MONTANA STATE UNIVERSITY | MONTANA AGRICULTURAL EXPERIMENT STATION

Northwestern Agricultural Research Center

FIELD DAY

Thursday, July 13, 2023

11:00 am **Registration & Introductions**

11:30 Ken McAlpin – NWARC Farmer Advisory Chair
11:35 Dr. Tracy Dougher, MSU College of Agriculture
11:45 Dr. Darrin Boss – MSU Research Center Department Head
11:55 Dr. Jessica A. Torrion – MSU NWARC Superintendent

12:00 pm **Lunch**

12:30 Mackenzie Dey, Patrick Mangan, Wendy Carr – MSU Extension Agents
12:40 Andy Lybeck – CHS General Update

1:00 pm **Field Tours** **Pages**

We are interested in what research needs you have so we can make future investments. Please complete the survey at **bit.ly/msuagresearch** or scan the QR code. For more information about the Montana Agricultural Research Stations please visit **agresearch .montana.edu**.

Northwestern Ag Research Center Faculty and Staff

From left: Asher Khoury, Elaina Wagoner, Dr. Jessica Torrion, Lauren Thamert, Ashley Rochlitzer, Dan Porter, Reese Whitehead, Moose Larson, Jordan Penney, Ray Volin, Ashley Goodman, Kyla Hays, Charlene Kazmier

Advisory Committee Members

Toby Hook, Andy Lybeck, Mackenzie Dey, Bridgett Lake-Cheff, Ken McAlpin, Chuck Stephens, Terry Stephens, Wendy Carr

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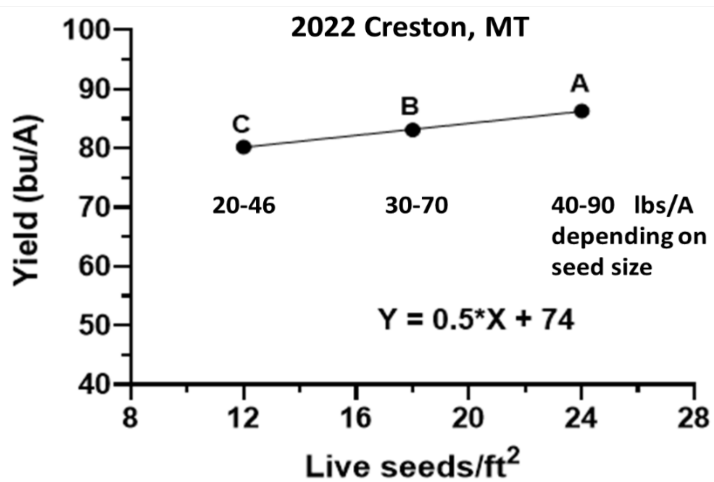
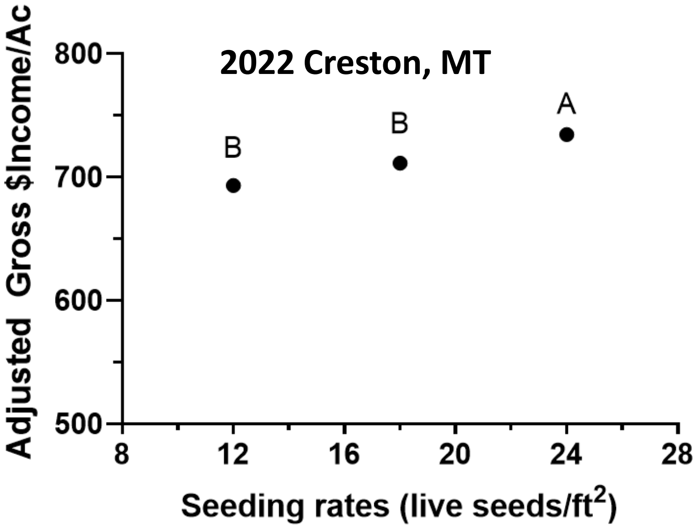
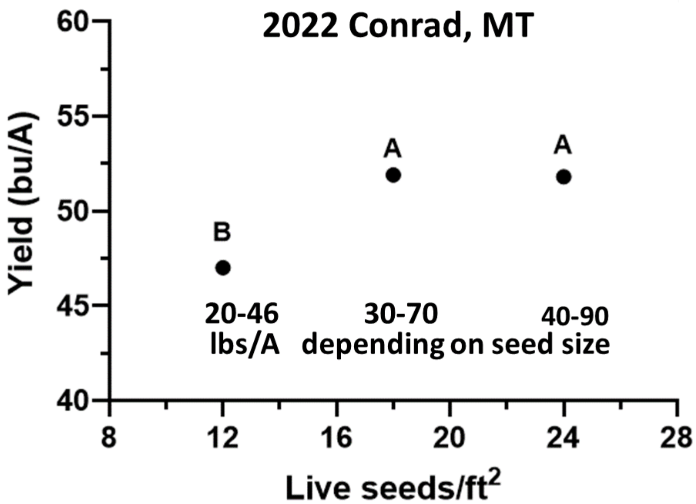
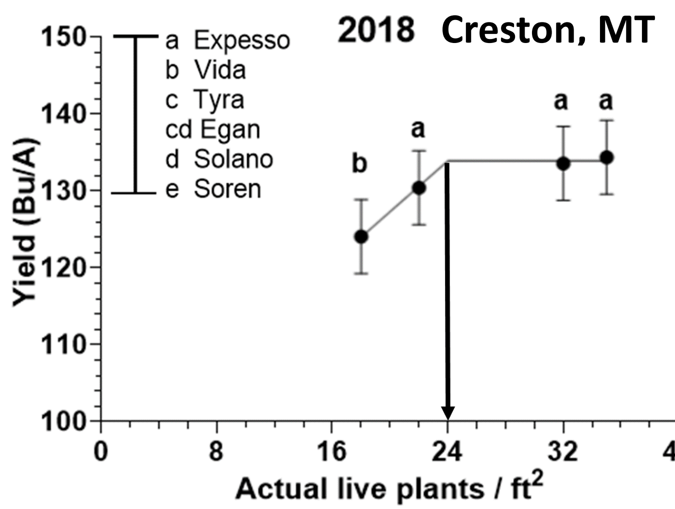
Seeding Spring Wheat by Population (J.A. Torrion)

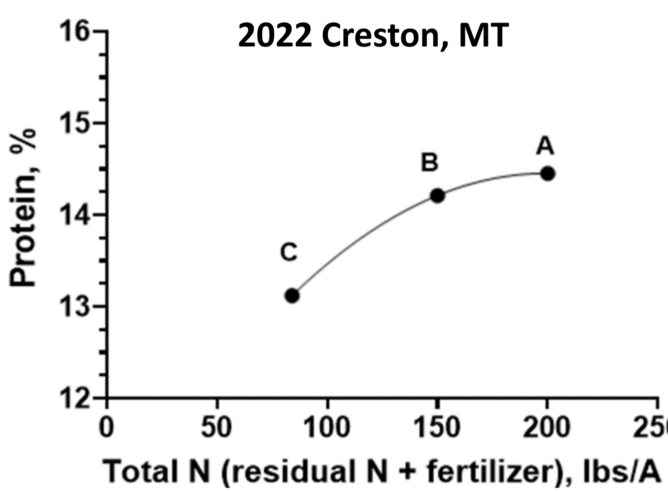
Egan	Midge resistant; Gpc-B1 (high protein)
Dagmar	Semi-solid stem, sawfly
MT Sidney	Fusarium head blight
Vida	Stay-green
Sy Ingmar	Syngenta (high protein)

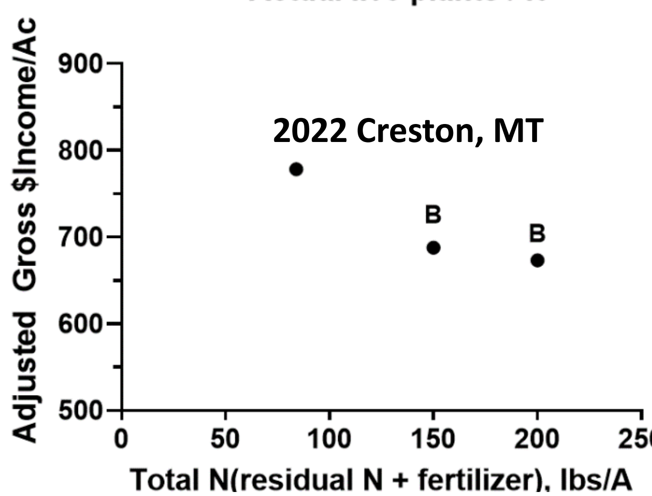












Impact of seeding rate, nitrogen availability, and disease pressure on cheatgrass and winter wheat interactions

Berríos-Ortiz, Laura; Clint Beierman, Lovreet Shergill, Alan Dyer, and Fabián Menalled

In the Northern Great Plains, the concentration of winter wheat production can result in a specialized and interacting pest complex of cheatgrass (*Bromus tectorum*) and *Fusarium* crown rot pathogens that threaten its economic and environmental sustainability. However, management recommendations do not address cheatgrass and *Fusarium* crown rot jointly, and no study has assessed their relationship and joint management. The goal of this study is to develop and deliver easy-to-adopt, economically viable, and environmentally appropriate recommendations for the joint management of grassy weeds and pathogens in winter wheat, using cheatgrass and *Fusarium pseudograminearum* crown rot as model species. To do this, we evaluated how winter wheat yield is impacted by seeding rates, cheatgrass, nitrogen availability, and disease pressure. The treatments included (1) winter wheat seeding rate: low (67 kg/ha) or high seeding rate (101 kg/ha), (2) weed competition: no cheatgrass or with cheatgrass (500 seeds/m^2), (3) nitrogen level: low (80 kg/ha) or high (200 kg/ha), and (4) pathogen pressure: no disease protection (untreated wheat seeds) or disease protection (Vibrance Extreme® fungicide treated wheat seeds).

Test sites were established in fall 2021 and fall 2022 at three locations: (1) Northwestern Agricultural Research Center near Kalispell, (2) Post Farm in Bozeman, and (3) Southern Agricultural Research Center near Huntley. Each site followed a split-plot design with four or five replications and 16 treatment combinations. Prior to winter wheat seeding, the entire field was inoculated with *F. pseudograminearum* infested barley (500 seeds/m^2). After inoculation, the cheatgrass and the winter wheat (variety 'Yellowstone') were planted. To develop cheatgrass life history models, we are measuring weed seedling emergence, tillering, seed production, biomass, and seed predation. During midseason, we collect wheat roots to isolate pathogens and determine disease pressure. At the end of the growing season, we measure wheat yield, and grain quality by assessing protein content, grain moisture, and test weight. At harvest, we collect wheat root sections for real-time qPCR to measure pathogen density. Data analysis was made using the packages car, lme4, qqplot2, and yarrr in R Studio.

Our preliminary results indicate that winter wheat yield, cheatgrass biomass, and *Fusarium pseudograminearum* abundance were impacted by management. Specifically, when assessing yield, we observed an interaction (ANOVA III χ^2 $p < 0.05$) among wheat seeding rate, cheatgrass biomass, and nitrate. The high seeding rate did not improve yield when cheatgrass was present as nitrogen was increased. However, in the low seeding rate as nitrogen increased so did yield when cheatgrass is present (Figure 1). We also observed an interaction (ANOVA III χ^2 $p = 0.09$) between cheatgrass biomass and seeding rate on yield. When cheatgrass was not present, the low seeding rate showed a slightly higher wheat yield in than the high seeding rate. However, when cheatgrass was present, the high seeding rate had higher yield than the low seeding rate (Figure 2). To support producers, we will develop and deliver easy-to-adopt, economically viable, and ecologically based recommendations for the joint management of grassy weeds and pathogens in winter wheat.

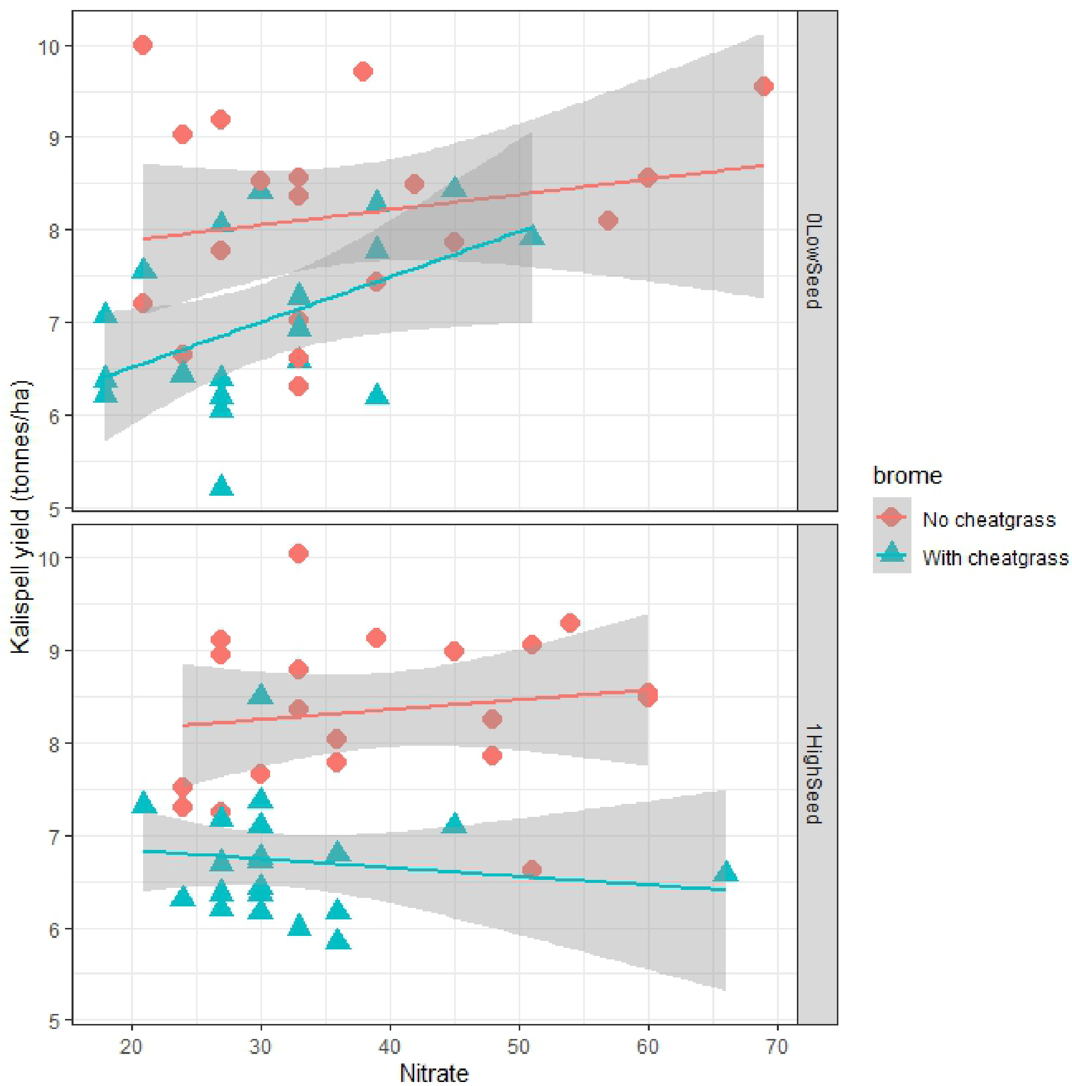


Figure 1. QQ plot on Kalispell winter wheat yield (tonnes/ac) impacted by nitrogen availability presented as Nitrate (lbs/ac) depending on the seeding rate and the presence of cheatgrass.

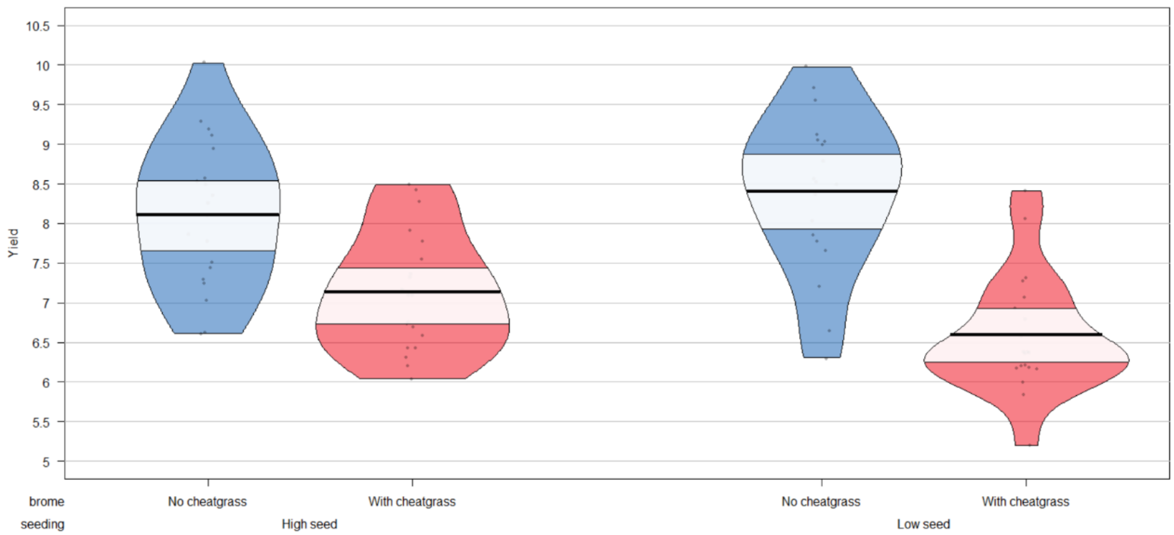


Figure 2. Pirate plot showing the interaction of seeding rate and cheatgrass presence and its impact on yield.

Perennial Grass Forages and Nitrogen

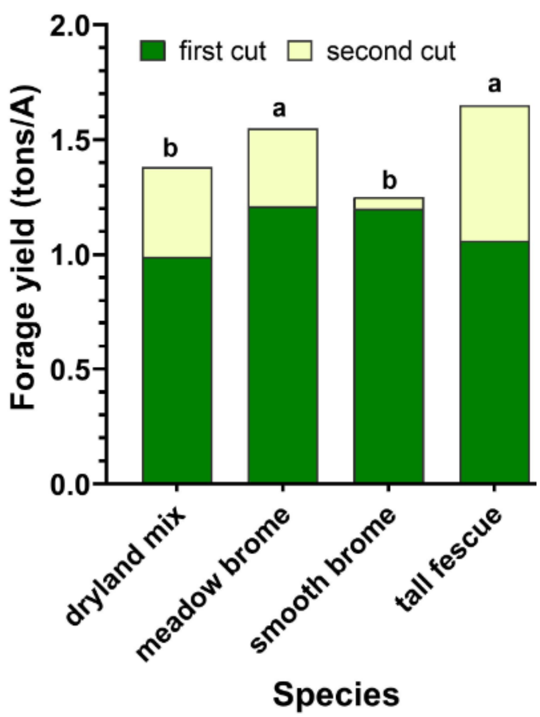
Hayes Goosey, Jessica Torrion, and Peggy Lamb

Table 1. Grass entries (Barenbrug™)

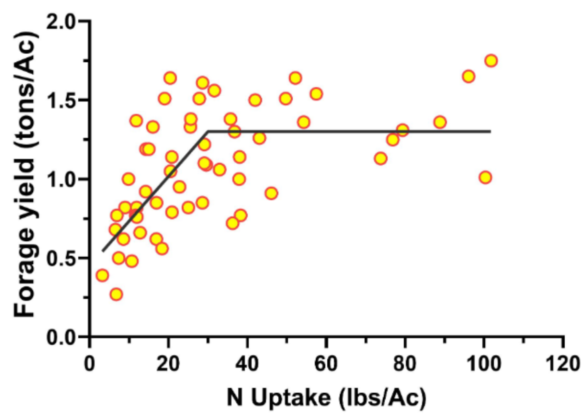
Dryland mix	Barricade with yellow jacket coating: Barricade is a drought-tolerant variety of meadow and smooth brome, tall fescue, and intermediate wheatgrass
Meadow brome	Arsenal: drought tolerant, early spring growth, winter hardy
Smooth brome	Artillery: exceptional drought resistant, high stress-tolerant, perform well in colder US temperatures, rhizomatous
Tall fescue	STF-43. Adaptable to either wet or dry conditions. A blend of late-maturing, soft-leaved tall fescues.

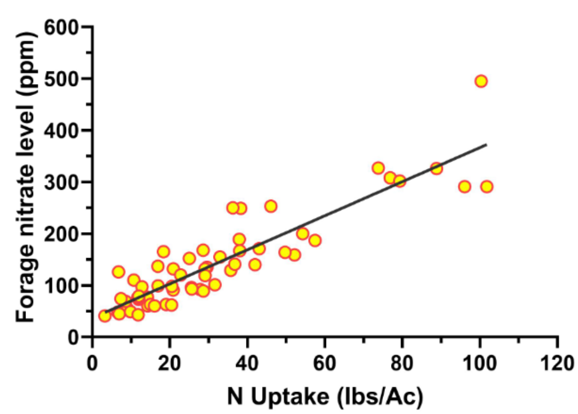
Nitrogen levels: 1) Control (No added N), 2) 50 lbs N/A at planting, 3) 25 lbs N/A at tiller + 25 lbs N/A after first cut, 4) 50 lbs N/A at tiller + 50 lbs N/A after first cut.

2022 Yield and Quality Data



N Treatment	Yield (tons/Ac)
Control	0.88c
50 lbs N at planting	1.55b
25 lbs N at tiller + 25 lbs N after 1st cut	1.53b
50 lbs N at tiller + 50 lbs N after 1st cut	1.87a





Winter Canola Planting Date (J.A. Torrion, C. Beiermann)

Target population: 18 plants/ft2 ; 8-15 lbs/A depending on the seed size of each variety

Table 1. 2022-2023

Planting Date (PD)	% Germination	Plant Density/ft2		% Stand loss
		Fall (Oct 28)	Spring (May 2)	
August 15, 2022	43 b	7.8 b	4.2 a	46 c
September 1, 2022	47 b	8.4 b	3.2 b	61 b
September 15, 2022	61 a	11.0 a	1.7 c	84 a

**Letters that have the same letter assignment are not statistically different.*

Table 2. 2021-2022

Planting Date (PD)	Plant Density/ft2		% Stand loss
	Fall	Spring	
August 15, 2022	12.3	9.6 a	20 b
September 1, 2022	13.3	8.9 a	31 b
September 15, 2022	11.5	2.4 c	79 a

**Letters that have the same letter assignment are not statistically different.*

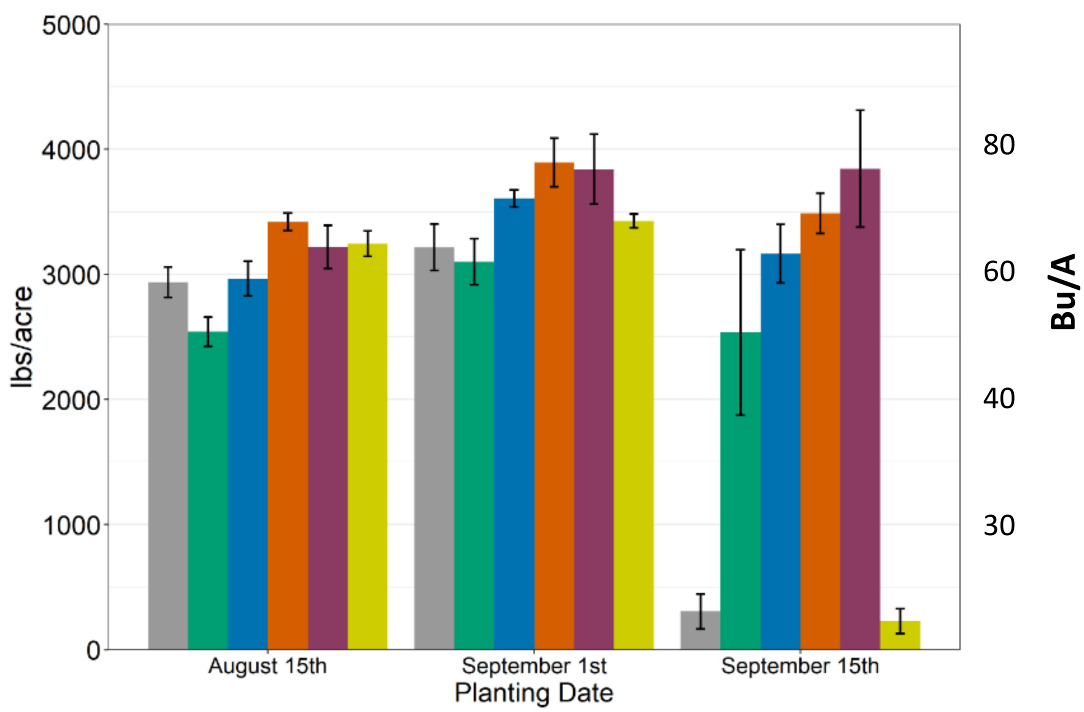


Figure 1. Planting date and variety interaction on canola yield, 2021-2022

Table 3. 2020-2021

Planting Date (PD)	% Stand loss
August 15, 2022	23 b
September 1, 2022	17 b
September 15, 2022	42 a

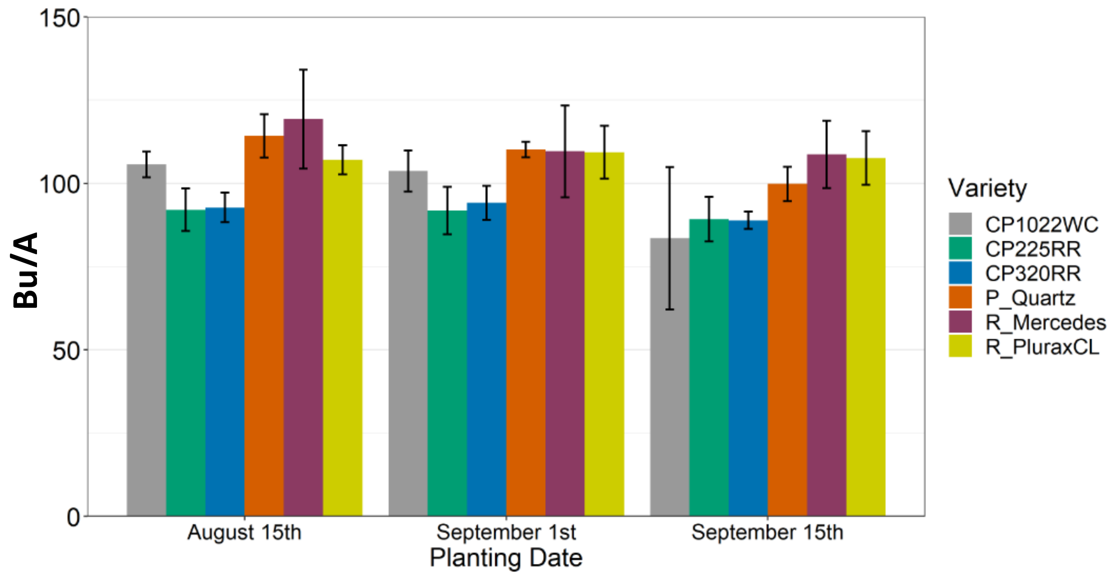


Figure 2. Planting date and variety interaction on canola yield, 2020-2021

2022 Winter Barley Intrastate Forage Trials

	Bozeman				NARC				NWARC			
name	Forage yeild (Tons/Acre)	ADF	NDF	Grain Yield	Forage yeild (Tons/Acre)	ADF	NDF	Grain Yield	Forage yeild (Tons/Acre)	ADF	NDF	Grain Yield
Ray	4.44	36.6	62.47	NA	0.99	34.26	61.04	NA	NA	35.48	61.35	129.7
Saturn	5.42	36.52	65.13	193.1	0.76	27.05	51.91	NA	NA	31.39	57.1	99.3
MTW_19:130-05	5.37	38.77	65.61	141.3	0.71	31.84	59.2	NA	NA	34.31	59.43	27.5
MTW_19:131-01	NA	NA	NA	NA	0.65	31.15	57.37	NA	NA	36.03	63.9	25.2
MTW_19:131-10	5.88	37.32	62.27	113.6	0.93	30.36	55.8	NA	NA	34.57	59.16	28.8
MTW_19:132-01	NA	NA	NA	NA	0.49	28.44	51.66	NA	NA	34.73	60.28	19.3
MTW_19:132-02	NA	NA	NA	NA	0.22	29.33	53.9	NA	NA	33.43	59.67	19.8
MTW_19:50-01	5.92	38.2	64.89	117.9	0.9	30.99	57.33	NA	NA	36.02	63.16	32.9
MTW_19:50-03	4.68	35.65	61.02	116.1	0.84	30.86	59.15	NA	NA	34.4	60.53	38.4
MTW_19:50-07	6.97	37.36	62.88	111.4	0.79	30.15	56.13	NA	NA	34.23	59.41	26.8
MTW_19:50-10	5.99	34.33	57.7	105	0.9	30.01	56.16	NA	NA	35.19	60.1	30.5
MTW_19:51-02	5.62	36.85	62.3	162.9	0.66	32.32	58.43	NA	NA	34.65	59.44	22.8
MTW_19:51-05	7.02	39.04	66.21	152.9	0.6	31.16	56.46	NA	NA	33.93	59.4	76.2
MTW_19:51-06	4.19	38.27	65.03	140.4	0.66	31.12	57.39	NA	NA	34.64	59.77	65.3
MTW_19:51-09	6.89	38.53	66.35	151.5	0.76	30.59	57.82	NA	NA	34.83	60.55	60.7
MTW_19:51-10	6.62	37.15	63.26	134	0.77	30.36	57.15	NA	NA	33.14	58.33	52.6
GRAND MEAN	4.69	30.29	51.57	102.51	0.73	30.62	56.68	NA	NA	34.44	60.1	47.24
LSD	2.26	2.89	4.54	24.82	0.23	3.38	5.9	NA	NA	1.89	3.12	17.73
CV	28.86	5.73	5.28	14.52	18.94	6.62	6.24	NA	NA	3.29	3.11	22.51

Spring Barley releases

MT Cowgirl is a high-performance forage barley with taller plant height, contributing to higher hay yields. Earlier heading and later maturity extends harvest flexibility and increases seed size. Certified seed available.

Forage Yield 2020-2021 Forage Intrastate Trial
Lattice square design, 25 entries, 3 replications

	Tons/Acre						
Variety	Bozeman	Conrad	Havre	Kalispell	Moccasin	Sidney	All Locations
loc years	2	1	2	2	1	1	9
Hays	4.54	3.05	1.87	4.87	4.69	1.61	3.76
Haymaker	4.72	3.32	2.03	4.94	4.83	**1.92***	3.61
Lavina	4.98	3.02	1.98	5.84	4.77	**1.96****	3.78
MT Cowgirl	4.71	3.12	**2.91****	**7.85****	**5.76****	**1.86***	**4.19****
LSD (0.05)	0.82	0.55	0.24	1.50	0.14	0.31	0.38

Scan for more data

MT Boy Howdy is a two-row, high performing feed barley variety for Montana and surrounding regions. MT Boy Howdy has extended grain-fill due to early heading, resulting in high yields and plump seed. MT Boy Howdy out yielded most lines in the Western Regional Trial, during the drought of 2021, potentially related to root architecture. Smooth awns and fewer hairs increase grower comfort. Certified seed available through MSU Foundation Seed in 2024.

2021 Western Regional Spring Barley Nursery Agronomic Data

Source	Entry	Yield (bu/ac)	Test Wt. (lbs/bu)	Heading (julian)	Height (cm)	Plump (%)	Protein (%)
Check	AAC Synergy	96.2	49.6	179.1	68.0	92.2	13.4
Check	ABI Eagle	95.3	50.3	179.4	61.2	88.2	13.9
Check	ABI Voyager	91.4	49.6	179.2	67.4	95.9	14.1
Check	AC Metcalfe	85.4	50.2	178.9	70.2	91.2	14.3
Check	CDC Copeland	89.5	50.3	179.1	68.6	91.5	13.9
Check	ND Genesis	80.9	49.5	177.2	70.8	89.3	12.6
MSU	MT Boy Howdy	101.8	50.4	177.7	66.8	93.5	12.0
	Trial Mean	95.6	50.1	178.4	65.8	91.8	13.1
	Check Mean	89.8	49.9	178.8	67.7	91.4	13.7
	# loc*	9	8	6	7	7	6

*Locations: Aberdeen ID, Ruberd ID, Tetonia ID, Bozeman MT, Osnabrock ND, Williston ND, Rosalia WA, Powell WY, Saskatoon SK

Buzz is a two-row, malt barley variety with high plumps and low grain protein across environments and management practices. Shorter than Hockett, reducing lodging. Good malt quality with high extract, low β glucan with reduced steeps. Certified seed is available through MSU Foundation Seed.

Scan to see data on Buzz.

MT Endurance is a two-row, high performing malt barley variety, with extended grain-fill due to early heading that results in high plumps and low grain protein, particularly in dryland. Stable malt quality during drought of 2021. 3% higher malt extract than controls. Irrigation can result in malt with elevated β glucans. Slower to modify than Buzz but faster than Hockett. Can have acceptable malt quality with either two or three steeps. Certified seed available through MSU Foundation Seed in 2024.

Scan to see data on MT Endurance.

SEEDING PEA BY POPULATION

Simon Fordyce[1], Sally Dahlhausen[1], McKenna Volkman[1], and Patrick Carr[1], Peggy Lamb[1], Perry Miller[2], Jessica Torrion[1], and Justin Vetch[1]

[1]Montana State University Dep. Research Centers, Central Agricultural Research Center, Moccasin, MT

[2]Montana State University, Dep. Of Land Resources and Environmental Sciences, Bozeman, MT

Summary

Seed costs can represent a major input in spring pea and canola production. Seeding rate decisions are not always based on local knowledge but can have significant consequences for a farmer's bottom line. This study is designed to determine what the optimal seeding rate is for maximum seed yield. The experiments consist of five seeding rates for each crop: 5, 7, 9, 11, and 13 pure live seeds (PLS) per square feet (PLS/ft^2) for pea and 5, 8, 11, 14, and 17 PLS/ft^2 for canola. Both experiments are located at the MSU Central Agricultural Research Center (CARC) near Moccasin. The pea seeding rate study also is located at the MSU Arthur H. Post Farm in Bozeman, the Northern Agricultural Research Center south of Havre, the Northwestern Agricultural Research Center in Kalispell, and the Western Triangle Agricultural Research Center near Conrad. Results from 2023 are not available but those from the studies at the MSU Central Agricultural Research Center done over the past few years are. Those preliminary results suggest that the current recommended seeding rate for spring pea (~9 to 12 PLS/ft^2) may be unnecessary for maximum yield. No difference in seed yield was detected when spring pea was planted from 5 PLS/ft^2 to 13 PLS/ft^2 (4 to 11 established plants/ft^2) in either 2021 (1035 vs. 1038 lb/ac, $P = 0.53$) or 2022 (1536 vs. 1655 lb/ac, $P = 50$). Likewise, there were no differences in grain protein concentration or test weight across seeding rates in either year. For canola, no differences in seed yield were detected across seeding rates in either year, and in test weight and seed oil percentage in 2022. Similar results generated from experiments in 2023 would suggest that seeding rate recommendations when planting spring pea and canola should be revisited in Montana. Those interested in learning results from 2023 are encouraged to reach out to Simon Fordyce or Patrick Carr at the MSU Central Agricultural Research Center beginning in January 2024, or the local contact for a specific field experiment (e.g., Jessica Torrion for results of the field experiment at Kalispell).

Acknowledgements
We are grateful to the Montana Agricultural Experiment Station for providing funding for this research.

Table 1. 2021 Spring pea seeding rate trial, Central Agricultural Research Center, Moccasin, MT.

Seeding Rate (PLS ft^{-2})	Count (ft^{-2})	Height (in)	Yield (lb ac^{-1})	Test Weight (lb bu^{-1})	Protein (%)
13	**<u>11</u>**	32	1038	65.6	25.1
11	**10**	34	1052	66.2	24.9
9	8	34	1177	65.9	25
7	6	34	1103	65.8	25.2
5	4	36	1035	65.6	25.1
Mean	8	34	1081	65.8	25.1
LSD	2	NS	NS	NS	NS
CV (%)	17.9	6.8	12.2	0.6	1.7
P-Value	<0.0001	0.3651	0.5252	0.1404	0.8338

Table 2. 2022 Spring pea seeding rate trial, Central Agricultural Research Center, Moccasin, MT.

Seeding Rate (PLS ft^{-2})	Count (ft^{-2})	Height (in)	Yield (lb ac^{-1})	Test Weight (lb bu^{-1})	Protein (%)
13	**<u>10</u>**	17	1655	65.9	24.9
11	7	16	1765	65.8	25
9	6	17	1634	65.7	25
7	5	17	1665	65.8	24.9
5	4	17	1536	65.6	24.7
Mean	6	17	1651	65.7	24.9
LSD	2	NS	NS	NS	NS
CV (%)	16.9	7.9	9	0.4	3.3
P-Value	0.0009	0.9224	0.4989	0.7596	0.9903

Table 3. 2021 Spring canola seeding rate trial, Central Agricultural Research Center, Moccasin, MT.

Seeding Rate (PLS ft^{-2})	Count (ft^{-2})	Height (in)	50% Flower Date (Julian)	Yield (lb ac^{-1})
17	**<u>12</u>**	26	174	72
14	10	26	174	74
11	7	27	174	83
8	6	27	174	73
5	4	28	174	76
Mean	8	27	174	76
LSD	1	NS	NS	NS
CV (%)	10.8	4.2	0.2	14.3
P-Value	<0.0001	0.3473	0.0895	0.6409

Table 4. 2022 Spring canola seeding rate trial, Central Agricultural Research Center, Moccasin, MT.

Seeding Rate (PLS ft^{-2})	Count (ft^{-2})	Height (in)	50% Flower Date (Julian)	Yield (lb ac^{-1})	Test Weight (lb bu^{-1})	Oil (%)	Protein (%)
17	**<u>14</u>**	33	170	1630	53.9	45.9	23.3
14	**12**	33	169	1525	53.9	45.6	23.7
11	**11**	33	170	1608	54.0	46.1	23.4
8	8	34	169	1564	54.0	45.6	23.9
5	5	34	169	1389	53.9	46	23.8
Mean	10	33	169	1543	53.9	45.8	23.6
LSD	4	NS	NS	NS	NS	NS	NS
CV (%)	19.4	2.8	0.6	8.1	0.2	0.8	2.3
P-Value	0.0031	0.2870	0.5331	0.2354	0.6844	0.3731	0.7364