short	PG	
Spider	L	Mod	Tall	LL	2008
SW Midas	M	Mod	Mod	SW	2004
Trapeze	VL	Late	Short	SW	2010

CDC = Crop Development Centre, University of Saskatchewan; AC = Agriculture Canada; LL = Legume Logic; PG = ProGene Plant Research; LIMG = Limagrain, Nederland; SW = Svalöf-Weibull. \*Because some of the breeding entries have not been registered and released as varieties and lack of information for other entries, this table does not contain complete information for all entries tested.



Table 6. Montana Statewide Yellow Dry Pea Variety Evaluation–Grain Yield (lb/ac) in 2018.

Yellow pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Asher					2750				3142		
AAC Carver					2559			2968	2632	2299	3536
AAC Chrome					–				3253		
AAC Profit			1488		2368			2583	2816		
AC Agassiz					2685			2736	3242	2105	3497
AC Earlystar					2504			2849	2834	1687	2732
Bridger			2085		2557			2898	2728		
CDC Amarillo					2300			2514	2110	1866	2940
CDC Inca					2207			2664	2148	2321	2949
CDC Saffron					2399			2911	3238	2124	3611
CDC Spectrum					2477			2511	2818	1965	3054
DS Admiral	2952	1200	2126	5464	2380	3365	4029	2784	2195	1753	2756
Delta	3626	2068	2161	5865	2596	3178	3929	3066	2995	1384	2386
Durwood		1207	2046		2380	3222	4078		2616		
Hyline			2269		2469			2707	2834		
Jetset	3026	1605	2312	6349	2430	3382	4975	3160	2303	1767	3005
Korando		1295	2363		2780	3397	4622		2878		
LG Amigo		1282	2170		2547	2948	3174		2644		
LG Sunrise		1465	2130		2644	2995	3694		2372		
LL-1					–				2660		
LL-2					–				2484		
Majestic					–				2925		
Navarro	3137	1819	2303	5446	2640	3865	4461	3048	2851	1676	2871
Nette 2010	3013	1510	2268	5843	2758	2572	4428	3242	3191	1951	3359
PSO7100925			2148		2838			3095	2703		
PSO8101022			2199		2985			3052	2673		
PSO826MT460	3260	1301	1942	5906	2676	3372	4246	2968	2710	1642	2694
PSO826MT492	2988	1209	2140	6024	2502	3614	3850	2886	2579	1829	2970
PSO877MT632	3108	1593	2152	5192	2464	3516	4157	2769	3076	1938	3386
Pro 093-7410			2526		2831				3143		
Pro 133-6243			2657		3006				3010		
Pro 143-6230			2298		2465				2480		
Pro 143-6236			2454		2312				2908		
Pro 153-7405					–				2714		
Salamanca			2391		2784			2745	2362		
Spider			769		1835			2731	2348		
<i>Mean</i>	3139	1462	2147	5761	2555	3285	4136	2858	2739	1887	3049
<i>P-Value</i>	0.0141	0.0405	<0.001	0.1848	<0.0001	0.2110	0.0005	0.0002	<0.0001	0.0075	0.0033
<i>LSD (0.05)</i>	339	521	398	NS	331	NS	635	322	555	421	552
<i>CV (%)</i>	7.63	25.19	13.13	10.13	9.17	17.27	10.86	7.97	14.33	13.66	11.09

Table 7. Montana Statewide Yellow Dry Pea Variety Evaluation –Thousand Kernel Weight (g) in 2018

Yellow pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Asher					236						
AAC Carver					207			221			
AAC Chrome					–						
AAC Profit			216		215			223			
AC Agassiz					194			221			
AC Earlystar					194			212			
Bridger			209		204			217			
CDC Amarillo					199			214			
CDC Inca					200			218			
CDC Saffron					215			228			
CDC Spectrum					208			228			
DS Admiral	238		218	246	216			245			
Delta	241		216	252	215			230			
Durwood			221		215						
Hyline			219		207			229			
Jetset	240		225	246	218			232			
Korando			241		265						
LG Amigo			204		213						
LG Sunrise			225		205						
LL-1					–						
LL-2					–						
Majestic					–						
Navarro	278		253	270	244			249			
Nette 2010	238		218	246	220			226			
PSO7100925			233		233			251			
PSO8101022			234		227			249			
PSO826MT460	263		228	266	223			243			
PSO826MT492	267		244	253	232			237			
PSO877MT632	231		208	237	194			218			
Pro 093-7410			205		184						
Pro 133-6243			254		263						
Pro 143-6230			207		190						
Pro 143-6236			207		203						
Pro 153-7405					–						
Salamanca			234		236			247			
Spider			215		224			233			
<i>Mean</i>	250		223	252	216			230			
<i>P-Value</i>	<0.0001		<0.0001	0.0001	<0.0001			<0.0001			
<i>LSD (0.05)</i>	13.4		12.6	11	6.9			6.7			
<i>CV (%)</i>	3.79		4.02	3.11	2.25			2.06			

Table 8. Montana Statewide Yellow Dry Pea Variety Evaluation – Test Weight (lb/bu) in 2018.

Yellow pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Asher					61.13				64.70		
AAC Carver					61.43			63.43	64.80	64.50	64.83
AAC Chrome					–				64.00		
AAC Profit			69.08		60.90			63.08	64.53		
AC Agassiz					60.13			62.73	63.30	64.03	64.27
AC Earlystar					61.23			63.15	64.05	64.20	64.23
Bridger			68.33		61.30			63.60	63.78		
CDC Amarillo					61.90			63.20	63.97	64.83	65.23
CDC Inca					61.63			63.05	63.63	64.53	64.83
CDC Saffron					61.30			63.73	64.45	65.00	65.30
CDC Spectrum					60.88			62.50	64.60	64.30	65.17
DS Admiral		66.13	68.18	63.05	60.33	65.60	65.28	63.05	64.75	65.30	64.77
Delta		65.85	67.50	64.75	61.70	65.23	65.90	64.35	64.45	64.00	63.87
Durwood		66.25	68.75		60.90	64.90	65.75		64.43		
Hyline			67.70		61.20			63.58	64.50		
Jetset		65.90	68.63	63.23	59.95	64.95	65.90	63.05	65.03	65.10	64.53
Korando		65.08	66.98		61.58	64.60	64.28		63.90		
LG Amigo		66.03	67.88		59.73	64.73	65.63		63.63		
LG Sunrise		64.00	68.78		61.48	65.05	65.95		64.80		
LL-1					–				64.68		
LL-2					–				64.23		
Majestic					–				64.05		
Navarro		66.50	68.05	64.13	61.38	65.80	65.25	63.83	63.98	64.50	64.37
Nette 2010		65.78	68.60	65.33	61.93	65.05	66.70	64.03	65.15	65.87	65.20
PSO7100925			68.20		60.30			62.55	63.48		
PSO8101022			68.88		60.47			63.73	64.43		
PSO826MT460		66.18	68.98	63.53	60.43	65.33	64.33	62.73	63.95	64.27	63.23
PSO826MT492		65.90	68.65	64.68	61.50	65.28	65.73	64.80	64.05	64.57	64.97
PSO877MT632		66.38	68.68	64.75	61.15	65.70	65.80	63.38	64.25	64.13	64.23
Pro 093-7410			68.85		61.03				64.63		
Pro 133-6243			67.88		61.55				63.90		
Pro 143-6230			66.78		60.40				63.25		
Pro 143-6236			67.95		60.98				64.65		
Pro 153-7405					–				63.25		
Salamanca			68.33		60.98			63.45	63.98		
Spider			68.90		61.67			64.30	64.23		
<i>Mean</i>		65.83	68.28	64.17	61.05	65.18	65.54	63.42	64.21	64.61	64.59
<i>P-Value</i>		0.4970	0.0004	<0.0001	<0.0001	0.1880	<0.0001	<0.0001	<0.0001	0.0003	<0.0001
<i>LSD (0.05)</i>		NS	1.03	0.79	0.42	NS	0.79	0.91	0.77	0.69	0.67
<i>CV (%)</i>		2.11	1.07	0.88	0.48	0.96	0.86	1.02	0.85	0.66	0.64

Table 9. Montana Statewide Yellow Dry Pea Evaluation – Plant Height (cm) in 2018

Yellow pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Asher					41				59		
AAC Carver					46			90	76	52	58
AAC Chrome					–				68		
AAC Profit			65		48			85	80		
AC Agassiz					50			82	80	49	56
AC Earlystar					47			88	82	51	60
Bridger			62		46			79	70		
CDC Amarillo					59			89	76	44	63
CDC Inca					50			93	79	55	59
CDC Saffron					45			82	59	43	55
CDC Spectrum					53			81	65	43	59
DS Admiral	86	58	65	85	42	85	96	88	72	41	50
Delta	65	65	59	69	34	84	86	75	59	35	46
Durwood		66	67		52	89	120		81		
Hyline			59		40			84	71		
Jetset	86	65	64	86	45	84	100	86	74	42	54
Korando		64	63		40	84	101		67		
LG Amigo		54	65		43	91	99		70		
LG Sunrise		67	64		57	92	104		80		
LL-1					–				78		
LL-2					–				77		
Majestic					–				80		
Navarro	79	73	64	89	41	103	96	84	67	41	8
Nette 2010	84	62	62	84	44	82	101	82	70	38	53
PSO7100925			57		32			68	55		
PSO8101022			60		26			70	63		
PSO826MT460	74	63	62	46	29	94	93	64	66	39	47
PSO826MT492	84	61	65	86	48	84	105	88	65	39	56
PSO877MT632	80	60	62	45	28	95	96	60	66	46	56
Pro 093-7410			62		38				65		
Pro 133-6243			59		34				64		
Pro 143-6230			62		47				65		
Pro 143-6236			57		31				59		
Pro 153-7405			–		–				70		
Salamanca			57		49			89	72		
Spider			65		54			88	74		
<i>Mean</i>	80	63	61	74	43	89	100	81	70	44	55
<i>P-Value</i>	0.0002	0.0728	0.5901	<0.0001	<0.0001	0.3448	<0.0001	<0.0001	<0.0001	0.0154	0.0496
<i>LSD (0.05)</i>	7.5	NS	NS	12	5.8	NS	8.1	7.3	8.6	9.8	10
<i>CV (%)</i>	6.65	11.21	10.41	11.81	9.50	13.41	5.77	6.31	8.71	13.72	11.18

Table 10. Montana Statewide Yellow Dry Pea Variety Evaluation – Number of Days to Flowering in 2018

Yellow pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Asher					52						
AAC Carver					54			62		51	49
AAC Chrome					–						
AAC Profit			59		57			65			
AC Agassiz					52			63		50	49
AC Earlystar					52			62		51	49
Bridger			56		52			61			
CDC Amarillo					55			66		55	51
CDC Inca					56			64		55	52
CDC Saffron					56			64		54	50
CDC Spectrum					56			65		55	51
DS Admiral	63		56	54	52	54	51	62		51	48
Delta	61		56	52	52	55	51	61		50	47
Durwood			58		53	53	52				
Hyline			57		55			62			
Jetset	64		56	54	52	55	51	62		51	48
Korando			56		49	53	50				
LG Amigo			57		52	52	51				
LG Sunrise			56		52	55	52				
LL-1					–						
LL-2					–						
Majestic					–						
Navarro	59		57	53	51	53	50	59		50	47
Nette 2010	60		57	51	52	53	50	59		50	
PSO7100925			58		52			61			
PSO8101022			57		50			60			
PSO826MT460	62		57	51	51	54	51	60		50	47
PSO826MT492	64		56	52	51	53	52	60		50	48
PSO877MT632	64		57	55	52	52	53	62		50	49
Pro 093-7410			57		52						
Pro 133-6243			56		48						
Pro 143-6230			58		53						
Pro 143-6236			56		51						
Pro 153-7405					–						
Salamanca			58		54			62			
Spider			57		53			63			
<i>Mean</i>	62		57	53	52	53	51	62		51	49
<i>P-Value</i>	0.0038		0.0007	0.0529	<0.0001	0.4115	0.0101	<0.0001		<0.0001	<0.0001
<i>LSD (0.05)</i>	2.5		1.2	NS	2	NS	1.5	0.8		1.1	0.8
<i>CV (%)</i>	2.82		1.53	3.21	2.70	3.39	2.13	0.88		1.27	0.99

Table 11. Green dry pea variety sources and characteristics

<b>Variety*</b>	<b>Size</b>	<b>Maturity</b>	<b>Height</b>	<b>Breeding</b>	<b>Release</b>
Aragorn	M	Mod	Mod	PG	2006
SW Arcadia	M	Mod	Short		2009
Banner	M	Early	Tall	PG	2007
Bluemoon	VL	Late	Short		
CDC Striker	L	Mod	Mod	CDC	2002
Cruiser	S	Mod	Tall	PG	2002
Daytona	VL	Late	Short		
K2	M	Mod	Mod	LL	2005
Majoret	M	Mod	Short	SW	1994
PS07ND0190	M	Late	Tall	NDSU	
Viper	L	Late	Mod		

PG = ProGene Plant Research; CDC = Crop Development Centre, University of Saskatchewan; LL = Legume Logic; NDSU = North Dakota State University; LIMG = LImagrain, Netherlands; SW = Svalöf-Weibull. \*Because some of the breeding entries have not been registered and released as varieties and lack of information for other entries, this table does not contain complete information for all entries tested thus not inclusive.

Table 12. Montana Statewide Green Dry Pea Variety Evaluation – Grain Yield (lb/ac) in 2018.

Green pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Comfort					2425			2844	3230	2095	3260
Aragorn	2407	1422	1892	5136	2553	3446	4011	2744	2519	1251	2184
Banner			2249		2476						
Bluemoon					–				2671		
CDC Dakota					–				2161		
CDC Greenwater					2330			2354	2723	2053	3166
Empire					–				2576		
Ginny			2049		2873				2649		
Greenwood			2255		2785						
Hampton	2952	1350	2431	4941	2642	3301	3938	3165	3102	1556	3179
Majoret	2025	1669	1637	4521	2382	3584	2842	2358	1937	1381	2442
PS0877MT457	2690	1378	2168	4978	2697	3481	2603	2932	2906	1329	2682
PSO826MT190	2869	1220	1676	5566	2477	3314	3603	2655	2507	1822	2925
PSO877MT076	3352	1481	2421	5584	2555	3164	3457	2579	3107	2000	3094
Pro 121-7126			2095		2751				2710		
Pro 121-7127					–				3281		
Pro 131-7123			2248		2644				2678		
Shamrock			2061		2024			2695	2707		
SW Arcadia									2371		
<b>Mean</b>	2716	1419	2098	5120	2544	3381	3408	2702	2696	1686	2866
<b>P-Value</b>	<0.0001	0.8076	0.0054	0.0955	0.0014	0.7423	0.0053	0.0013	<0.0001	0.0019	0.0015
<b>LSD (0.05)</b>	376	NS	417	NS	300	NS	705	337	486	394	435
<b>CV (%)</b>	9.81	31.49	13.84	10.44	8.45	12.10	14.64	8.82	12.76	14.34	9.29

Table 13. Montana Statewide Green Dry Pea Variety Evaluation – Thousand Kernel Weight (TKW in g) in 2018

Green pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Comfort					226			256			
Aragorn	219		203	223	198			212			
Banner			190		191						
Bluemoon					–						
CDC Dakota					–						
CDC Greenwater					195			218			
Empire					–						
Ginny			201		186						
Greenwood			199		187						
Hampton	231		200	224	192			209			
Majoret	234		221	239	201			228			
PS0877MT457	235		215	237	212			222			
PSO826MT190	219		207	232	184			209			
PSO877MT076	206		204	214	176			194			
Pro 121-7126			216		200						
Pro 121-7127					–						
Pro 131-7123			178		156						
Shamrock			202		189			217			
SW Arcadia											
<i>Mean</i>	224		203	228	193			218			
<i>P-Value</i>	<0.0001		<0.0001	0.1088	<0.0001			<0.0001			
<i>LSD (0.05)</i>	8.6		9.6	NS	6.3			8.1			
<i>CV (%)</i>	2.72		3.28	5.51	2.29			2.63			



Table 14. Montana Statewide Green Dry Pea Variety Evaluation – Test Weight (lb/bu) in 2018.

Green pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Comfort					61.53			62.85	64.10	63.90	64.23
Aragorn		65.78	66.63	62.30	59.97	65.75	64.30	62.40	63.55	63.77	63.67
Banner			67.83		62.20						
Bluemoon					–				64.40		
CDC Dakota					–				64.70		
CDC Greenwater					60.80			62.80	63.85	64.53	64.83
Empire					–				64.15		
Ginny			67.30		60.70				64.20		
Greenwood			68.25		61.25						
Hampton		65.25	68.38	63.58	61.13	65.35	64.85	63.25	63.43	63.17	64.17
Majoret		66.05	68.70	63.30	61.80	65.23	64.98	63.75	64.58	64.33	64.20
PS0877MT457		65.68	68.00	63.90	60.40	65.68	63.20	62.68	64.15	63.40	63.73
PSO826MT190		66.13	67.63	63.50	60.28	65.35	64.53	62.13	63.93	63.63	64.33
PSO877MT076		66.25	67.63	63.50	60.60	65.63	64.68	62.90	63.43	63.30	64.60
Pro 121-7126			67.35		60.33				63.65		
Pro 121-7127					–				63.68		
Pro 131-7123			66.48		59.50				63.83		
Shamrock			69.28		61.15			65.38	64.78		
SW Arcadia									64.15		
<b>Mean</b>		65.85	67.78	63.34	60.84	65.49	64.42	63.13	64.03	64.61	64.22
<b>P-Value</b>		0.9114	0.0003	0.0022	<0.0001	0.7361	0.1028	0.0001	0.0408	0.0003	0.0756
<b>LSD (0.05)</b>		NS	2.28	0.61	0.37	NS	NS	1.04	0.86	0.69	NS
<b>CV (%)</b>		2.07	1.10	0.68	0.43	0.88	1.33	1.17	0.95	0.66	0.68

Table 15. Montana Statewide Green Dry Pea Variety Evaluation – Plant Height (cm) in 2018

Green pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Comfort					50			83	71	44	61
Aragorn	78	63	60	69	36	91	93	75	65	34	52
Banner			60		41						
Bluemoon					–				68		
CDC Dakota					–				74		
CDC Greenwater					52			84	76	51	62
Empire					–				91		
Ginny			67		40				65		
Greenwood			61		39						
Hampton	61	64	66	51	28	87	84	70	61	40	53
Majoret	79	72	69	76	45	94	93	77	64	42	53
PS0877MT457	83	60	68	64	38	86	104	75	70	47	51
PSO826MT190	88	56	66	83	45	86	112	82	81	47	59
PSO877MT076	81	63	61	52	37	89	95	57	65	44	55
Pro 121-7126			61		41				62		
Pro 121-7127					–				76		
Pro 131-7123			68		45				67		
Shamrock			67		48			92	77		
SW Arcadia									54		
<b>Mean</b>	78	63	64	66	42	89	97	77	70	44	56
<b>P-Value</b>	0.0010	0.3924	0.2975	0.0092	<0.0001	0.8895	0.0002	<0.0001	<0.0001	0.0154	0.2309
<b>LSD (0.05)</b>	9.6	NS	NS	16.9	5	NS	9	10.5	8.3	9.8	NS
<b>CV (%)</b>	8.69	16.06	9.56	18.21	8.41	11.64	6.43	9.68	8.52	13.71	10.46

Table 16. Montana Statewide Green Dry Pea Variety Evaluation – Number of Days to Flowering in 2018

Green pea variety/line	Bozeman	Broadview	Conrad	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
AAC Comfort					58			69		56	55
Aragorn	59		56	51	49	53	51	59		50	47
Banner			56		47						
Bluemoon					–						
CDC Dakota					–						
CDC Greenwater					56			65		55	52
Empire					–						
Ginny			57		52						
Greenwood			56		51						
Hampton	70		59	59	57	53	54	64		55	50
Majoret	64		59	59	56	52	54	65		54	51
PS0877MT457	59		56	51	49	52	50	59		50	47
PSO826MT190	67		58	59	55	53	54	64		55	51
PSO877MT076	63		60	58	56	54	55	63		52	50
Pro 121-7126			55		51						
Pro 121-7127					–						
Pro 131-7123			59		54						
Shamrock			60		57			65			
SW Arcadia											
<i>Mean</i>	64		58	56	53	53	53	63		51	50
<i>P-Value</i>	<0.0001		<0.0001	<0.0001	<0.0001	0.3525	<0.0001	<0.0001		<0.0001	<0.0001
<i>LSD (0.05)</i>	1.9		2.1	1.4	1.6	NS	1	0.81		1.1	1.5
<i>CV (%)</i>	2.07		2.58	1.72	2.15	2.91	1.36	0.90		1.27	1.79

## **Multi-Year and Multi-Location Statewide Dry Pea Variety Evaluation Summary**

### **Multi-year (2011-2018) Summary:**

The multi-year grain yield data for different varieties and locations are shown in Table 17. This information was intended to show the stability of varieties across years and locations. But one of the problem with this multi-year data is that every year variety entered in the trial changed and make it difficult for comparison purpose to calculate the mean for a variety across years. This is mainly due to the interest of seed suppliers to test their varieties changing every year. However, this table may provide some information for those interested in the magnitude of yield change across years for only those few varieties submitted/repeated every year in each locations.

Table 17. Montana Statewide Dry Pea Variety Evaluation – 2011-2018 Multi-Year Grain Yield Summary (lb/ac).

Varieties	Bozeman								Conrad							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Yellow Pea</b>																
AC Agassiz		905	1857	2492	1384	2385			2867	2746	1519	2876		3863		
<b>Bridger</b>	2476	1085	1763	2464		2191			3259	2793	1741	2212		4223	2534	2085
Delta	2105	1011	1779		1564	2265	2243	3626	2832	2526	1641			3933	2592	2161
<b>DS Admiral</b>	2206	910	1910	2665	1569	2229	2159	2952	3070	2204	1638	2795		3239	2460	2126
Montech 4152	2378	1074	2019	2444					3066	3116	1862	3456				
<b>Spider</b>	2188	1037	1971						2664	2426	1748	3492		4666	2328	769
SW Midas	2382	1048	1780	2396					2774	2674	1846	3216				
<i>Yellow Ave*</i>	<b>2246</b>	<b>1008</b>	<b>1883</b>	<b>2452</b>	<b>1577</b>	<b>2320</b>	<b>2175</b>	<b>3139</b>	<b>2853</b>	<b>2745</b>	<b>1741</b>	<b>2723</b>		<b>4039</b>	<b>2569</b>	<b>2147</b>
Green Pea																
<b>SW Arcadia</b>	2378	966	1978	2349	1101	2029	2078		3178	2281	1718	3346		4838	2257	
CDC Striker	2081	918	1502	2283	1385				2632	2254	1812	2017				
<b>Cruiser</b>	2152	872	1731	2101		2001			2746	2002	1488	2995		2923		
K2	2018	962	1500						2622	2246	1713	2619				
<b>Majoret</b>	2039	961	1705	2255	1110	2067	2048	2025	2382	2407	1607	2469		2367	2065	1637
Stirling	2184	1088							2651	2746						
<i>Green Ave*</i>	<b>2123</b>	<b>961</b>	<b>1709</b>	<b>2312</b>	<b>1370</b>	<b>2162</b>	<b>2080</b>	<b>1419</b>	<b>2581</b>	<b>2373</b>	<b>1704</b>	<b>1177</b>		<b>4003</b>	<b>2425</b>	<b>2098</b>
Trial Mean <sup>§</sup>	2177	986	1811	2385	1504	2250	2123		2702	2577	1734	2798		4023	2500	
<b>LSD (0.05) <sup>§</sup></b>	NS	144	NS	NS	70	288	176		NS	NS	483	NS		1110	596	
CV (%) <sup>§</sup>	7	10	11	14	16	9.04	5.84		14	29	20	32		19.51	16.87	

<sup>§</sup>Indicate results when both green and yellow dry peas combined and analyzed together for year 2011 to 2017 only.

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Table 17. Statewide Dry Pea Variety Evaluations – 2011 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Varieties	Corvallis								Creston							
	2011	2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	
<b>Yellow Pea</b>																
AC Agassiz		2812	1902	1066	2169	3535			2282		4868	1172	6274			
Bridger	1862	3170	2525	1593		2382			3747	4440	4632		5201			
Delta	1674	2987	2594		2410	2519			3352	4020		889	5143	5865	5865	
DS Admiral	1770	2518	2385	1622	2396	3005			3468	1065	5018	1192	5699	5793	5464	
Montech 4152	1946	2899	2096	1395					4017	4346	5009					
Spider	2155	2899	1503						3657	4440	4890		5204			
SW Midas	1998	3064	2333	1495					3340	3912	4888					
<b>Yellow Ave*</b>	<b>1865</b>	<b>2907</b>	<b>2306</b>	<b>1350</b>	<b>2405</b>	<b>2692</b>			<b>3494</b>	<b>4404</b>	<b>5016</b>	<b>1144</b>	<b>5414</b>	<b>5804</b>	<b>5761</b>	
Green Pea																
SW Arcadia	2272	3029	2704	1295	2499				3545	4701	4283	1155		5935		
CDC Striker	1866	2375	2053	1354	1960				3126	3391	3934	1137				
Cruiser	1967	2562	1543	1384		2631			2763	3150	4605		4737			
K2	1894	2470	2000						2982	3418						
Majoret	1641	2447	1439	1570	2136	1710			3082	4303	4430	1243	5024	5185	4521	
Stirling	1475								3278							
<b>Green Ave*</b>	<b>1750</b>	<b>2630</b>		<b>1380</b>	<b>2327</b>	<b>2258</b>			<b>3129</b>	<b>3907</b>	<b>4462</b>	<b>1142</b>	<b>4717</b>	<b>5135</b>	<b>5120</b>	
Trial Mean <sup>§</sup>	1801	2779	2203	1362	2376	2551			3326	4215	4814	1098	5193	5495		
LSD (0.05) <sup>§</sup>	NS	1057	950	NS	NS	733			598	498	710	393	888	456		
CV (%) <sup>§</sup>	23	14	30	17	31	20.32			12.59	8.36	10.43	25.32	12.10	5.87		

<sup>§</sup>Indicate results when both green and yellow dry peas combined and analyzed together for year 2011 to 2017 only.

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Table 17. Statewide Dry Pea Variety Evaluations – 2011 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Varieties	Havre								Huntley (Dry)							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Yellow Pea</b>																
AC Agassiz	2236	1965	2027	2215	1479	2537		2685	1965		1144	1616				
Bridger	2149	1837	2127	1920	1561	2065	892	2557	2360	1975	2687	892	1447	536		
Delta	2139	2222	1700		1793	2132	1322	2596	1904	1414	2648		1635	829	1542	3178
DS Admiral	2102	1798	2008	2592	1897	2562	1516	2380	2128	1261	2840	1223	1733	716	1752	3365
Montech 4152	2266	2146	1828	2056					2337	1491	2637	1103				
Spider	2071	1903	1734	1953	1526	2259	997	1835	2283	1220	2710	1012	1547	874		
SW Midas	2111	1729	2033	2100					2106	1855	2745	1151				
<i>Yellow Ave*</i>	<b>2173</b>	<b>2039</b>	<b>2032</b>	<b>2228</b>	<b>2199</b>	<b>2438</b>	<b>1330</b>	<b>2555</b>	<b>2065</b>	<b>1630</b>	<b>2707</b>	<b>1126</b>	<b>1644</b>	<b>692</b>	<b>1179</b>	<b>3285</b>
<b>Green Pea</b>																
SW Arcadia	2405	1930	2598	1817	1782	2479	1174		2224	1639		956	1617	541	1663	
CDC Striker	2012	1953	1571	1833	1528				1568	1128		986	1541			
Cruiser	2286	1735	1669	1856		2008			1998	1232	2566	991				
K2	1576	1463	1650	1773					2092	1525		821				
Majoret	1612	1685	2193	2105	1822	2459	1220	2382	1660	1331		1128	1307	693	1324	3584
Stirling	1915	2122							1527	1942						
<i>Green Ave*</i>	<b>1987</b>	<b>1874</b>	<b>2011</b>	<b>2080</b>	<b>1806</b>	<b>2265</b>	<b>1288</b>	<b>2516</b>	<b>1729</b>	<b>1482</b>	<b>2442</b>	<b>1042</b>	<b>1581</b>	<b>667</b>	<b>1524</b>	<b>3381</b>
Trial Mean <sup>§</sup>	2069	1968	2022	2170	1776	2370	1312		1878	1556	2634	1096	1623	683	1635	
LSD (0.05) <sup>§</sup>	NS	309	447	294	285	284	174		NS	NS	300	295	NS	245	196	
CV (%) <sup>§</sup>	13	11	14	10	11	8.47	9.38		20	29	8	19	15	25.32	8.48	

<sup>§</sup>Indicate results when both green and yellow dry peas combined and analyzed together for year 2011 to 2017 only.

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Table 17. Statewide Dry Pea Variety Evaluations – 2010 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Varieties	Joplin								Moccasin									
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018		
<b>Yellow Pea</b>																		
AC Agassiz									1123	1100	559	2220	2287	1545			2736	
Bridger	773	1387							1160	1064	1826	2176			1275	2898		
Delta	775	1454							963	1313	1899			2644	1405	796	3066	
DS Admiral	1012	1299							999	1295	1835	2213	2731	1428	1155	2784		
Montech 4152	1040	1679							1018	1084	1791	2176						
Spider	908	1202							1005	1252	1750	2069	2702	1392			2731	
SW Midas	1060	1702							1031	1165	1557	2019						
<b>Yellow Ave*</b>	<b>969</b>	<b>1454</b>							<b>992</b>	<b>1241</b>	<b>1678</b>	<b>2165</b>	<b>2654</b>	<b>1445</b>	<b>952</b>	<b>2858</b>		
Green Pea																		
SW Arcadia	1142	2017							978	1186	1655	2010	2333	1186			876	
CDC Striker	606	1517							774	1193	1753	2156	2212					
Cruiser	977	1517							988	1123	1502	1860			1155			
K2	748	1457							851	1457	1259	1780						
Majoret	465	1688							848	1027	1584	2054	2867	1265	839	2358		
Stirling	1257	1854							838	1392								
<b>Green Ave*</b>	<b>790</b>	<b>1686</b>							<b>887</b>	<b>1200</b>	<b>1594</b>	<b>2029</b>	<b>2505</b>	<b>1303</b>	<b>863</b>	<b>2702</b>		
Trial Means <sup>§</sup>	870	1570							934	1224	1640	2113	2603	3160			914	
LSD (0.05) <sup>§</sup>	NS	NS							120	NS	291	245	412	1023			251	
CV (%) <sup>§</sup>	46	23							9	16	13	8	11	22.89			19.6	

<sup>§</sup>Indicate results when both green and yellow dry peas combined and analyzed together for year 2011 to 2017 only.

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Table 17. Statewide Dry Pea Variety Evaluations – 2011 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Varieties	Richland								Sidney dryland							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Yellow Pea</b>																
AC Agassiz	2224	3242	4107	1359	1596	5538		3242		1619		2436		3915		2105
Bridger	2494	3878	3323	1145	1875	5791	863	2728	2998	1249		1983		3865		
Delta	1501	3706	3573		1923	5459	911	2995	2662	1464				3628	405	1384
DS Admiral	1664	3564	3645	1153	1735	5166	1004	2195	2517	1158		2693		3591	376	1753
Montech 4152	1809	3409	3786	1216					2463	1586		2521				
Spider	1910	1252	3959	1296	1859	5428	719	2348	2504	1297						
SW Midas	2166	2983	3873	1034		5112			2589	1571		2909		3715		
<b>Yellow Ave*</b>	<b>1855</b>	<b>3566</b>	<b>3807</b>	<b>1200</b>	<b>1908</b>	<b>5541</b>	<b>1006</b>	<b>2739</b>	<b>2502</b>	<b>1421</b>		<b>2604</b>		<b>3924</b>	<b>306</b>	<b>1887</b>
<b>Green Pea</b>																
SW Arcadia	1494	3143	3777	1182	2273	5865	669	2371	2772	1302		2575		3783		280
CDC Striker	1732	3270	2914	1125	1652				2212	1122		2594				
Cruiser	1684	3010	3289	998		5291			2223	1202		2440		3294		
K2	1772	3476	2803						2296	1435				3468		
Majoret	1653	3078	3022	1275	1873	4897	744	1937	2233	1336				3819	236	1381
Stirling	1493	3725							2601	2041						
<b>Green Ave*</b>	<b>1628</b>	<b>3410</b>	<b>3440</b>	<b>1127</b>	<b>1907</b>	<b>5166</b>	<b>935</b>	<b>2696</b>	<b>2341</b>	<b>1406</b>		<b>2515</b>		<b>3571</b>	<b>264</b>	<b>1686</b>
Trial Mean <sup>§</sup>	1729	3501	3622	1172	1908	5416	980		1659	1414		2569		3784		289
LSD (0.05) <sup>§</sup>	289	NS	777	NS	NS	737	254		NS	465		NS		572		93
CV (%) <sup>§</sup>	10	16	15	30	17	9.62	18.6		14	20		13		10.69		19.7

<sup>§</sup>Indicate results when both green and yellow dry peas combined and analyzed together for year 2011 to 2017 only.

Table 18. Claims and/or Resistance of Commercial Pea Varieties  
 (This table is claims made by the breeding programs and/or commercial dealers and is not based on research conducted by MAES or EARC).

Variety*	Powdery Mildew Resistant <sup>1</sup>	Lodging Resistant <sup>2</sup>	Height	<i>Fusarium</i> Resistance <sup>3</sup>	Bleach Resistant <sup>4</sup>	Maturity
AC Agassiz	X	X				
Aragorn		X			X	Med
Arcadia	X	X				Early
Banner		X				Early
Bluemoon	X	X	Tall			Med
Bridger	X	X	Tall			Early
CDC Striker			Med			Med
CDC Treasure	X	X				
Cruiser		X		X		Med
Daytona	X	X	Tall			Med
Delta				X		
DS Admiral	X	X				Early
Jet Set	X	X				Med
K2	X	X			X	Early
Korando						Early
Majoret		X				Med
Montech 4152			Tall			
Navarro	X	X				Early
Spider	X	X				Med
SW Midas	X	X				Early
Trapeze	X	X	Med			Early

<sup>1</sup>Varieties exhibit above average resistance to Powdery Mildew; <sup>2</sup>Varieties have above average resistance to lodging;

<sup>3</sup>Varieties are resistant to *Fusarium*; <sup>4</sup>Varieties are resistant to bleaching; \*Because some of the breeding varieties have not been registered and released as varieties and lack of information for others, this table is not complete and inclusive.

## **Lentil**

### **Lentil Variety Evaluation in 2018**

A total of 17 lentil varieties/experimental lines were tested in this statewide lentil variety evaluation trial at 11 locations. The data from Corvallis (Western Agricultural Research Center) was not ready for this report due to late harvest. The plant stands at Huntley dryland and Sidney dryland were poor and data from these locations not included in this report.

#### ***Lentil grain yield***

Substantial yield differences were recorded from location to location. The mean grain yield for the different locations ranging from 673 lb/ac to 2646 lb/ac (Table 20). Average lentil yields were 1117 lb/ac at Bozeman, 1180 lb/ac at Conrad, 2646 lb/ac at Creston, 1080 lb/ac at Havre, 673 lb/ac at Huntley (irrigated), 1876 lb/ac at Moccasin, 1651 lb/ac at Richland and 1236 at Sidney irrigated. The differences in grain yield among entries within a location were significant (Table 20).

#### ***Lentil TKW***

The thousand kernel weight (TKW) data were measured in most of the locations (Table 21). The mean TKW ranging from 32 g per 1000 seeds recorded at Bozeman to 36 gm per 1000 seeds recorded at Conrad. These TKW mean data showed significance differences among entries within a location (Table 21).

#### ***Lentil test weight***

The mean test weight varied from location to location. The test weight differences among entries within a location were significant for all locations except Huntley irrigated (Table 22). The mean test weight ranged from 57.42 lb/bu measured at Huntley irrigated to 65.69 lb/bu recorded at Moccasin (Table 22).

#### ***Lentil plant height***

The mean plant height ranging from 21 cm recorded at Havre to 41 cm recorded at Huntley under irrigation (Table 23). Plant height differences among entries within a location were significant for all location except Richland and Sidney irrigated.

***Lentil number of days to flowering***

The mean number of days to flowering ranging from 59 days recorded at Conrad to 68 days recorded at Bozeman (Table 24). The differences in mean number of days to flowering were significant for the different entries at each location.

Table 19. Lentil variety sources and characteristics

Variety*	Type	Maturity <sup>1</sup>	Breeding Program <sup>2</sup>	Release Date
<b>Large Green</b>				
CDC Greenland	Green	Mod	CDC	2006
Merrit	Green			
Riveland	Green			
<b>Medium Green</b>				
Avondale	Green		USDA	
CDC Richlea	Green		CDC	
Imi-Green	Green			
Impress CL	Green			
<b>Small Green</b>				
Eston	Green			
Viceroy	Green			
<b>Small Red</b>				
Crimson	Red	Mod	USDA	1990
CDC Impact	Red		CDC	
CDC Impala CL	Red		CDC	
CDC Red Coats	Red		CDC	
CDC Redberry	Red	Mod	CDC	2004
<b>Spanish Brown</b>				
Morena	brown			
Pardina	brown			

<sup>1</sup>Compared to trial means; <sup>2</sup> Refers to developer: CDC = Crop Development Centre, University of Saskatchewan; NDSU = North Dakota State University; USDA = USDA-ARS Grain Legume Genetics and Physiology Research.

The variety characteristics in this table are not complete and inclusive due to lack of information.

Table 20. Montana Statewide Lentil Variety Evaluations – Grain Yield (lb/ac) in 2018.

Variety/lines	Bozeman	Conrad	Corvallis <sup>±</sup> (Irri.)	Creston	Havre	Huntley* (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney* (Dry)	Sidney (Irri.)
Avondale	1595	1062		3314	1398		1081	2330	1993		1489
CDC Impala CL	1345	1412		3290	1062		1026	1770	1690		1466
CDC Invincible CL	1039	1194		2877	1269		1432	1934	1769		1683
CDC Maxim CL	1478	1195		3032	1321		1349	2177	2094		1439
CDC Richlea	1296	1326		3357	1232		1091	2103	1886		1492
LC08600113P	–	1377		–	1523		–	–	1595		–
LC146000088R	–	1406		–	1207		–	–	1967		–
LC146000100L	–	1180		–	1066		–	–	1799		–
LC99709065	990	1053		2638	1165		509	1937	1684		1271
LC9976079	803	809		2214	605		344	1644	1377		1197
LC9977019	1250	1128		2231	1146		402	2098	1544		987
LC9977116	938	1289		2722	1051		529	1856	1729		962
LC99780571	549	1078		2554	639		352	1608	1431		679
LC9978094	590	1075		1960	598		234	1431	1265		785
LC9979016	908	1269		2130	985		256	1673	1318		1402
LC9979120	1085	1096		1929	918		286	1605	1410		1356
WA8649090	1778	1104		2810	1180		534	2111	1552		1100
<b>Mean</b>	1117	1180		2646	1080		673	1876	1651		1236
<b>P-Value</b>	<0.0001	0.0001		<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		0.0011
<b>LSD (0.05)</b>	239	204		510	128		199	218	173		413
<b>CV (%)</b>	15.12	12.35		13.63	8.44		20.95	8.22	7.39		20.49

<sup>±</sup>Data was not available for this report due to late harvesting; \*Trials were abandoned from Huntley dryland and Sidney dryland due to poor plant stands.

Table 21. Montana Statewide Lentil Variety Evaluations – Thousand Kernel Weight (TKW) (in g) in 2018

Variety/lines	Bozeman	Conrad	Corvallis (Irri.)	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
Avondale	43	48		46	42			48			
CDC Impala CL	28	25		29	26			26			
CDC Invincible CL	30	28		28	27			28			
CDC Maxim CL	35	35		33	31			36			
CDC Richlea	43	49		46	43			51			
LC08600113P	–	36		–	37			–			
LC146000088R	–	46		–	43			–			
LC146000100L	–	76		–	66			–			
LC99709065	31	29		34	28			33			
LC9976079	31	31		33	28			34			
LC9977019	31	31		33	30			38			
LC9977116	31	32		33	30			34			
LC99780571	31	31		32	27			32			
LC9978094	29	32		33	30			34			
LC9979016	27	31		32	27			32			
LC9979120	26	27		29	25			29			
WA8649090	28	27		30	26			29			
<b>Mean</b>	32	36		34	33			34			
<b>P-Value</b>	<0.0001	<0.0001		<0.0001	<0.0001			<0.0001			
<b>LSD (0.05)</b>	2	3.18		2.19	1.4			2.3			
<b>CV (%)</b>	4.53	6.39		4.61	2.92			4.77			

Table 22. Montana Statewide Lentil Variety Evaluations – Test Weight (lb/bu) in 2018

Variety/lines	Bozeman	Conrad	Corvallis (Irr.)	Creston	Havre	Huntley (Dry)	Huntley (Irr.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irr.)
Avondale		60.10		62.18	62.05		58.08	63.25	63.80		62.40
CDC Impala CL		63.90		65.08	65.58		59.93	66.80	66.38		65.93
CDC Invincible CL		62.98		64.10	64.68		59.35	65.75	65.53		64.90
CDC Maxim CL		62.13		64.05	64.00		58.50	65.33	64.98		63.80
CDC Richlea		60.08		61.15	61.25		58.58	62.65	63.05		61.90
LC08600113P		62.60		–	64.33		–	–	–	–	–
LC146000088R		60.73		–	61.87		–	–	–	–	–
LC146000100L		58.07		–	59.00		–	–	–	–	–
LC99709065		63.50		65.70	66.13		59.48	66.48	66.25		65.53
LC9976079		58.70		64.55	65.38		53.40	65.95	65.75		64.87
LC9977019		62.85		63.95	65.35		58.93	65.80	65.40		65.03
LC9977116		62.98		64.65	65.45		53.33	66.18	65.75		65.30
LC99780571		63.50		64.88	65.35		57.85	66.40	65.98		65.13
LC9978094		63.08		64.80	64.85		60.88	66.08	65.63		64.95
LC9979016		63.48		64.18	65.50		54.08	66.03	66.00		65.33
LC9979120		63.45		64.40	65.90		59.68	66.35	65.88		65.30
WA8649090		63.23		64.38	65.88		51.80	66.70	66.00		65.47
<b>Mean</b>		62.08		64.14	64.38		57.42	65.69	64.98		64.70
<b>P-Value</b>		<0.0001		<0.0001	<0.0001		0.7315	<0.0001	<0.0001		<0.0001
<b>LSD (0.05)</b>		2.34		0.66	0.26		NS	0.32	0.495		0.39
<b>CV (%)</b>		2.67		0.73	0.29		12.06	0.35	0.54		0.43

Table 23. Montana Statewide Lentil Variety Evaluations – Plant Height (cm) in 2018

Variety/lines	Bozeman	Conrad	Corvallis (Irri.)	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
Avondale	36	29		24	25		43	36	39		45
CDC Impala CL	32	27		35	26		44	39	35		37
CDC Invincible CL	35	29		28	21		44	34	36		41
CDC Maxim CL	39	29		36	23		48	40	37		36
CDC Richlea	29	29		29	23		46	36	40		43
LC08600113P	–	31		–	20		–	–	37		–
LC146000088R	–	33		–	27		–	–	41		–
LC146000100L	–	29		–	23		–	–	37		–
LC99709065	27	27		23	19		38	35	35		39
LC9976079	31	28		23	20		40	33	37		40
LC9977019	25	29		24	17		41	29	34		41
LC9977116	28	27		21	16		40	29	36		45
LC99780571	26	29		24	15		35	28	37		37
LC9978094	28	32		23	16		39	28	36		38
LC9979016	30	30		22	22		44	32	38		41
LC9979120	25	31		26	18		40	29	34		43
WA8649090	25	25		26	20		36	30	38		37
<i>Mean</i>	30	29		26	21		41	33	37		40
<i>P-Value</i>	0.0174	0.0016		<0.0001	<0.0001		0.0057	<0.0001	0.3130		0.7062
<i>LSD (0.05)</i>	7.9	2.9		5.9	1.9		6.2	3.8	NS		NS
<i>CV (%)</i>	19.13	7.13		16.01	6.5		10.62	8.14	9.74		14.81



Table 24. Montana Statewide Lentil Variety Evaluations – Number of Days to Flowering in 2018

Variety/lines	Bozeman	Conrad	Corvallis (Irri.)	Creston	Havre	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (Dry)	Sidney (Irri.)
Avondale	64	55		55	54			60			48
CDC Impala CL	69	61		61	57			64			55
CDC Invincible CL	67	59		61	57			64			55
CDC Maxim CL	64	56		59	55			62			50
CDC Richlea	65	57		61	55			63			51
LC08600113P	–	54		–	53			–	–	–	–
LC146000088R	–	59		–	57			–	–	–	–
LC146000100L	–	55		–	58			–	–	–	–
LC99709065	72	60		65	59			68			59
LC9976079	71	60		63	59			65			62
LC9977019	67	56		60	53			62			53
LC9977116	68	61		60	56			63			55
LC99780571	68	60		64	59			65			53
LC9978094	71	61		62	62			66			60
LC9979016	70	63		66	62			70			68
LC9979120	71	65		69	61			70			67
WA8649090	69	60		66	59			69			59
<b>Mean</b>	68	59		62	57			65			57
<b>P-Value</b>	<0.0001	0.0015		<0.0001	<0.0001			<0.0001			<0.0001
<b>LSD (0.05)</b>	1.7	4.6		3.4	1.7			0.9			2.8
<b>CV (%)</b>	1.78	5.62		3.84	2.117			0.98			5.27

**Multi-Year and Multi-Location Statewide Lentil Variety Evaluation Summary**

Table 25. Statewide Lentil Variety Evaluations – 2011 – 2018 Multi-year grain yield summary (lb/ac)

Variety	Bozeman								Conrad							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Small Green</b>																
Essex	1538	462		1839					2842	1823		1865				
<b>Medium Green</b>																
Brewer	1340	528							2034	1120						
CDC Richlea	1534	569	1400	1911	1113	1522	1644	1296	2307	1800	1698	1752	665	3288	2035	1326
Avondale	1578	685	1745	1919	1083	1238	1651	1595	2284	1696	1501	1597	535	2226	2096	1062
<b>Large Green</b>																
Merrit	1360	607		1444					2151	1243		1744				
Riveland	1558	567		1736					1821	1464		1616				
<b>Small Red</b>																
Crimson	1281	588	1424	1725					1762	1543	1039	1590				
CDC	1400		1348	1700					2318	1338	1351	1869				
<i>Mean</i>	<i>1476</i>	<i>560</i>	<i>1363</i>	<i>1723</i>	<i>974</i>	<i>1315</i>	<i>1510</i>	<i>1117</i>	<i>2227</i>	<i>1496</i>	<i>1460</i>	<i>1682</i>	<i>716</i>	<i>2636</i>	<i>1979</i>	<i>1180</i>
<i>LSD (0.05)</i>	<i>138</i>	<i>98</i>	<i>167</i>	<i>NS</i>	<i>NS</i>	<i>217</i>	<i>132</i>	<i>239</i>	<i>NS</i>	<i>NS</i>	<i>236</i>	<i>NS</i>	<i>NS</i>	<i>550</i>	<i>NS</i>	<i>204</i>
<i>CV (%)</i>	<i>7</i>	<i>12</i>	<i>8</i>	<i>19</i>	<i>14</i>	<i>9</i>	<i>6.17</i>	<i>15.12</i>	<i>21</i>	<i>25</i>	<i>11</i>	<i>24</i>	<i>60</i>	<i>14</i>	<i>22.00</i>	<i>12.35</i>
Variety	Corvallis								Creston							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Small Green</b>																
Essex		536		450					2091	1409		1299				
<b>Medium Green</b>																
Brewer		405							1464	1250						
CDC Richlea		893	1330	471	1735	1299	942		1873	1625	1303	1753	969	2674	4170	3357
Avondale		837	1387	528	1421	927	667		2024	1790	1244	1625	925	2992	4524	3314
<b>Large Green</b>																
Merrit		394		536					1730	1038		1094				
Riveland		552		340					1547	1310		710				
<b>Small Red</b>																
Crimson		838	951	365					2095	1245	1238	1021				
CDC		706	795	540					2090		1816	1851				
<i>Mean</i>		<i>700</i>	<i>1155</i>	<i>511</i>	<i>1366</i>	<i>1066</i>	<i>726</i>		<i>1822</i>	<i>1345</i>	<i>1347</i>	<i>1409</i>	<i>911</i>	<i>2894</i>	<i>3613</i>	<i>2646</i>
<i>LSD (0.05)</i>		<i>354</i>	<i>222</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>		<i>NS</i>	<i>421</i>	<i>279</i>	<i>136</i>	<i>NS</i>	<i>460</i>	<i>452</i>	<i>510</i>
<i>CV (%)</i>		<i>36</i>	<i>13</i>	<i>35</i>	<i>32</i>	<i>33</i>	<i>33.10</i>		<i>22</i>	<i>22</i>	<i>14</i>	<i>28</i>	<i>26</i>	<i>11</i>	<i>8.86</i>	<i>13.63</i>

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Table 25. Statewide Lentil Variety Evaluations – 2011 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Variety	Havre								Huntley (Dry)							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016*	2017	2018
<b>Small Green</b>																
Essex	1838			2131					784	569		843				
<b>Medium Green</b>																
Brewer	1024	1121							402	583						
CDC Richlea	1743	830	1530	1649	1081	2991	1557	1232	873	734	1585	699	987	315	1247	
Avondale	1385	874	1483	1808	1046	3170	1663	1398	877		1767	718	1274	133	1210	
<b>Large Green</b>																
Merrit	1127	977		1306					717	523		499				
Riveland	968	1033		1282					717	727		557				
<b>Small Red</b>																
Crimson	1705	902	625	1685					458	607	1683	578				
CDC Redberry	904	846	760	1440					819	620	1956	412				
<b>Mean</b>	<b>1362</b>	<b>830</b>	<b>1123</b>	<b>1557</b>	<b>912</b>	<b>2869</b>	<b>1345</b>	1080	<b>672</b>	<b>614</b>	<b>1690</b>	<b>650</b>	<b>1100</b>	<b>295</b>	<b>1049</b>	
<b>LSD (0.05)</b>	<b>299</b>	<b>179</b>	<b>173</b>	<b>352</b>	<b>27</b>	<b>301</b>	<b>139</b>	128	<b>NS</b>	<b>167</b>	<b>NS</b>	<b>141</b>	<b>NS</b>		<b>113</b>	
<b>CV (%)</b>	<b>10</b>	<b>15</b>	<b>11</b>	<b>15</b>	<b>7</b>	<b>7</b>	<b>7.32</b>	8.44	<b>54</b>	<b>19</b>	<b>16</b>	<b>15</b>	<b>17</b>		<b>7.58</b>	
Variety	Joplin								Moccasin							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Small Green</b>																
Essex	726	2521								1743		2036	918	809	1713	
<b>Medium Green</b>																
Brewer	350	2027							730	756						
CDC Richlea	616	1919							1100	958	1904	1672	952	1513	824	2103
Avondale	581	2421							903	955	1859	1440	751	1445	801	2330
<b>Large Green</b>																
Merrit	546	2127							771	838		1258				
Riveland	247	2303							926	827		1519				
<b>Small Red</b>																
Crimson	774	1479							911	907	1403	1087				
CDC Redberry	785	1717							764		1491	1456				
<b>Mean</b>	<b>624</b>	<b>2077</b>							<b>888</b>	<b>833</b>	<b>1538</b>	<b>1383</b>	<b>754</b>	<b>1326</b>	<b>702</b>	1876
<b>LSD (0.05)</b>	<b>NS</b>	<b>NS</b>							<b>NS</b>	<b>144</b>	<b>320</b>	<b>248</b>	<b>NS</b>	<b>233</b>	<b>204</b>	218
<b>CV (%)</b>	<b>44</b>	<b>20</b>							<b>24</b>	<b>12</b>	<b>15</b>	<b>13</b>	<b>27</b>	<b>12</b>	<b>19.85</b>	8.22

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Table 25. Statewide Lentil Variety Evaluations – 2011 – 2018 Multi-year Grain Yield Summary (lb/ac)...continued

Variety	Richland								Sidney (Dry)							
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
<b>Small Green</b>																
Essex	1097	1705		441					1737	458		1057				
<b>Medium Green</b>																
Brewer	581	1882							1061	184						
CDC Richlea	1077	1874	1914	755	1138	1346	1046	1886	1594	530		1170		2325	85	
Avondale	1398	2041	2193	582	1075	1678	1098	1993	1774	453		982		2315	276	
<b>Large Green</b>																
Merrit	880	1710		371					1418	222		704				
Riveland	836	1712		398					1413	401		821				
<b>Small Red</b>																
Crimson	859	1734	1573	287					981	261		947				
CDC Redberry	933	1743	1582	524					1604	448		867				
<i>Mean</i>	<i>945</i>	<i>1666</i>	<i>1896</i>	<i>479</i>	<i>999</i>	<i>1567</i>	<i>960</i>	1651	<i>1444</i>	<i>371</i>		<i>938</i>		<i>2200</i>	<i>190</i>	
<i>LSD (0.05)</i>	<i>392</i>	<i>332</i>	<i>603</i>	<i>206</i>		<i>2</i>	<i>NS</i>	173	<i>434</i>	<i>NS</i>		<i>165</i>		<i>Ns</i>	<i>95</i>	
<i>CV (%)</i>	<i>25</i>	<i>12</i>	<i>22</i>	<i>31</i>		<i>10</i>	<i>14.42</i>	7.39	<i>17</i>	<i>42</i>		<i>12</i>		<i>26</i>	<i>20.56</i>	

## Chickpea

### Chickpea Variety Evaluation in 2018

The statewide chickpea variety evaluation includes nine Kabuli types and one Desi type, and were tested at nine locations. Grain yield results from Sidney was very low due to deer damage. Deer ate the pods. The mean grain yield for all locations ranging from 261 lb/ac to 3067 lb/ac. The mean grain yields were 3067 lb/ac at Bozeman, 1992 lb/ac at Conrad, 2935 lb/ac at Corvallis, 2983 lb/ac at Huntley dryland, 1578 lb/ac Huntley irrigated, 1666 lb/ac at Moccasin, 1099 lb/ac at Richland, 261 lb/ac Sidney dryland, and 2774 lb/ac Sidney irrigated (Table 27). The mean grain yield differences for the different entries were significant for all locations except Huntley dryland.

We also evaluated the seed size from Bozeman, Sidney dryland, Sidney irrigated and Richland locations using sieve with 8.73 mm (22/64) diameter round openings. The results are shown in Table 28. On average, CDC Orion, CDC Palmer and Nash had 50, 51 and 50% of their seeds above 22/64, respectively (Table 28). All the seeds for the variety Myles (Desi type) has seeds less than 22/64. Among locations, mean seed size was higher at Richland than other locations.

Table 26. Chickpea variety type and characteristics

Variety	Type
Dwellely	Kabuli
CDC Alma	Kabuli
CDC Frontier	Kabuli
CDC Leader	Kabuli
CDC Orion	Kabuli
Myles	Desi
Nash	Kabuli
Royal	Kabuli
Sawyer	Kabuli
Sierra	Kabuli

Table 27. Statewide Chickpea Variety Evaluation – Yield (lb/ac) in 2018

Variety/lines	Bozeman	Conrad	Corvallis (Irri.)	Huntley (Dry)	Huntley (Irri.)	Moccasin	Richland	Sidney (dry) <sup>±</sup>	Sidney (Irri.)
CDC Frontier	3528	1925	3740	3139	2017	1787	1581	397	3445
CDC Leader	3122	2018	2988	2796	2657	1725	1275	448	3422
CDC Orion	3456	2203	3369	2597	1725	2014	1290	192	3701
CDC Palmer	3178	2200	3056	3171	3150	1788	1342	565	3428
GNC-18010	–	–	–	–	–	–	1287	–	–
Myles	2842	1828	3218	2792	2338	1571	1036	547	2584
Nash	2918	1694	2383	3415	209	1748	908	8	2037
Royal	2931	2157	3092	2803	240	1473	627	32	1993
Sawyer	3022	2115	2693	3161	1361	1629	937	150	2346
Sierra	2606	1786	1874	2980	507	1260	706	14	2012
<b>Mean</b>	3067	1992	2935	2983	1578	1666	1099	261	2774
<b>P-Value</b>	0.0001	0.0059	0.0198	0.0712	<0.0001	0.0016	<0.0001	<0.0001	0.0009
<b>LSD (0.05)</b>	339	280	914	NS	586	284	227	154	809
<b>CV (%)</b>	7.87	9.97	22.04	11.80	26.17	12.07	14.44	36.20	17.86

\*Yield from Sidney dryland was low due to deer damage and low soil moisture stress and plant stand was not uniform resulting high CV.

Table 28. Mean percent of seed size of chickpea entries with seed size greater than 8.73 mm (22/64) diameter at Bozeman, Sidney dryland, Sidney irrigated and Richland in 2018.

Variety	Percent of seed size > 8.73 mm (22/64) diameter			
	Bozeman	Richland	Sidney Dryland	Sidney Irrigated
CDC Frontier	51.3	48.5	40.1	16.4
CDC Leader	58.4	58.5	42.1	31.4
CDC Orion	47.7	72.4	28.5	49.7
CDC Palmer	56.8	67.0	49.2	32.7
GNC-18010	---	14.1	---	---
Myles	0.0	0.0	0.0	0.0
Nash	13.2	79.3	39.9	66.2
Royal	24.6	61.2	20.9	35.8
Sawyer	51.8	80.7	39.0	12.6
Sierra	20.7	63.9	25.3	34.9
<b>Mean</b>	<b>36.5</b>	<b>54.5</b>	<b>31.7</b>	<b>31.1</b>
<b>P-Value</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
<b>LSD (0.05)</b>	<b>9.3</b>	<b>18.0</b>	<b>12.0</b>	<b>13.0</b>
<b>CV (%)</b>	<b>18.08</b>	<b>22.68</b>	<b>23.32</b>	<b>25.66</b>

## Multi-Year and Multi-Location Statewide Chickpea Variety Evaluation Summary

Table 29. Multi-Year and Multi-Location Statewide Chickpea Variety Evaluations – 2014–2018 - Grain Yield Summary (lb/ac). Trial means, LSD and CV are from Table 31 that include other entries.

Variety	Bozeman					Conrad				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BGC08008M										
BGC08009M										
BGC090016										
BGC090023										
CA0790B0042C										
CA0790B0547C										
CA0790B0549C										
CAO890B0427C										
CDC Alma	1458			2244		214		3172	2305	
CDC Frontier				2748	3528			5463	2349	1925
CDC Orion	1923			2490	3456	118		3662	2756	2203
Myles	1821			2014	2842	476		3306	2267	1828
<i>Mean</i>	<i>1734</i>			<i>2305</i>	<i>3067</i>	<i>269</i>		<i>3963</i>	<i>2435</i>	<i>1992</i>
<i>LSD (0.05)</i>	<i>NS</i>			<i>449</i>	<i>339</i>	<i>189</i>		<i>754</i>	<i>NS</i>	<i>280</i>
<i>CV (%)</i>	<i>24</i>			<i>13</i>	<i>7</i>	<i>43</i>		<i>13</i>	<i>13</i>	<i>9</i>
Variety	Huntley (irri.)					Moccasin				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BGC08008M										
BGC08009M										
BGC090016										
BGC090023										
CA0790B0042C										
CA0790B0547C										
CA0790B0549C										
CAO890B0427C										
CDC Alma	3082		3012	1889		1036			15	
CDC Frontier		2970	4592	3774	2017	1020	1337		20	1787
CDC Orion	3598	3191	3494	3076	1725	999	1477		38	2014
Myles	2979	2474	3379	3199	2338	1566	1164		718	1571
<i>Mean</i>	<i>3219</i>	<i>2707</i>	<i>3844</i>	<i>2424</i>	<i>1578</i>	<i>871</i>	<i>1155</i>		<i>106</i>	<i>1666</i>
<i>LSD (0.05)</i>	<i>510</i>	<i>459</i>	<i>NS</i>	<i>677</i>	<i>586</i>	<i>307</i>	<i>NS</i>		<i>88</i>	<i>284</i>
<i>CV (%)</i>	<i>9</i>	<i>11</i>	<i>29</i>	<i>19</i>	<i>26</i>	<i>24</i>	<i>21</i>		<i>56</i>	<i>127</i>

-----Continued -----



Table 29. Multi-Year and Multi-Location Statewide Chickpea Variety Evaluations – 2014– 2017  
 - Grain Yield Summary (lb/ac). Trial means, LSD and CV are from Table 31 that include  
 other entries.

Variety	Corvallis (irri.)					Richland				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BGC08008M										
BGC08009M										
BGC090016										
BGC090023										
CA0790B0042C										
CA0790B0547C										
CA0790B0549C										
CAO890B0427C										
CDC Alma	734			773		599		186	409	
CDC Frontier				1479	3740	838	2020	277	294	1581
CDC Orion	934			1500	3369	416	1958	135	168	1290
Myles	1155			1285	3218	922	1027	87	257	1036
<b>Mean</b>	<b>1087</b>			<b>1240</b>	2935	<b>459</b>	<b>1619</b>	<b>137</b>	<b>306</b>	1099
<b>LSD (0.05)</b>	<b>NS</b>			<b>NS</b>	914	<b>245</b>	<b>85</b>	<b>68</b>	<b>81</b>	227
<b>CV (%)</b>	<b>43</b>			<b>24</b>	22	<b>37</b>	<b>11</b>	<b>35</b>	<b>18</b>	14

## **FUTURE PLANS**

The contribution of dry pea, lentil and chickpea for cropping systems sustainability and for the State's economy is substantial. In addition, the national and international demand for these crops as plant based protein source is considerable. Therefore, this project will continue to evaluate spring dry pea, lentil and chickpea varieties and experimental lines across Montana to generate information that can help to make with informed decision based on availability of fund and resources. Beside variety evaluation, research is needed to develop best agronomic management practices to increase yield and improve quality of these crops. These include but not limited to nutrient management, weed control both for conventional and organic pulse growers and enhancing biological nitrogen fixation. We hope research fund, support and collaboration among researchers, seed dealers and chemical companies will continue to achieve the objective.

**Note:** The results and summary mentioned in this annual report are for **informational purposes only**. Inclusion and or exclusion of any commercial variety in this summary does not constitute a recommendation by MSU-MAES or EARC.

### **DISCLAIMER:**

The information given herein is supplied with the understanding that no discrimination is intended and no endorsement by the Montana Agricultural Experiment Station is implied. The results of individual trials and studies are considered to be of a **PRELIMINARY** nature and should **NOT** be considered as a product endorsement or recommendation for commercial use.